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NEPAL

PROJECT PAPE

TRAIL SUSPENSION BRIDGES
(367-0119)

Prepared by USAID/Nepal
May 5, 1978

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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: [A] (A = ADD, C = CHANGE, D = DELETE) — PP

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10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	1492	1508	3,000	1492	1508	3,000
(GRANT)	(1492)	(1508)	(3,000)	(1492)	(1508)	(3,000)
(LOANS)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1. PEACE CORPS	90		90	270		270
OTHER U.S. 2.						
HOST COUNTRY		135	135		550	550
OTHER DONOR(S)	499		499	499		499
TOTALS	2081	1643	3724	2261	2058	4319

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 78 F. GRANT	E. 1ST FY 78 G. LOAN	H. 2ND FY 79 I. GRANT	H. 2ND FY 79 J. LOAN	K. 3RD FY 80 L. GRANT	K. 3RD FY 80 M. LOAN
(1) FN	133B	829		3,000					
(2)									
(3)									
(4)									
TOTALS				3,000					

A. APPROPRIATION	N. 4TH FY 81 O. GRANT	N. 4TH FY 81 P. LOAN	Q. 5TH FY R. GRANT	Q. 5TH FY S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN					3,000	
(2)						
(3)						
(4)						
TOTALS					3,000	

12. IN-DEPTH EVALUATION SCHEDULED: MM/YY [0|2|8|1]

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14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Samuel H. Butterfield

TITLE: SAMUEL H. BUTTERFIELD
Director
USAID/NEPAL

DATE SIGNED: MM/DD/YY [1|0|1|8|7|8]

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PART I - B. TABLE OF ABBREVIATIONS

1. AID/W ... Agency for INternational Development/Washington.
2. EAST. ..EAST Consulting Engineers, Kathmandu.
3. FAR. ... Fixed Amount Reimbursement System.
4. FAA. ... Foreign Assistance Act (1961).
5. GON. ... Government of Nepal.
6. International Consulting Engineers (German Consult.).
7. HMG. ... His Majesty's Government of Nepal.
8. IIEF. ... Impact Identification and Evaluation Form.
9. IBRD. ... International Bank for Reconstruction and Development.
10. LDD. ... Local Development Department of Ministry of Home and Panchayats.
11. PC. ... American Peace Corp.
12. PCV. .. Peace Corps Volunteer.
13. RLDC. ... Relatively Least Developed Country.
14. SBD. ... Suspension Bridge Division of Ministry of Works & Transport.
15. SATA. . Swiss Association for Technical Assistance.
16. USAID/Nepal. ... United States Agency for International Development in Nepal.
17. UNDP. .. United Nations Development Programme.
18. UN. ... United Nations.
19. UNCTAD. ... United Nations Conference on Trade and Development.

C. GENERAL DATA

1. Project Committee

   (A) David Tiedt, Section Chief Capital Inputs, USAID/Nepal.

   (B) Steven J. Freundlich, Capital Projects Development Officer, Capital Inputs USAID/Nepal.

   (C) J. Gabriel Campbell, Social Anthropologist, USAID/Nepal.

   (D) John Babylon Program Economist, USAID/Nepal.

   (E) William Ross, Office of Financial Management Program and Accounting Division, AID/Washington.

   (F) Rod MacDonald, Office of Engineering, ASIA AID/Washington.

2. Executing Agencies

   (A) His Majesty's Government of Nepal (HMG), Ministry of Works and Transport, Suspension Bridge Division of Roads Department (SBD).

   (B) His Majesty's Government of Nepal (HMG) Ministry of Home and Panchayat, Local Development Department (LDD).

3. International Donors

   (A) Swiss Association for Technical Assistance (SATA).

   (B) American Peace Corps/Nepal (PC).

   (C) U. S Agency for International Development/Nepal (USAID).

D. PROJECT RECOMMENDATIONS

...	USAID appropriated funds	$ 3,000,000
...	HMG contribution	550,000
...	SATA contribution	499,000
...	PC contribution	270,000
	TOTAL	4,319,000

PART II A. PROJECT DESCRIPTION

> "...The greatest constraint to modernizing and commercializing the small, tradition farming operations in the rural hill regions of Nepal is the inaccessibility of markets for both the purchase of essential agricultural inputs and the selling of surplus production. Little progress can be expected until motorable roads, improved trails and bridges, as well as other inexpensive means of transport can be made available in these regions".
>
> "One of HMG's major developmental goals is to integrate isolated rural economics and peoples into the economic and political life of the nation".

The above quotations from the Food and Nutrition Sector Analysis of the 1974 USAID/Nepal Development Assistance Program (DAP) and the fifth Five Year Plan (1975-80) of the GON provide the context within which the Trail Suspension Bridge Project (367-0119) was conceived and designed.

Approximately four - fifths of Nepal (1974 DAP) is made up of hilly, mountainous terrain, which is completely isolated from other regions of the nation during the three to four month monsoon season. At best, the 60% of Nepal's population which inhabits these regions can depend only on long, arduous and dangerous treks to the nearest motorable road or market town and then only during the non-monsoon season.

As one means of devoting top national priority to the alleviation of this crucial transportation and development problem, GON has established the Suspension Bridge Division (SBD) of the Ministry of Public Works and Transport as well as the Local Development Department (LDD) of the Home and Panchayat Ministry. These governmental units are concerned with different aspects of the task of constructing and maintaining a nation-wide transportation and communication network. As the government's capabilities to deal with this question has improved, an increasing level of financial, material and political support has been made available to these vital governmental units. The GON has thus conclusively demonstrated over a period of years a continuing commitment to allocate national resources and energy to the resolution of this basic developmental problem of Nepal. USAID as part of a program of assistance and support for the GON's efforts to improve the quality of life of the "Poor Majority" of its people, has designed this project with the specific goal of "... Increasing the flow of goods and services to and from the rural areas of Nepal by improving the nation-wide bridge and trail network and thereby promoting balance integrated national development".

At present, the GON's efforts to address this problem are being supported by two foreign donors. The Swiss government is providing technical assistance and limited financial support through the Swiss Association for Technical Assistance (SATA). While the United States is providing Peace Corps Volunteers to work with governmental personnel at the local level in bridge design and construction.

Due however, to Nepal's RLDC status and the concomitant demand on very limited development resources the GON has found increasing difficulty in providing the budgetary support essential to meet an almost unlimited demand from both the rural population and the national planners. As a result the GON has as yet been unable to fully develop the management techniques necessary to initiate a standard operational procedure for either bridge site survey and selection or for the establishment of a comprehensive bridge maintenance program. Nor has the GON been able to devote adequate attention to the requirements of the diverse network of trails which are an integral part of any nation-wide transportation and communication system in Nepal.

The purpose, therefore, of this USAID project is to concentrate on assisting the GON to upgrade the existing institutional capacity of both the LDD and the SBD in the evaluation and selection of future bridge sites, and to materially supplement the construction, maintenance and planning capabilities of these governmental units.

Background

Since the inception in 1958 of a GON program to construct bridges throughout the nation, the U.S. has been the major foreign donor concerned with this effort. To date USAID has provided assistance through three separate projects. The last one being completed in 1975. This proposed FY 1978 project is viewed by both USAID and the GON as the necessary culmination of a successful bilateral program of assistance in Nepal.

In 1964 the GON, with the advise of USAID, established the SBD as the governmental unit charged with the major responsibility for the overall supervision and coordination of the national bridge construction program. SBD was to construct and maintain bridges throughout the nation, as well as improve the approach trails within 1 kilometer of the bridge site. SBD was also seen as a technical and material resource for other governmental units involved in the development of a national transportation and communication system.

Since its establishment the SBD has gradually grown in size and in ability to perform successfully. The proposed budget for FY 1979 reflects a substantial increase in the number and type of government personnel assigned to the division as well as the Rupees allocated by the GON for the total construction program.

While SBD has gradually become the national focal point for the construction of large scale regional suspension bridges, the task of coordinating the construction of the innumerable local small scale bridges required in Nepal has been delegated to LDD. By working closely with local and district panchayats the LDD concentrates upon the construction of small scale projects utilizing local participation whenever possible. Normally such bridges will not exceed 70 meter in length (although there are exceptions) and will be completed in one construction season. Should the LDD determine that the project proposed by the district local panchayat requires a bridge beyond it's technical capability, the SBD is brought in for technical and material support. Once a survey of the site is completed SBD will either provide its personnel to construct the bridge or it will allocate some limited material support to LDD. In this manner GON has provided for the essential elements of a nation-wide construction program.

At present both of these governmental units are receiving assistances from foreign donors. SBD has a number of highly skilled Swiss engineers working in Kathmandu in the division's design and engineering units. These technicians are assisting SBD to standardize their bridge designs and to improve the divisions procurement, fabrication, construction and maintenance operations. In addition SATA is providing limited financial assistance for the purchase of certain bridge building materials and instruments. The LDD for the last few years has been utilizing U. S. Peace Corps to work on the construction site with local people. The volunteers are normally recent university graduates able to supply the limited technical knowledge required for such local small-scale under-takings. The PCVs have also proven to be invaluable aids in organizing the essential local participation for such projects.

The $ 3 million USAID grant envisioned in the project is designed to provide vital financial and limited technical assistance to an ongoing GON program. By concentrating attention on a number of specific problems (See Administrative Feasibility), the project will substantially improve the GON's institutional capacity to select bridge sites, and then construct and maintain these bridges. The project will also begin to study and apply a classification system for the national trail network, which serves as the only transportation and communication link for the majority of Nepal's population which lives beyond any actual or proposed network of motorable roads. By initiating such a study USAID plans to produce some pragmatic recommendations which will assist the GON to improve and develop the national trail network in the future.

The major out puts envisioned for the project include:

1. Development of an operational system of site survey and selection for future bridge construction, based on objective engineering, administrative, social and economic criteria.

2. An increased inventory of bridge parts to be utilized by SBD/LDD in constructing an increased number of bridges resulting from the use of the operational site survey system,

3. Development of a national trail network map and classification system, and

4. Development of an operational system of bridge maintenance and trail improvement, including training of local technicians, in both SBD and LDD.

During the project design process, extensive consultations were held between all parties involved in the project (GON Ministries, SATA and Peace Corp) inorder to determine the most appropriate method of providing a USAID input into the ongoing program of bridge construction.. The Fixed Amount Reimbursement (FAR) system was chosen as the best method due to the fact that it is the most appropriate method to financially supporting the type of institutional building envisioned by the project designers. Approximately two-thirds of the total project costs ($2,665 Million) will be allocated to the reimbursement of GON's bridge construction costs. Under FAR the GON, in collaboration with SATA and USAID, will survey and select the bridge sites according to previously agreed upon engineering, administrative and socio-economic criteria. SBD will then procure, fabricate and transport the essential bridge parts and then construct the bridges. USAID will then inspect the completed bridge and reimburse the GON according to pre-established and agreed upon estimates of the cost. By utilizing FAR in this manner USAID will insure that objective engineering, administrative and socio-economic survey criteria are the basis of the selection of the bridge sites.

Inorder to provided limited financial support to the LDD program of bridge construction, approximately 10% ($250 thousand) of the monies allocated to SBD under the FAR system, have been earmarked for use by LDD. USAID, in conjunction with the efforts of SATA and PC, will finance under the FAR system the costs for Mini-tool Kits for local maintenance technicians, and steel cables. These will be utilized in the construction and maintenance of local small-scale bridges as part of the LDD program. LDD bridges and sites will be expected to meet a modified standard of the SBD/SATA criteria for site selection and bridge design and construction, prior to their being accepted for FAR reimbursement. The results of this portion of the project will be carefully monitored and thoroughly evaluated in terms of an increased future USAID involvement in the operation of the LDD.

Another portion of the total project costs ($250 thousand) will be devoted to the initiation of the nation-wide classification and survey of the Trail Network System. It is expected that a contract for the initial survey will be signed with a non-governmental consultant and the resulting recommendations will provide a firm direction for further activities in this area.

The project will also finance ($10 thousand) the costs of a study of the trademen which have been displaced as a result of the construction of bridges in the past. (See Social Soundness Analysis and EAST report). The study is being planned so as to result in recommendations, which can be utilized by the GON to develop the means of dealing with this problem on a national level. i.e. training programs in cottage industries etc.

The remaining portion of the project costs ($75 thousand) have be.. earmarked for the costs of a continuing program of bridge site inspections and project evaluations. The inspections will be essential to the successful use of the FAR system, while the continuing process of evaluation and revision is an integral element of the implementation of the project. USAID has thereby provided room for not only the fine tuning such an institutionally oriented project requires, but has also provided for the qualitative and quantitative measurements essential for any subsequent program of bridge construction which USAID may wish to consider.

PART III - PROJECT ANALYSIS:

A. TECHNICAL ANALYSIS

1. History of SBD

The SBD was established in 1964 to coordinate, design, and implement the trail bridge construction program of the GON. The division is responsible for developing an "in house" construction capability to carry out the construction of those bridges which are designed, approved and designated for completion in each fiscal year. Results have been mixed. The division required assistance in the technical and management aspects of the program. This need has been partially addressed by SATA in the form of technicians who have been assigned to the SBD, since 1972 under a Swiss program of foreign assistance.

SATA recognized the need for change within the SBD, assisted in implementing changes in the procedures where such changes were agreed to by the SBD. One example of such improvements is the preparation and publication of a set of standard bridge drawings for the various size spans which are encountered in the SBD programs. An updated revision of these drawings is now being completed which incorporates improvements generated by field use of the original data. These drawings have simplified the design work required to fit a bridge to a specific site. Standard bridge element quantity lists are included with each standard plan, thereby greatly facilitate the cost estimating procedures. These data greatly reduced the time and cost of designing a bridge for a specific site.

SATA by standardizing many of the required elements of bridge hardware and cables has made it possible for SBD to stock many bridge parts, consequently construction can often be implemented soon after a final bridge designs is completed. The procurement of stock items has not been altogether successful as is noted later in this section of the Project Paper.

2. Sequence of Bridge Construction

Site surveys requires experienced professionals to accurately evaluate soil conditions, river course stability, choice of anchorage best suited to each site, and design span lengths. Also there may be several locations which must be studied to determine which site best meets cost, engineering, and socio-economic criteria.

Another example of SATA's work, aimed at improving the SBD operation, is the development of a manual of "Guidelines for Site Survey Teams." A draft of the manual is included as an Annex to the Project Paper. The initial manual, which will be utilized in training SBD site survey teams for the coming construction season, will include the socio-economic criteria developed in the Project Paper. (see Social Soundness Analysis and Economic Analysis Section of Project Paper.) Thus the initial site surveys will take into account engineering, administrative, and socio-economic

criteria. The resulting data will be utilized by SBD to prioritize the list of bridges to be constructed in any given year. The use of this data will also play a vital role in the USAID decision to reimburse the costs of any particular bridge under FAR. The project has scheduled a joint evaluation of the initial application of these criteria, in order to insure that necessary revisions and adaptations can be incorporated into the manual prior to the initiation of a second stage of site surveys.

The socio-economic criteria to be utilized have been derived from the research done by EAST Consulting Engineers, German Consult, SATA , as well as theory and practical experience. A more detailed explanation of the criteria can be found in the Economic Analysis and Social Soundness sections of the Project Paper.

Once the necessary site survey data is delivered to the SBD Kathmand office the design section will do the full bridge design including the construction drawings. They will also prepare the cost estimate for bridge materials to be supplied, the cost estimated for delivery of project materials to site, the labor costs estimates, and local materials cost estimates. In short an itemized estimated cost breakdown and materials list.

Once the materials list is available, the SBD will issue all standar items from their warehouse stocks, and order the materials to be delivere to the bridge site. Special items will be contracted for with a local fabricator and delivered to site when fabricated.

An experienced bridge erection crew of SBD employes is then sent to the site. Such a crew normally consists of an engineer, a work foreman and an accountant. A construction contract is then signed with a firm or individual for the provision of labor, both skilled and unskilled. As a result of the Planning Commission's latest directive the SBD is now required to sign a larger percentage of such construction contracts with local firms or individuals. Thus insuring that a greater share of the expenditure for the bridges are channeled to the local people of the area. Once construction has been completed an inspection by SBD/SATA/USAID will be held and upon certification of results payments under FAR can be instituted.

Since 1972 the SBD has made rather remarkable progress in producing standard plans and implementing the bridge construction program. As evidence of this improvement, a list of the bridges completed since 1957 is given shown below:

TABLE 1

Period	No. of completed structures*
1957 to 1962	7
1962 to 1965	6
1965 to 1970	12
1970 to 1975	17
FY 1977	13
First half FY 1978	8

* Source EAST Consulting Engineers Interim Report. See EAST Consulting Engineers Final Report Vol.1 p. 38 for table of USAID Financed Bridges. (total 23 by 1975).

Information on SBD budget figures is available in Table 3 of the Financial Analysis Section of the Project Paper. The budget shows the increased emphasis being given to the trail bridge program by the GON. The success of the SBD, and the recognition of the high priority of the bridge program in the development planning of Nepal is reflected in many ways, but none as dramatic as the budget expenditures shown in the Financial Analysis Section of the Project Paper.

3. Procurement Problems

SATA, in order to get the construction program moving, in 1977 financed a large order of basic steel stocks for construction. These stocks of steel and cable were fabricated into bridge parts by local businesses contracted with to manufacture parts for warehouse stock, (standard parts), or special items for a specific bridges. This procedure worked quite well even though there was a portion of materials lost in warehousing and fabrication. The quality of the steel was controlled by bulk ordering. As a result of this procedure parts were available in the GON warehouse, or could be quickly fabricated for any particular structure.

The SBD is now purchasing bridge parts for which the fabricator supplies the steel, or at other times SBD orders stock steel through GON procurement procedures. In either case the quality of the steel is difficult to control, and the resultant bridge elements are generally inferior. In addition the layers of approval authority during procurement have slowed the procurement process to an unacceptable degree, and have increased the cost of manufactured products to an alarming level.

Some method of effective procurement must be developed early in the life of the project which will meet quality, time, and cost requirements.

This question of procurement has not as yet been fully resolved but a number of possible solutions have been proposed. As an initial method of dealing with this issue, the Project Paper is proposing that the procurement of raw materials (i.e. structural steel, suspension cables and cement) purchased from international sources, remain with SBD. Assistance with international tendering procedures is presently received from SATA technical advisors who also assure that procurement delays do not stop bridge construction. A requirement for firms submitting tenders on bulk steel and cable is a mill certificate attesting that the steel and cable meet specifications. Material purchased with these procedures is put into SATA controlled warehouses where quantities are broken down for individual fabricators under contract by SBD. After fabrication the parts are sent to bridge construction sites. Maintaining this system using SATA technicians, in conjunction with on-the-job training of SBD personnel, will assure that quality steel is being used in bridges reimbursed by USAID's FAR. Thus the project would continue to provide a catalyst for improving the institutional capability of GON, while maintaining quality control.

Should such a procedure prove unacceptable an alternative method would require that all materials be procured by AID/W from 935 countries under AID/W procedures and meeting specifications worked out between SBD, SATA and USAID. Such a method might well increase certain costs, result in fewer bridges, cause long delays and most certainly will insure that minimum standards are met. Although beneficial in many ways, such a method of procurement will not necessarily upgrade the GON's capacity to construct bridges over the long term and will place a great strain on USAID in terms of personnel etc.

Therefore, the Project Paper proposes that the initial phase of procurement be done following the first approach recommended above and that an evaluation of this method determine, early on, if revisions are required. If such revisions are required, USAID will seek an appropriate waiver in 935 countries.

4. Project Targets:

One of the objectives of this project is to systematize the method of selecting bridges to be constructed, so as to maximize the socio-economic considerations, and to minimize political pressures in setting construction program priorities. To this end selection criteria are now incorporated into the project so as to assure that engineering and socio-economic conditions are fully addressed prior to establishing which bridges will be funded under FAR. Therefore the exact targets, (number of bridges to be constructed, or total meters of completed structure), will be established only after the SBD has proposed bridges

which meet the selection criteria, and USAID has given approval to their selection. The FAR system will insure that USAID funds are used only for those bridges which are of the highest socio-economic priority. Setting definitive targets in terms of number of bridges to be constructed inhibits the Project's ability to promote the basic objective of establishing a rational selection procedure and improving the institutional capacity of the GON.

5. LDD Bridge Construction:

As part of the overall project 10% of the total project cost is being set aside to procure bridge cable/hardware and Mini-Tool kits to support the LDD program of local bridge construction. These funds will be channeled through the SBD, who in turn supply technical support to the LDD. Here again individual bridge costs will be reimbursed under the FAR system. Cost estimated and designs would be produced by PCVs working with LDD personnel and agreements will be reached in terms of technical feasibility in consultation with SATA and SBD engineers. USAID will then approve the estimates for FAR and reimbursement could be made upon completion and inspection of the completed bridges.

This phase of the project is being designed as a first limited effort to support the LDD. It is expected that after a thorough evaluation of the initial performance, additional support may be considered. Should an evaluation determine that such a procedure of support for LDD is not feasible the earmarked monies would rever to SBD for use in financing additional SBD bridges.

The LDD has been assigned responsibility for constructing the relatively short span local Trail Bridges throughout Nepal. This program draws heavily on locally donated support and participation. Designs are prepared, whereever possible, to incorporate local construction methods in order to more fully utilize such local skills and capabilities.

The LDD has on their staff 12 PCV's who are active in identifying appropriate projects, and mobilizing local support for them. These PCV's are able to provide the essential technical skills for the projects.

The selection of appropriate designs for local bridges are done in collaboration with SBD and SATA. The PCV's supervise construction in conjunction with a district engineer. This program has proved very effective, and has the potential of becoming a major element of any subsequent USAID program of assistence in bridge construction.

A SATA engineer, working in conjunction with an Ex. PCV, is now designing a manual including a set of standard local bridge designs. This manual will be utilized for short span, local crossings. This procedure should greatly facilitate the project implementation process, and provide the opportunity to stock standard bridge elements within country so as to expedite the construction process.

6. Trail Bridge Maintenance:

Given the fact that the only maintenance on bridges is now done on an emergency basis, the entire structuring of the maintenance system needs to be reorganized from ground zero. There is a line item called Repair and Maintenance in the SBD budget of approximately US $ 97,000, (20% of the total budget), however this is used mainly for building maintenance and other non-bridge maintenance projects, and virtually no routine bridge maintenance is performed. Too often, the first news received at the SBD of repair needs is an alert that a structure is in imminent need of repair inorder to prevent total collapse. This crisis management style is very expensive, and diverts SBD construction efforts to emergency work, thus reducing scheduled construction work.

Thus another element of the project is to assist in the establishment of a system of preventative maintenance, which would include a component of training semi-skilled personnel from within the district panchayat where a SBD bridge is located. Each trainee would be supplied with a tool kit for maintaining the structure on a routine basis. Each maintenance man selected will be trained to observe potential bridge damage signs, and will serve as the trigger of an early warning system to the SBD for specialized assistance.

As a first step in setting up such a system, it is proposed that an individual be selected from each district level agency in charge of a SBD bridge, for on-the-job training. He will be seconded to a SBD bridge construction crew, (i.e. a working member of that construction crew) until he had participated in the construction of one major trail bridge. Working as a member of the construction crew, he would become familiar with construction methods, and under the guidance of the construction superintendent he will be instructed on routine maintenance procedures, as well as warning signs indicating the need for a major preventative maintenance effort. After training, the individual will be issued a maintenance tool kit which he will take back to his local area, to be used in performing yearly bridge maintenance within the local government's jurisdicational area. Previously USAID funded bridges will be addressed in the first stages of the training program, however this training system should be started immediately, and continued indefinitely to assure the continuation of preventative maintenance on all SBD bridges. District Panchayats, as a first stage of such a revised maintenance program will be ask to submit to the SBD an annual inventory of bridges in their area including a brief check list noting the bridges' present condition.

Coupled with this a section of the SBD will be established to provide periodic site inspection services for each bridge every 4 years or at such frequency as is deemed appropriate. This inspection service will evaluate the effectiveness of the local maintenance technician, schedule periodic repairs such as redecking, and evaluate the need for foundation protection adjustment, river training devices, or other structural adjustments required to prolong the life of the structure.

The centralized SBD unit will also be responsible for responding to calls for technical assistance triggered by the local governmental groups, and for assisting in crisis construction to prevent collapse of a structure due to floods or other unanticipated emergencies.

All training for this section of the project will be performed under the direction of SATA. USAID will fund the tool kits as part of the FAR cost of the bridge construction on which the technicians are trained.

The salary payment for maintenance technicians while in training and afterward will be worked out on a case by case basis by the local governmental organization and the SBD. Other organizational and financial details may have to be faced as the system develops. Also a trail improvement and maintenance system should be launched as soon as the bridge maintenance function is semi-operations and the first results of the National Trail Network classification study are available. As in other element of the project, an evaluation has been scheduled early in the life of this proposed project element, in order to allow for essential readjustment and revision of the reorganization of the maintenance program.

7. National Trail Network Survey and Classificatinn System:

The project includes a sub-activity which will provide a base map of the existing trunk trails and satellite trails which make up the current National Trail System of Nepal.

Such a base map will allow for the systematic storing in a filing system, by trail number, all information on trail condition, bridge locations, their condition and any needed trail improvements. It will also provide a base map for trail bridge planning and a means of prioritizing construction project throughout the nation.

Without such a base no rational system can be developed for planning construction, projecting changes dictated by other infrastructure construction, or systematically setting priorities for construction or improvements.

The map will be promulgated from recent aerial photography of Nepal. Currently used trails will be plotted on an existing topographic map of Nepal The topographic map, drawn to a scale of one inch to a mile, is considered accurate enough for trail classification and study purposes. The trail system superimposed on the base map, will be interperated to project a trunk system which appears to most rationally serve the hill area of Nepal. When the map is prepared, it will be checked with the SBD, SATA and PC in Kathmandu for local inputs (Kathmandu only). This period of review will not exceed 8 calender weeks. Based on this review the National Trail System will be corrected, and the trunk satellite trail system will be numbered using a flexible transportation system

method allowing for expansion and future adjustment. The map and accompanying information will be utilized in conjunction with maps of the existing and planned rail road, air, and ropeway infrastructure system, in order to provide useful planning data to governmental institutions and personnel involved in Nepal's development efforts.

8. Engineering Geologist

The services of an engineering geologist are required to properly evaluate the geotechnical hazards of any candidate bridge sites. He could evaluate evidence of potential slides, stability of rock masses at anchorage points, possibility of river under cutting of bridge foundations, channel aggregation due to slides above or below the river crossing, and choice of exact location based on the differences in foundation hazards and costs at alternative crossing sites. SATA will be financing the costs of such a specialist working with SBD, in order to develop appropriate GON procedures as well as train the necessary SBD personnel to operate in such a capacity. Should SATA be unable to provide such financial support USAID should be able to assist by utilizing the IQC method.

B. ENVIRONMENTAL ANALYSIS

Environmental degradation in the hills of Nepal is a severe problem. Over population is continuing to increase the intensity of land use well beyond ecologically sound limits. Deforestation, overgrazing, and farming on marginal lands is resulting in considerable soil erosion on the steep mountain slopes. This erosion contributes to lower agricultural yields which are further decreased by the growing necessity of using animal manure for fuel.

In relation to an environmental problem of this magnitude, the small negative environmental impacts which could potentially occur as a result of this project become insignificant. Of significance, however, is the fact that this project could play an important positive role in facilitating nation-wide efforts to conserve the environment and check its widespread degradation. Recent national and international awareness of environmental degradation in Nepal is currently being translated into several large conservation projects (such as USAID's Resource Conservation and Utilization Project) whose effectiveness will be enhanced by the availability of better transportation facilities in the Nepalese hills

The principle negative environmental impact identified by East Consultants Engineers, as being directly attributable to the construction of suspension bridges, is the increased fuelwood and fodder collection which can take place across a river in areas which were previously more inaccessible. (See Annex Impact Identification and Evaluation Form (IIEF) D. 3) Conceivably this could result in some reduction of a riverbank's natural defenses (See Annex IIEF A. 2) as well as some additional land clearing across the river (See Annex IIEF A 1. c), although this latter impact is unlikely given GON restrictions on new land clearing as well as the insignificant amount of land available for this purpose anywhere in the hills of Nepal.

In fact, it is doubtful whether this increased use of forest products across rivers from some bridge sites does anything more than alter the place these products are collected. That is, the total amount of deforestation does not increase through the construction of a bridge; it merely shifts from the less convenient near side of the river to the other side. This altered natural resources use could thus serve the beneficial purpose of lessening the pressure on forestry products in areas where they are more intensively used and thus reduce the rate of enviornmental degradation in more endangered areas. It is therefore not clear as to whether this altered natural resources use is, in balance, more negative or positive. It <u>is</u> clear, however that even if there is a net increase in deforestation and a slight decrease in the natural defenses of the river, the total amount of such an increase or decrease is relatively miniscule and is much more than offset by the bridge's potential future role in promoting the spread of conservation activities sponsored by government projects. (See Annex IIEF. I).

As is discussed in the sections on social and economic aspects of the project, it is anticipated that the construction of bridges in high priority locations will effect economic and employment patterns (See Annex IIEF. F. 1) as well as some cultural patterns (See Annex IIEF F 3). Both of these sets of impacts are perceived by the government and most of the people as favorable.

Among the changes in economic and employment patterns that are anticipated are: increased agricultural production through increased access to agricultural development inputs, increased rural employment through easier all-year access to areas where employment is available, and increased income through greater access to markets. Changes in cultural patterns include those which will stem from greater access to educational facilities and modern health facilities (See Annex IIEF G.3 a.) as well as greater social interaction with peoples across unfordable rivers from each other. While some traditional medical healers may perceive some of these changes as a dilution of cultural traditions, most people perceive them as beneficial and it is very doubtful whether bridges will cause any major cultural upheaval.

In addition to improving the rural population's health by increasing more peoples' access to health facilities (See Annex IIEF G.3.a), bridge construction will also have the positive impact of reducing the loss of life. (See Annex IIEF G.3 b.) Although statistics are unavailable, frequent newspaper reports attest to the relatively high loss of life that now occurs at some sites as the result of dugout canoe ferries overturning and inadequate bridges collapsing. The construction of safe bridges will eliminate this loss in areas served by the bridge.

In summary, this project is <u>not</u> expected to result in any significant negative environmental impact, while it <u>is</u> expected to provide the means for a number of positive environmental impacts to take place.

C. ECONOMIC ANALYSIS

In 1975 and 1976 a German consortium, German Consult, under a contract funded by the United Nations Development Programme, made a study which included a detailed economic/financial analysis of 42 selected bridge sites using Net Present Value and Internal Rate of Return criteria for ranking future bridges according to their feasibility. German Consult's analysis was based purely on economic and financial costs and benefits. Social and cultural costs and benefits were not taken into account except in two extreme cases of obvious danger and hardship. The possible benefits of improved access "to and from administrative centres and medical and educational facilities" (German Consult, Vol 4 p. 40) were included in the analysis only to extent that the time and cost of travel was quantified in user time savings. The study made the explicit assumption that, "in general it is doubted whether the total unquantified and unquantifiable benefits from bridge construction would amount to more than a small porportion of the direct benefits which have been quantified "(German Consult, 4.4.4.p.30). The German Consult study asserted that it is "extremely doubtful whether the construction of bridges at the sites studied would, in the absence of other required inputs, have any significant development impact" (German Consult 4.4.4. p. 29 and p 24).

This virtual disregard of the possible social and developmental benefits to be derived from bridges led to a 1977-78 study by the East Consulting Engineers of Kathmandu. This study of 12 bridges constructed by USAID over the years shows that, depending on the location, a number of beneficial social and cultural effects have and can take place as the result of bridge construction. Since the two studies employed different methodologies and reached somewhat different conclusions it is important to note a convergence of results indicating that the value of benefits is contingent upon the sites selected and that the application of suitable site selection criteria to proposed bridge sites is indispensible to maximizing benefits.

The present project design builds upon this research by placing emphasis upon development and refinement of bridge site selection criteria, which incorporate both social and economic methodologies. The optimum set of criteria would maximize social returns to trail bridge construction. Preliminary criteria have been worked out by GON, USAID and SATA personnel, drawing upon the German Consult and EAST reports and the GON/SATA experience in the field. These criteria will be applied and refined utilizing the FAR system of reimbursement.

For purposes of quantitative analysis, this institution building approach unfortunately means that the Project Paper calls for the construction of an indefinite number of bridges at a variety of sites throughout the nation. An attempt at this time to precisely define either the number of bridges to be constructed or their locations, would produce either results that are so hypothetical that they would be inoperable or would force the activity to fit artificial analytical requirements. Therefore, this section examines;

1. The economic context of suspension and suspended bridges.

2. How such bridges fit into Nepal's economic planning,

3. The economic benefits to be investigated in the analysis of such bridges, as well as the analysis of individual bridge sites.

Economic Context

Because of large demands and lower costs to bridge up-country rivers, construction of suspension and suspended bridges under this project is envisioned only at sites in the hills and mountains of Nepal. The hill economy of Nepal may be characterised as a stagnent agricultural economy of low labor productivity, in which animal and human power provide nearly all the energy inputs. The region is made up of a great many relatively isolated, traditional village economics, most of which have been settled for a long time. Recent growth patterns in human and animal populations have led to an increased exploitation of marginal agricultural lands and forest resources, and to large scale seasonal migration by adult males seeking unskilled employment as a supplement to their very low agricultural incomes. The hills of Nepal receive rainfall largely in the months of July, August and September, while rivers start to rise from snowmelt runoff in May. The period of maximum river flow (mid May to mid - October) coincides with the period of peak on - farm labor demand, and thus the low period in seasonal migration.

The major link between the thousands of village economics of Nepal is some 10,000 kilometers of foot trails which cross and recross hundreds of rivers, streams and gorges. Movement on these trails is of necessity slow. Transport is limited to a maximum per/piece weight of some 60 kilograms and to lengths of roughly twelve feet. However, construction and maintenance of trails and transport along these trails is well suited to a labor surplus economy with low per/production/unit trade. Lack of roads and railroads means heavy and bulky products, when demanded, can be transported by air, at very high costs, to one of the 35 STOL air-strips or one of the 20 landing strips located in or near the hills. After which, they must then either be broken down and transported by porters on the foot trails or lifted the final leg of the journey by helicopter. The few roads in the hills have a

very limited impact and then only on areas near the road alignment or at the road terminals. Trail networks are rarely improved beyond the basic requirements of a single passage by a laden porter. At rivers, some type of crossing is always available except at times of high flood (which rarely exceed 60 days a year). Most trade is in small lots, often for personal account and carried on a part-owner's back. There are very few professional porters and few full time traders.

Economic Planning

There is no set of trail network maps or trail classification schematic available for Nepal. No comprehensive mapping or inventory of existing ferry and bridge crossing facilities exists. There are no national, regional, zonal, district or local plans (except for Baglung District) which incorporate improved river crossing facilities into a general scheme of development. There are uncoordinated notions at all levels of the GON as to the approximate locations where improved crossings should be investigated or built. There is no effort to plan entirely new trail routes (perhaps including river crossings) as part of regional or local development programs. The suspension or suspended trail bridges constructed by the GON are either viewed as local (GON grants through the Local Development Department) or national (GON turnkey via the Suspension Bridges Division). There are no systematic policies to encourage local inputs on turnkey projects or to provide for periodic maintenance or to encourage/discourage toll collection.

Systematic identification of possible bridge sites for construction has been undertaken to date either using national security considerations or following what could be termed as the "Bottleneck Hypothesis". This hypothesis is that, the absence of an adequate river crossing on a trail constitutes such a severe bottleneck to transport and movement, that the efficiency of the entire trail network is substantially lower than it would be if a bridge were constructed. Bridge sites then became obvious targets of opportunity for construction. It must be observed that, even when the absence of bridge does constitute a severe bottleneck, without complementary investment in the associated trail network the bridge investment usually is not optimized.

The recent investigations carried out by EAST Consulting Engineers and German Consult suggest that the time has passed when bridge sites can be routinely located throughout Nepal as obvious "Bottlenecks". Two of twelve constructed bridges that were investigated by EAST were found to have only nominal economic or social value. The German Consult report found only 18 (of 42) bridges to have a positive Net Present Value, in

an analysis which was heavily biased towards the "Bottleneck Hypothesis" approach, utilizing traffic delay time as the major benefit variable. In fact, 16 of the 66 bridge sites identified in 1975 for possible future construction, were found to have adequate bridges already in place.

The IBRD has suggested (report 1973a-NEP of 3/16/78 pps. v. and 21) that program or sector assistance to improve access to and from the hills be considered. Trail improvement and suspension bridges are mentioned in this context. The logical next step is to consider suspension and suspended bridges as components for improvement of a vital element in rural infrastructure - the trail network. When analyzed this way, to optimize investment in trail bridges, complementary inputs in other components of the trail network would be required. Examples are trail widening, reduction in extreme trail gradients, improvements in trail alignment, construction of cattle ramps at water's edge to facilitate herd crossing when the bridge design does not permit such loads, improved river crossings at other points on the trail networks (bridge or ferry), culverts and slide barriers at points where the risk of washout/slide is extreme, and maintenance training. Only where a bridge replaces an inadequate crossing system on an otherwise adequate trail network would the optimal infrastructure investment consist of the bridge alone. At the other extreme, construction of a bridge or a new route without completion of the through trail network obviously would be implausible.

The present project design moves beyond identification of bridge construction sites as "Bottlenecks" through the use of site selection criteria which incorporate the bridge into the overall rural infrastructure of the target area. The Project design assumes the provision of essential complementary investments either by other GON programs or by the international donor community. Bridges are recognized as generating marginal incremental benefits insofar as they replace or supplement existing river crossing systems.

Ideally, each bridge investment should constitute an incremental input to a regional or local development plan. Given the present absence of such regional or local plans, bridge sites will continue to be identified in a number of ways, chiefly through the political process.

Economic Benefits

As a first step, identified bridge sites should be screened at the national level through a search for obvious "Bottleneck" sites. This should be done utilizing essentially the German Consult procedure, giving substantial weight in the Net Present Value and Internal Rate of Return Analyses to traveler delay time. However, the German Consult methodology should be modified by: 1) allowing (perhaps maximizing) local contributions to construction and maintenance and, 2) including an initial investigation of complementary investment necessary for the trail network.

The second step in screening possible sites should be coordination with existing and certain-to-be-built roads and ropeways. This has been done for a number of sites in the German Consult methodology.

At present, the German Consult investigation has ranked 42 bridges for construction. Those with a positive Net Present Value should be considered for FAR reimbursement under this project without futher economic or social studies. The possibility of cost reductions through local contributions to construction and maintenance and the investigation of complementary investment on associated trail networks should be conducted for each bridge. It should be noted that in this German Consult priority ranking are, six suspended bridges.

The third step should be a detailed site investigation utilizing the site selection criteria worked out by the GON in consultation with USAID and SATA. Guidelines to be used in evaluation of possible economic benefits are listed below. They should be used by incorporation into the overall site selection criteria for both bridges and associated improvement in the trail network of which the bridge is one component. (See below for detailed outline of social benefits, social soundness analysis and preliminary operational site selection criteria sections).

1. Reduction in traveler delay times.

2. Reduction in total trip times (applied to new routes and to diverted traffic).

3. Increased Agricultural Productivity.

   A. Reduced inventory fluctuation.

   B. Reduced risks.

      i. input supply

      ii. marketing stability

      iii. losses through spillage.

   C. Enhanced localized exploitation of comparative agricultural advantage.

      i. soils, ii. water, iii. sun exposure, iv. community forests.

D. Increased efficiency of animal utilization.

i. flexible grazing patterns.

ii. flexible utilization of draft animals during monsoons.

iii. reduced incidence of injury.

4. Reduced cost of goods sold.

A. Increased weight and/or volume per unit of transport

i. reduced risk crossing rivers.

ii. reduced trail gradients.

iii. increased trail width.

iv. use of new transport methods. (horses, mules etc.)

B. Reduced risk.

i. year round access.

ii. increased marked availability.

a elimination of trail blockages.

b. increased contact of persons in market.

iii. probability of decreasing waste.

a. on the trail.

b. in storage.

C. Reduced fluctuation of inventory.

i. decreased wet season storage.

ii. increased market information.

5. Development of Service Centers.

   A. Traffic generation.

   B. Reduced market imperfections.

      i. increased competition.

      ii. increased market information.

   C. Reduced risks.

      i. complementary product availability.

      ii. complementary service availability

6. Reduced price instability.

7. Increased health.

   A wet season access to health facilities.

   B. crop diversification.

   C. increased availability of food.

8. Enhanced "Nation building".

   A. reduced village isolation.

      i. broadened marriage patterns.

      ii. broadened religious exposure.

      iii. broadened linguistic exposure.

   B. Increased participation in Panchayat and district activities.

   C. Increased GON presence in infrastructure development.

   D. Increased local political activity.

      i. toll collection,

      ii. disposition of toll revenue.

      iii. community construction and maintenance.

D. SOCIAL SOUNDNESS ANALYSIS

Generally, an analysis of a project's social soundness is concerned with answering three related questions: a) social feasibility (is it acceptable), b) distribution of benefits (who benefits), and c) spread effect (will any benefits accrue to people outside of the immediate project area?). In the case of the Trails Suspension Bridges project, the question of social feasibility is easily resolved. Bridges of various kinds and varying degrees of technological sophistication have been constructed by local hill people throughout the history of Nepal whenever they have had the resources and requisite technological skills. The Nepalese hill economy has always depended on a high degree of mobility for trade and seasonal employment, and the present intermixture of ethnic groups and network of marriage patterns throughout the country testifies to a history of high social mobility. There is no question that the rural population of the Nepalese hills wants and will accept assistance in building bridges. Concerned government offices are piled high with petitions and requests for assistance in building bridges and almost every where, where it is within their means, the local people are constructing small bridges in their own areas-even though many of these must be reconstructed each year following the monsoon torrents.

An important additional indicator of the social feasibility of suspension bridge projects is found in the high degree of local participation which is easily generated. Bridges constructed by the Local Development Department (often with the assistance of Peace Corps Volunteers) usually have all of the non-skilled labor, including the transportation of materials from railheads or airports, donated by the local village panchayats as voluntary labor. As documented by the EAST Consulting Engineer's study of Baglung bridges, the degree of local participation in the construction of local - type bridges that is possible when there is strong local leadership, is phenomenal. In fact, the Baglung example of local participation is so successful that the government is presently seeking ways for extending this kind of activity into other spheres of development, and it is planned that the Suspension Bridge Department also devote some of its budget to constructing local "participatory bridges".

Social Impact

There are three groups of people who will be directly affected by the construction of bridges. First, all of the laborers (both skilled and unskilled) who will be employed for the transportation and construction of bridge components will benefit directly be receiving employment on the project. Since, except for a few highly skilled technicians and engineers, these will consist entirely of local farmers, farm laborers, and low caste

artisans, this benefit will be of direct value to the local people, albeit on a one time basis. Given the severe problem of under employment of the rural population of Nepal, this "Public-Works" aspect of the project should not be under-rated.

Second, the East report demonstrates that bridges benefit women living in their vicinity. It is well known (although exact data awaits the results of the USAID financed status of Women Project) that women are the primary collector's of fuel and fodder resources. By shortening the time required for this laborious year-long chore, women who are able to collect fodder and fuelwood from across a river have more time to devote to other activities such as cottage industries, childcare, food preparation, and socializing. In addition, bridges allow women to marry closer to home across rivers and to attend more market and religious fairs. This in turn means more opportunities to visit their parental home (which serves as a refuge from the hard work and low status associated with their husband's home) and be further integrated into public life.

Finally, there is one group of people that will be negatively affected by the project. These are the families of traditional ferrymen (often members of the special "rivermen" caste known as Majhis) who will be put out of work by the completion of the bridge. The East report shows that while in some cases, these people are able to make the adjustment to new forms of employment, in others, the ferry men were forced to migrate. The East report has suggested that special programs (such as cottage industry training) be devised to assist these people. This is a laudable recommendation, which, while beyond the scope and capacity of the present project, should be seriously addressed during the project period so that a long term approach can be devised.

Since, in contrast to most of the main ethnic groups in Nepal, there is practically nothing known about these people except that they speak a language belonging to the Tibeto-Burman family and that they make their living through fishing and ferrying throughout most of the rivers of Nepal, it is proposed that an extremly modest research study be funded through the project. The primary purpose of this anthropological study would be to identify appropriate forms of alternate income generating strategies for these ferrymen so that appropriate training and credit facilities can be provided to the families displaced by the bridge construction. The recommendations generated from this study would be turned over to the GON for use in their future suspension bridge building operations. It is envisioned that the study could either be conducted under a letter of agreement with an appropriate researcher in Tribhuvan University (such as graduate students or staff at the Research Centre for Nepal and Asian Studies) or by local contract.

Social Benefits

Social benefits can be conveniently divided between those in which the bridge can be the critical variable and those in which the bridge can be an important infrastructural first step, but is not necessarily the cirtical variable (economic benefits have been discussed above, see Economic Analysis).

Social Benefits in which Bridge can be Critical Variable:

--Increased access to employment possibilities.

--Time and labor saved by women in fuel and fodder collection.

--Stimulus for cottage industry development.

--Increased access to educational facilities.

--Increased access to health facilities.

--Decrease in accidental loss of life.

--Increase in social and religious interaction.

Benefits in Which Bridge Can Be An Important, But Not Necessarily Critical Variable:

--Adoption of new agricultural practices.

--Spread of development institutions.

--Improved government services, including more mobility of government officials and extension agents.

--Stimulus for development of additional employment opportunities.

--Increased use of improved livestock breeds.

The construction of needed bridges also tends to produce a crucial, if difficult to measure, attitudinal benefit which is one of the keys to development in Nepal. By serving as concrete evidence of government concern and willingness to assist the people, the construction of high priority bridges helps to bring about a postive attitude to development and modern inputs in a country where many of the people have yet to be convinced of the government's ability to help them. Since there is a

long-standing Nepalese tradition of local persons sponsoring the construction of bridges to gain religious merit, it is anticipated that this project will be particularly effective in this regard. As noted in East's report, "Because there is no material exploitation perceived, modern bridge building is in consonance with the religious values whereby sponsors derive spiritual merit".

The benefits listed above can be said to apply equally to all of the rural population served by a particular bridge. Since the vast majority of these people are small agriculturalists with land holdings of less than an acre per family, the majority of the people benefited according to anyone's definition, are very much the rural poor.

In summary the suspension bridge project is socially feasible and contains the potential for generating a number of social benefits for women and poor hill farmers. The magnitude of the benefits depends on location and complementary investments.

E. PRELIMINARY OPERATIONAL SITE SELECTION CRITERIA

AID's concern with the issue of site selection criteria in order to insure that a given bridge is socially and economically justified had led to this project's use of a FAR system in which only bridges which meet AID's selection criteria will be reimbursed. While the exact criteria have yet to be refined, weighted, and tested, it is anticipated that they will include the following:

1. Estimated amount of traffic by destination and user time savings in relation to estimated bridge construction cost (with cost of transportation of materials discounted for remote locations).

2. River classification (i.e. perennially unfordable, wet season unfordable, etc.).

3. Availibility of alternate crossing facilities.

4. Trail classification (i.e. main regional trail, local trail, etc.).

5. Location (very remote area, remote area, etc.).

6. Degree of local interest.

7. Access to social and service institutions (health and education).

8. Potential for increasing marketing and trade and stabilizing prices.

9 Potential for increased local mobility for firewood collection, more efficient agricultural production, marriage, and social and political interaction.

10. Potential for increasing spread of government institutions.

11. Potential for increasing agricultural productivity through expanded extension services and agricultural input availability.

12. Special conditions (i.e. presently no trail because of lack of bridge, but strong reason to believe that a bridge would be highly beneficial by creating a new trade and transportation route)

The development and incorporation of these criteria in the Suspension Bridge Division site survey will not only insure that the bridge constructed through USAID financing will be beneficial to the people, but it will also assist the GON in the process of allocating its own resources in the future so that they will be of maximum benefit to the Nepalese hill farmers. The detailed site survey methodology should not be finalized until considerable experience in application has been gained. For example, several

relationships apparent in German Consult table 4.2.I (volume 4, page 4) should be investigated in the continuing effort to refine the criteria of each potential bridge's role in the area economy. Bridges tend to be either local or non-local, either to carry significant numbers of animals or virtually no animals, and to carry far greater daily average loads of people and animals in the dry season than in the wet weason. It may be that the most difficult relationship will hinge on the finding that traffic will resist diversion of even a few hundred meters to a bridge crossing in the dry season. Trails often cross rivers in the dry season at points where the river bed is broad and the water shallow. Such sites are least attractive for bridging both because of cost considerations and because engineering problems increase rapidly as bridge spans exceed 400 meters. It may be that it is more efficient to construct truss or other rigid bridges directly on the trail at such locations rather than build a suspension or suspended bridge at a reasonable engineering site more than 500 meters from the trail alignment.

F. FINANCIAL ANALYSIS AND PLAN

a) Introduction

The Trail Suspension Bridge project is essentially a non-revenue producing project with benefits to bridge users being both social and cultural. However, it is expected that bridge users will realize economic benefits in the form of transportation time and cost savings, and better access to agricultural inputs such as seeds and fertilizer.

The Mission has decided, in collaboration with the GON Ministry of Finance and SBD to use the Fixed Amount Reimbursement (FAR) method of financing for the bridge construction element of the project. This decision is based upon the fact that the achievement of the institutionally oriented purpose of the Project is best served by such FAR financing. The Mission has not attempted to use FAR in Nepal previously, but conditions of this project seem ideal for a first attempt. The planned operation of this method is explained in greater detail under the Financial Plan Section.

b) Project Estimated Costs

The estimated total cost of the project is 4.3 million dollars of which the USAID grant will cover not more than 3.0 million dollars. Table No. 1 is a costing of project inputs and outputs, and Table No. 2 shows estimated expenditure levels by fiscal year. Since a Project or Grant Agreement will probably not be executed between USAID and the GON until late FY 1978, no expenditures are expected until FY 1979 when contractors begin their services, and the first series of Project Bridges are completed and reimbursement is made under FAR by the Mission to the GON.

The German Consult report contained detailed costing of the 23 bridges it considered economically feasible to construct. However, since the bridges to be built under this project have not yet been determined, it is quite likely that the overall costs shown in the German Consult report will not be applicable. Until Project Bridges are identified it is of little value to calculate estimated costs per bridge, etc. A cursory review of bridges constructed during the past two years shows costs have ranged from about $101 per meter of span to $1,185 per meter with an average of $605 per meter. Future costs can be expected to be higher. These fluctuations in costs of bridge construction are due to the fact that the location of the bridge site determines the transportation costs of parts etc. Therefore a bridge located in an extremely remote area will have higher costs than one which is closer to a source of materials, i.e. a road or airport.

Table No. 1
Costing of Project OUtputs/Inputs Trail Suspension Bridge Project
(US $ 000)

Project Inputs	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
A. AID						
1. Reimbursement under FAR method of bridge construction costs	2,665*					
2. Contractual services for trail classification study		250				
3. Study of tralesmen displaced as result of bridge construction			10			
4. In-depth project evaluation. a. Local contract b. U. S. consultant						33 42
B. GON						
1. Administrative and budget support for survey teams.				200		
2. Administrative and budget support for bridge maintenance					350	
C. SATA						
1 Additional contribution of materials to bridge construction	499					
D. US Peace Corps						
1. Technical Assistance to LDD in bridge construction and maintenance training	255	—	—	—	15	—
TOTALS	2,419	250	10	200	365	75

* This amount represents the residual USAID contribution remaining for bridge construction after deducting the more readily estimated costs for contractual services and evaluation costs.

Table No. 2
Projection of Expenditures by Fiscal Year
Trail Suspension Bridge Project

(US $ 000)

Fiscal Year	AID	HMG/N	SATA	Peace Corps	Total
FY 1978	-0-	-0-	-0-	-0-	-0-
FY 1979	755	135	499	90	1,479
FY 1980	1,490	295	X	90	1,875
FY 1981	755	120	X	90	965
TOTAL	3,000	550	499	270	4,319

c) Analysis of Suspension Bridge Division Budgets

Table No. 3 presents SBD's budgets for its budget years ending in 1975 through 1978, and the proposed budget for the year ending in 1979. Actual expenditures are shown for years 1975 through 1977, and for the first six months of 1978.

The overall SBD budget shows a slight decline in allocations from 1975 through 1978, although actual budget expenditures have increased over the same period. The budget line item for other Construction and Maintenance # 12 is of particular interest to the project as it represents the amount budgeted for bridge construction during the fiscal year. Despite the decreasing amounts budgeted for construction during the past three years, actual expenditures have been increasing. Expenditures during the first six months of 1978 are nearly 90% of the amount budgeted. Through budget supplements it appears actual expenditures will exceed the amount budgeted and will be higher than 1977 budget expenditures.

The amount proposed for 1979 construction is nearly double the 1978 budget. At the present time, a definite possibility exists for a FY 1979 budget for SBD which is substantially higher than the proposed figures. It is almost certain the 1979 budget will be significantly larger than 1978.

The 1979 proposed budget includes a nearly 32% increase for repairs and maintenance. This is a noteworthy increase as maintenance has not been given sufficient importance in the past. Bridge maintenance is covered in more detail in the Technical Analysis section of the Project Paper, but it can be said here that additional budgetary support will be necessary in the future.

The SBD was established in 1964 and has developed into a reasonably well operating and managed entity. The increased activity resulting from this project should not present a burden that cannot be handled by the present SBD organization. This will be especially true using the FAR method which requires minimal financial reporting by the implementing agency, SBD, to the Mission. USAID funds will only be released to the SBD upon satisfactory completion of each Project Bridge. This means the SBD will be required to initiate a certain amount of financial standardization in the construction program, including the budgeting and allocation of sufficient funds, in order to receive reimbursement from AID in a timely manner.

Table No. 3 - SBD Budgets and Expenditures for FY's 1975 to 1978 and Proposed FY 1979 Budget ($ 000).

&SUSPENSION BRIDGE BUDGETS

	FY 1975		FY 1976		FY 1977		FY 1978		FY 1979	
	Budget	Expenditure	Budget	Expenditure	Budget	Expenditure	Budget	Expenditure*	Budget	Expenditure
Salary			25,000	31,900	40,200	40,100	40,200	28,400	44,200	
Allowances			2,800	2,000	3,200	3,200	3,200	1,100	4,000	
T. A. & D.A			32,100	29,200	36,100	36,500	36,100	36,400	44,200	
Services			2,800	5,000	4,000	4,000	4,000	2,600	4,800	
Rent			1,000	200	800	700	800	100	4,000	
Repair & Maintenance			2,400	3,100	85,500	81,400	73,500	42,600	96,800	
Expendable Goods			2,400	3,000	2,000	2,800	2,400	2,400	2,400	
Books & News Papers			200	100	200	200	200	100	200	
Fuel for Vehicles			2,000	2,800	1,600	2,400	2,400	2,000	6,400	
Fuel for Other Purposes			400	100	200	200	200	-	200	
Other Expendable Goods			400	200	400	400	400	-	400	
Contingency	140,400	175,900	400	900	300	3,800	800	600	800	
Furniture			2,000	2,000	800	800	800	800	800	
Transport Devices					8,000	8,000			400	
Tools & Machinery			12,000	12,000	12,000	12,000	12,000	3,900	20,100	
Building Construction & Maintenance					2,400	4,600	2,400	1,600		
Other Construction and Maintenance	1,221,800	626,700	1,218,900	831,400	851,400	922,600	842,200 1/	753,900	1,647,400 2/	
TOTAL	1,362,200	802,600	1,304,800	923,900	1,049,100	1,128,600	1,021,600	876,500	1,877,100	

Note: The budget for overhead cost was included in the overall budget of Dept. of Roads.

Separate Budget for Survey and Investigation - $36,254 Expenditure.

* Expenditure as of Dec. 15, 1977.

1/ Swiss contribution is $ 281,124.

2/ Swiss contribution is $642,570 as per information available from SBD the total budget for this year is expected to be increased substantially.

Note: Balance of $ 401,606 of Swiss contribution will be used in FY 80.

d) Host Country Contribution

Nepal is one of the world's poorest Relatively Least Developed Countries (RLDC) as determined by the United Nations. Despite the severe limitations imposed by a lack of natural resources, and a shortage of trained managers and technicians, the GON has made considerable progress in its efforts to mobilize resources to develop the nation. The national budget has significantly grown in recent years and particular attention has been focused on the national bridge construction program.

The total GON contribution to the Project has been calculated as approximately $550,000, or 12.7% of the total life-of-project costs. Thus the GON will not meet the 25% requirement of FAA, section 110 (a), and a waiver is herewith requested. Provisions for such waivers are cited in section 307 of the International Development and Food Assistance Act of 1975 permitting a waiver of the 25% cost-sharing requirement for either of the following reasons: (a) a waiver can be granted for a project or activity, only on a case-by-case basis (i.e., no blanket country waivers), and (b) a waiver can be granted on the basis that the determination of the country's eligibility must be based on the UNCTAD list of "relatively least developed countries".

The project qualifies for such a waiver under both of the conditions cited above. The nature of the project provide a strong argument for such a waiver, in that the purpose of the project is oriented towards enhancing the present capacities and capabilities of an existing and functioning GON agency. USAID is convinced that the propose level of host country contribution is adaquate, given the fact that the annual SBD budget will continue to gradually increase. Rather than requesting an artificially high level of budget allocation during the life-of-the-project, which will not be maintained once the project is completed, USAID is requesting a 10% waiver of the requirement inorder to allow the GON to continue its program of gradually increasing the SBD's annual budget in line with the Division's demonstrated absorbsion capacity and management capabilities.

In addition Nepal has been classified by UNCTAD as a RLDC and qualifies for a waiver on these grounds. The 12.7% present level of contribution to project costs is a substantial investment of extremely scares resources and to require a higher level of contribution would undoubtablly place great strain on the overall development program of the GON.

The waiver request has been thoroughly discussed within USAID as well as with the various concerned GON agencies and in view of the strong arguments for such a waiver and the project's ability to meet statuatory requirements, the Project Paper firmly supports the necessity and desirability of granting a 10% waiver of the host country contribution requirements of the FAA. The GON will then be in a position to meet the 15% host country contribution by a gradual increase in the present level of the SBD budget.

e) Financial Plan

1. Fixed Amount Reimbursement

The major financial element of this project, 2.665 million dollars, is earmarked for construction of suspension bridges. Each bridge construction must go through a number of steps: site selection, procurement of raw materials and fabrication of bridge parts or allocation of materials and pre-fabricated parts from stored stocks, transportation of parts to site, and construction. Since all bridges individually must go through these steps, each bridge can be considered a discrete subproject. This sets up an ideal situation for using the Fixed Amount Reimbursement method of financing the costs of bridges. The Swiss Association for Technical Assistance (SATA) contributed a substantial supply of construction materials in 1977 for suspension bridges construction. Much of this inventory will still be on hand when this project starts up, and will be available for project bridges. The materials on hand, plus the fact that SBD's 1978/1979 budget will be finalized by July 1978, will make it possible to begin project implementation without an advance of funds from AID. Results of the first project evaluation will show the Mission whether or not the FAR method is working as effectively as planned. If not, some modifications will have to be made, such as direct commodity procurement by AID/W or advances of funds to SBD. (See Technical Analysis Section of Project Paper) Bridges to be constructed under the project have not yet been identified. SBD, based on site surveys, will select bridges to be constructed, and the Mission will review each to determine whether or not it meets agreed upon selection criteria. If it does, that bridge will be included as a project bridge. Once the total estimated cost of the bridge is established the Mission will agree to reimburse SBD under the FAR method for a percentage of the estimated cost. The reimbursement percentage will be determined from periodic reviews of SBD's budgets and budget performance in order to ensure a minimum 15 percent GON contribution is maintained. SBD will proceed to construct the project bridge using its own funds and materials. Upon completion of a project bridge, AID will inspect the bridge jointly with SBD, and if found acceptable, will proceed to reimburse SBD for the predetermined amount. The SBD, through GON's budgetary processes, will then have these funds available to continue its bridge construction program. As an example of how FAR would work in this project, we can use two bridges included in the German Consult report as high priority bridges. These are Bridge No. 19, on the Sun Kosi, with a span of 162 meters, and Bridge No. 6, on the Hongu Khola, with a 33 meter span. If SBD decides to build these bridges, and if the Mission determines they meet the site selection criteria, they will be included as project bridges. SBD would then obtain bids for fabrication of bridge components, transportation of the components to the construction site, and for the construction itself. After evaluation of the bids, contracts would be

awarded. Materials would then be delivered to the fabricator from SBD's stock, Based on the cost of materials delivered to the fabricator plus the values of contracts awarded, an estimated cost of each bridge could be determined. The Mission would then have to determine what percentage of estimated total cost would be reimbursed under FAR in order to insure GON's overall contribution to the project is 15%. The GON's contribution to project costs will include budget expenditures for project support costs, i.e. administrative expenses, maintenance, survey teams etc. The GON's contribution of 15% of total project costs will be a compilation of the contributions calculated for each individual bridge. As a result of keeping a running account of the contributions made by the GON to each bridge construction, the FAR reimbursement by USAID will be able to fluctuate inorder to insure that the overall total contribution by the GON reaches the 15% level required by the project. In the case of the above two bridges German Consult's estimated costs, projected to FY 1980 prices are:

Cost Component	Bridge No. 19 (Equivalent US $000 at	Bridge No. 6 Rs. 12.45 to US $ 1.00)
Materials	81.4	7.3
Fabrication	25.5	1.3
a. Truck	8.1	1.5
b. Porters	19.3	11.3
Construction	32.3	6.8
	TOTAL 166.6	28.2

Based on its review of SBD's budgets and expenditure level, the Mission might decide to reimburse 95 percent of the total estimated cost of each. Since Bridge No. 6's span is fairly short it could probably be completed in one constructinn season. If the USAID and SBD inspection found it acceptable, reimbursement of the equivalent of US $ 26.8 thousand (95% of $28.2) could be made immediately. Bridge No. 19 has a longer span and would probably not be completed during a single construction season. Reimbursement of the equivalent US $158.3 thousand (95% of $ 166.6) would be made only after completion and passing the final inspection.

All other project bridge costs would be reimbursed in the same manner. If the Mission reviews of SBD budgets indicate administrative and other project related expenditures are sufficient to make the 15% contribution, the entire estimated bridge costs could be reimbursed to the GON. at the time the final project bridge is identified a final review will be made

of SBD's life of project budget execution in order to determine the appropriate reimbursement percentage to use to ensure a GON 15% contribution to the total project cost.

2. Other Cost Elements

Table No. 4 presents a summary of estimated project costs and the source of funding. Total cost of the project is estimated to be about 4.25 million dollars. The estimated 1.2 million dollar USAID contribution for the foreign exchange element of bridge construction is based on German Consult's estimate that an average of 45% of bridge costs are for imported commodities. The remaining 1.465 million dollars is for local currency costs of fabrication of bridge parts, transportation of parts to the bridge sites, and construction contracts. The Mission plans to contract a U.S firm to make the Trail Classification Study, and Nepalese firms or institution to do the Displaced Tradesmen study as well as to assist in the in-depth project evaluation. SATA plans to continue its technical assistance program with the SBD and LDD, however, we do not have available the dollar value of these services.

Table No. 4
Summary Cost Estimates and Financial Plan
Trail Suspension Bridge

(US $ 000)

Use	(Source of Funding) AID FY	AID LC	HMG/Neapl FX	HMG/Neapl LC	SATA FX	SATA LC	Peace Corps FX	Total
1. Bridge Construction	1200	1465			499		255	3419
2. Trail Classification Study	250							250
3. Displaced Tradesmen Study		10						10
4. Survey Team								
a. Admin. Support				200				200
b. Technical Assistan Assistance					X			
5. Bridge Maintenance Capacity								
a. Admin. Support				350				350
b. Tech. Assistance					X		15	15
c. Training					X			
6. Project Evaluation	42	33	—	—	—	—	—	75
TOTALS	1492	1508		550	499		270	4319

Footnotes:

The figures above have already taken possible inflation into account. Inflation rates used are:

1. Materials 15% annually
2. Fabrication 12.5% ,,
3. Transport
   a. Truck 15% ,,
   b. Porters 10% ,,
4. Construction 10% annually

(Based on German Consult cost projections).

PART IV. IMPLEMENTATION PLANNING

A. ADMINISTRATIVE FEASIBILITY

In order to fully assess the administrative feasibility of successfully achieving the institutional building purpose envision by this project, it is essential to first clearly understand the planning and operational methodology presently being utilized and that proposed for the future, by the target GON institutions. Only upon completion of such an analysis, will the process of proposing and planning innovations aimed at improving the existing institutions, become a realistic and worthwhile excercise. Then during the implementation stage of the project, the vital functions of adaptation and amalgamation of pragmatic realities and theoretical concepts can ultimately result in the successful achievement of the institutionally oriented purpose of the project.

As a result of utilizing the FAR system, the administrative demands which the project will make on USAID/Nepal and AID/W are minimal. The present USAID staff should be able to provide essential monitoring and inspection personnel throughout the life of the project. AID/W will be required to provide minimal assistance to the project by contracting with an appropriate individual or firm for the Trail Classification Study. In the Initial and Final Project Evaluation AID/W will be expected to provide necessary TDY personnel. All other technical and administrative requirements will be filled by the SBD/LDD staff and/or the SATA/PC technicians.

At present the various elements of the GON nation-wide program of bridge construction fall under the jurisdiction of two Ministries. The major component of the program is the direct responsibility of the Suspension Bridge Division of the Department of Roads which is in the Ministry of Works and Transport. The GON is evaluating a plan of decentralization which would require SBD to divide its resources between the four development regions of the nation. Such a reorganization may well loosen the central control and monitoring function of SBD while at the same time inhibiting the division's ability to produce the require number of bridges each year, due to a lack of adequate personnel and resources. As it now is constituted the SBD has the responsibility to construct Trail Suspension Bridges according to the targets established by the planning documents of the GON and the various district panchayats of the four development regions. SBD must give technical advice and material support to the other governmental units involved in the nation-wide construction program. The SBD presently has a technical and administrative staff of more than 130 persons and a proposed annual budget for FY 1979 of 2 million dollars. At this

writing, there are discussions under way within the Planning Commission and the Ministry of Finance which will in all probability result in a substantial increase in the annual budget of the SBD.

Such a possible increase is seen by USAID as a very positive indication of the GON's willingness to recognize in concrete financial forms the vital role SBD and suspension bridge construction play in the overall development of the nation.

The annual construction targets of between 20 and 30 bridges for the SBD are presently establish by the Planning Commission, as a result of the demands generated throughout the nation by local and district panchayats. The present procedures call for only a limited engineering survey of the construction site, once national bridge locations have been set by the Planning Commission. Once this initial survey is completed by SBD engineers and surveyors, bridge designs and cost estimates are compiled by the design section of the SBD. The division then approves these technical elements and earmarks funds for the necessary raw materials from stocks previously stored as a result of standardized procurement, the fabrication of the needed standardized bridge components, the transportation to the selected site and the actual construction of the bridges.

Due to efforts of SATA technicians working with SBD personnel the division has been able to incorporate a certain amount of standardization of bridge design and bridge components into the program. Such standardization has minimized the bureaucratic delays involved in these crucial steps and has enable SBD to store a working quantity of raw materials and fabricated components in government warehouses. Thus once the site selection, survey and allocation of funds is accomplished the SBD can move ahead relatively quickly in its program of bridge construction. SBD operates a continuous program of procurement through their normal channels so as to insure that the program can continue. At present a portion of the funds utilized for this advanced procurement is provided to SBD by SATA under a 1977, 3 Million Swiss Franc grant in aid.

The transportation of components and the construction of bridges are accomplished by standard GON contracting procedures and SBD supervisory engineers etc. are assigned to each site in order to insure the proper technical and fiscal management of each bridge sub-project. Once completed, each bridge is subjected to a final inspection and a report is submitted to the division varifying completion of the construction.

In addition, the division has in the past cooperated closely with the Local Development Department of the Ministry of Home and Panchayat to

technically and materially support the LDD bridge construction program. The LDD, utilizing the assistance of PCVs and LDD overseers provides the essential site selection and survey information for a proposed bridge. Funds for the construction are then channelled from LDD through the District Panchayat to the Local Panchayats. Supervision and coordination by PCVs and district engineers are provided and the construction program utilizing local participation is initiated and completed. Should an initial survey of the site result in the need for a degree of technical inputs or material support beyond the capabilities of LDD and the local panchayat, SBD is contacted. SBD will then determine if the subject bridge falls within its own program of construction and therefore the above procedures will apply, or if only limited technical and material support from SBD will be required. In this manner the GON has been able to administer and coordinate the multi-departmental, nation-wide government program of bridge construction and has gradually increased overall construction capability.

As a result of the overwhelming national demand for bridge construction, the SBD has not as yet been in a position to devote sufficient time or personnel to the development of a comprehensive divisional program of major maintenance for bridges or trails. The system as it now exist is to a certain extent ad hoc. Minor maintenance to a limited extent is now carried on by the local or district panchayat. Reports concerning major maintenance requirements especially when a bridge is in danger of collapsing, are submitted to SBD by a number of sources. These include; SBD survey teams and engineers returning from field trips, district level engineers and panchayats, local panchayats or concerned individuals, LDD, Peace Corps Volunteers, and SATA technicians. Such reports are evaluated in SBD and then decisions are made as to priorities. Funds are then utilized by SBD from the line item earmarked in the budget for such maintenance. The required technicians are then assigned to the sites requiring maintenance and the necessary work is completed. Such an ad hoc program of maintenance will at times necessitate that SBD divert essential personnel from ongoing projects thereby causing unforeseen delays in the overall program.

In the bridge construction by LDD/PC the vast majority of the essential maintenance can be accomplished by local or district people. Should a specific bridge require a degree of maintenance beyond the capacity of local resources, a report is submitted to SBD. A prioritization is then made in terms of the overall national requirements and the availability of resources, and if feasible the necessary funds and personnel are allocated to the specific bridges and maintenance is accomplished.

In order to initiate the continuing process of upgrading the GON's institutional capability, the GON/USAID Trail Suspension Bridge Project

is recommending certain innovations in the existing operational procedures of both SBD and LDD. These concepts and innovations are based upon extensive discussion with the concerned GON agencies, with the international donors agencies presently involved in the overall program, and on the very thorough analysis and report written for USAID by EAST Consulting Engineers of Kathmandu.

From these discussions and reports USAID concluded that the weakest link in the existing administrative chain of events leading to the completion of a specific bridge is found in the initial site selection process. The existing system allows for only a minimal SBD/LDD input to the ultimate prioritization and selection of bridges to be constructed in any specific year. USAID's project, based upon the recommendation of the EAST Report, envisions the establishment of a Coordinating Committee in the Ministry of Works and Transport comprised of representatives of the SBD and LDD to ascertain the bridges that each of these agencies will undertake. Once such a determination is made, the Coordinating Committee will submit its annual request for resources to the Planning Commission and the Finance Ministry in the form of the proposed annual budget.

The project envisions the establishment of a staged selection procedure by the Coordinating Committee. In the first stage a prioritized listing of the bridges requested by each District is to be submitted to the Coordinating Committee. Each request is to be accompanied by certain base-line data concerning the proposed site and surrounding area (see Annex: EAST Consulting Engineers Report). Such a methodology insures that the projects will involve the target populations in the crucial initial phase of the program. Based on this data and the national and regional requirements for bridges, the Coordinating Committee will then request from the Planning Commission and the Finance Ministry the budgetary funds for the program of each of the governmental units concerned. (SBD/LDD). Upon receipt of a decision from the Planning Commission and the Finance Ministry, the Coordinating Committee will assign survey teams to carry out a more detailed engineering/socio-economic investigation of the proposed sites. The information resulting from these surveys will then enable the Coordinating Committee to establish a prioritized short listing or bridges to be constructed in a specific time frame. Then each governmental unit will proceed using established operational procedures.

In terms of upgrading the maintenance program of the SBD/LDD the Project Paper makes a number of recommendations. The Technical Analysis section of the Project Paper outlines a proposed program for incorporating maintenance training and an annual system of reporting from the districts

which will be incorporated into the SBD system of operation. In most cases the costs associated with minor maintenance of SBD bridges such as walkway repair, cable adjustment etc. could be recovered by local panchayats through the charging of tolls for all non-local traffic. Major maintenance such as erosion control, cable replacement etc. would still, of necessity, be the responsibility of SBD.

The repairs associated with LDD bridges would remain the responsibility of the local people and funding would again be recovered from toll charges for the use of bridges. The project proposes the incorporation of a maintenance training program as part of the Peace Corps Volunteers work at a specific bridge. An individual would be trained in maintenance during the building of the bridge and a mini-tool kit would be provided upon completion of the construction and training.

A crucial element in the establishment of a viable and continuous program of maintenance of bridges is a comprehensive listing of those bridges which presently exist in Nepal. No such inventory now exists. Nor is there any clear picture, either for planning or maintenance purposes, of the nation-wide network of trails. The Project Paper envision that the Trail Classification element of the project will result in a major initial step in the elimination of such problems. Once such a classification is completed the selection procedure for bridges will be provide with an extremely valuable tool in terms of planning and the nation-wide maintenance program can begin to function in a comprehensive and systematic manner.

In that the concepts and innovations proposed in the project are as yet untested in a field situation, the program is designed to provide adequate opportunities to test, evaluate, and revise procedures and methodologies throughout the life of the project.

PROJECT IMPLEMENTATION PLAN

I. Grant Agreement Signed.

II. Bridge Site Survey:

Prior Acting

1. SATA technical assistance in place in SBD. (SATA/SBD).
2. Design of initial criteria for site selection completed. (SATA/SBD).
3. Completion of initial training manual of Bridge Survey Guidelines. (SATA).
4. Assignment of SBD personnel to survey teams. (SBD).
5. Training of initial survey teams completed. (SBD/SATA)
6. Completion of initial field surveys. (SATA/SBD).
* 7. Completion of initial site selection. (SBD) (See III 7)
8. Evaluation of site selection criteria and survey methodology (SBD/SATA/USAID).
9. Revision of initial criteria and site survey methodology (SBD/SATA/USAID).
10. Completion of second training program for survey teams (SBD).
11. Completion of second field survey (SBD).
* 12. Completion of second set of site selection. (SBD/SATA/USAID) (See III B 7).
* 13. Evaluation of site selection criteria and survey methodology completed. (SBD/SATA/USAID) (See VII).
14. Completion of revision of criteria and survey procedures. (SBD/SATA/USAID).

III. A. Bridge Construction:

Prior Action

1. Advertise for procurement of raw materials completed (SBD).
2. Placement of orders for raw materials completed (SBD).
3. Delivery of raw materials to SBD completed (SBD).
4. Bridge part fabrication contracts signed (SBD).

5. Raw materials delivered to fabricator (SBD).

6. Fabrication of initial parts completed (SBD).

* 7. Site selection and construction cost estimates for FAR system sub-projects agreed upon (USAID/SBD/SATA) (See II 7).

8. Fabricated bridge parts delivered to construction sites (SBD).

9. Establishment of toll collection and maintenance system with panchayat completed. (SBD/Local and District Panchayat).

10. Construction of bridges completed (SBD).

11. Inspection of bridges completed (SBD/SATA/USAID).

12. Completion of initial FAR payment (USAID/SBD).

*13. Evaluation of initial FAR construction phase. (USAID/SBD) (See III B 7).

III.B. Bridge Construction:

Prior Action

1. Advertise for 2nd trance of procurement of raw materials completed (SBD).

2. Placement of orders for raw materials completed (SBD).

3. Delivery of raw materials to SBD (SBD).

4. Bridge part fabrication contracts signed (SBD).

5. Raw materials delivered to fabricator (SBD).

6. Completion of initial 2nd trance of fabrication of parts (SBD).

7. Site selection and construction cost estimated for FAR system sub-projects (phase B) agreed upon (USAID/SBD/SATA) (See II 13).

8. Fabricated bridge parts delivered to construction sites (SBD).

9. Establishment of toll collection and maintenance system with Panchayat completed (SBD/Local and District Panchayat).

10. Construction of bridges (phase B) completed (SBD).

11. Inspection of bridges completed (USAID/SBD/SATA).

12. Completion of phase B FAR payment (USAID).

*13. Evaluation of phase B FAR construction (USAID/SBD/SATA) (See VII).

IV. Trail Network Classification and Study:

Prior Action

1. Scope of work designed (USAID-TDY).
2. PIO/T issued (USAID/N).
3. Stereo aerial photos and national base map made available for use in AID/W (USAID/GON).
4. Consultant's contract signed (AID/W).
5. U.S. photo and map interpretation completed (consultant).
6. Nepalese adaptation of interpretation results completed (consultant).
7. Graphical representation of trail classification system completed (contractor).
8. Evaluation of study and submission of recommendations for possible follow on program completed (USAID/GON/contractor).

V. Operational SBD bridge maintenance and trail improvement capacity:

1. SATA technical assistance in place within SBD (SBD/SATA).
2. Manual of procedure and training completed (SATA).
3. District personnel for training designated and assigned to on the job training (SBD/District).
4. Training Complete (SBD).
5. District personnel reassigned to district (SBD/District).
6. Completion of initial year of program (SBD).
7. Evaluation of maintenance program completed (SBD/SATA/USAID).
8. Revision of procedures completed (SBD/SATA).

VI. Operational LDD bridge maintenance capacity:

1. Peace Corps Volunteer in place in LDD (PC/LDD).
2. Maintenance and Training manual completed (PC/LDD).
3. Selection of local technicians for training (PC/District).

4. Training of local technicians completed (PC).

5. Assignment of local technician to bridge site and provision of Mini-Tool kit (PC/LDD).

6. Inspection of completed bridge (PC/LDD/USAID).

7. Payment for initial bridge construction complete (USAID).

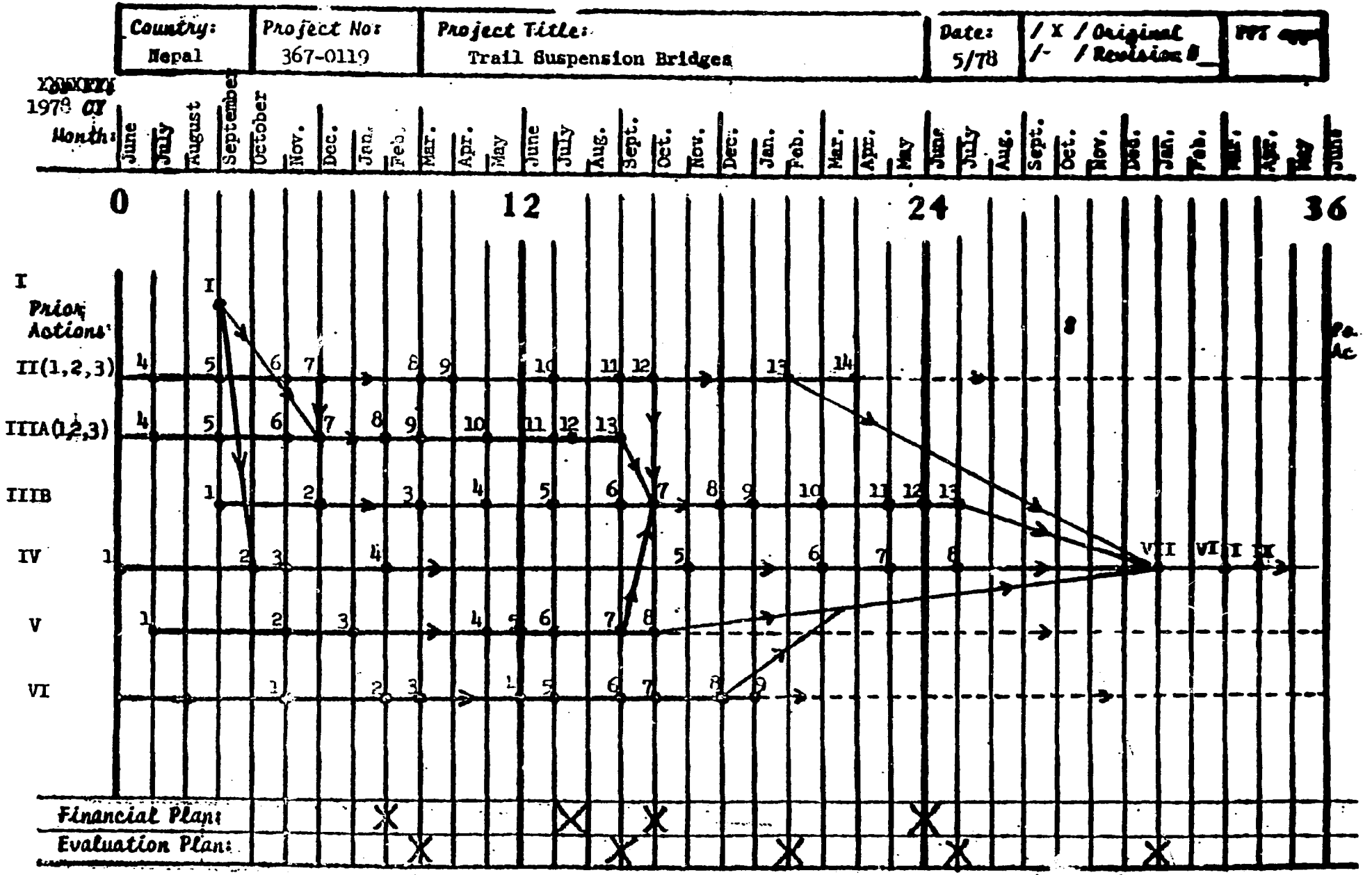
8. Evaluation of operation (SDD/USAID/LDD/PC).

9. Revisions in procedure completed (LDD/SDD/PC/USAID).

VII. Project evaluation completed (AID/W/USAID).

VIII. Project recommendation incorporated into rural development strategy (USAID).

IX. Initiation of recommendations:



PROJECT PERFORMANCE NETWORK

D. EVALUATION PLAN

In that the purpose of the Project is to upgrade an already existing and functioning GON institution by utilizing a number of innovations and concepts as yet not fully tested in a Nepalese context, the project relies heavily upon a thorough and continuous process of evaluation and refinement, in order to insure the successful adaptation and subsequent adoption of the proposed institutional development.

The Director of the Suspension Bridge Division of the Ministry of Works and Transport and the USAID Project Manager will be jointly responsible for evaluating the progress of the project on an informal continuous basis. In this manner potential problems will be identified and their detrimental effects minimized in advanced. This continuing evaluation process will also make it possible to highlight, during formal evaluation, those elements of the project which are proving themselves as being most effective.

Each of the five individual elements of the project is to be evaluated upon completion of one operational cycle or upon completion of the element in total. Once these initial individual evaluations are performed by the representatives of the concerned agencies (i.e. SBD, LDD, PC, SATA, USAID) necessary revision will be agreed upon. Then operational phases of the individual project elements can continue.

Such evaluations will be required by each of the following project elements:

1. SBD/LDD Bridge Site Surveys.

2. SBD/LDD Bridge Construction.

3. Trail Classification Study.

4. SBD Bridge maintenance and Trail improvement program.

5. LDD Bridge maintenance program.

At the end of the first construction season, after the initial FAR payment has been made, there will be a project evaluation covering all project elements. The evaluation will concentrate on the appropriateness of the FAR system, the utilization of the proposed criteria in site selection, the progress of the Trail Network Classification and study, as well as the SBD/LDD maintenance programs. It is crucial that the

evaluation be undertaken as a joint and collaborative effort of all concerned agencies i.e. SED/LDD/PC/SATA/USAID. The recommendations of the evaluation for revision will then be pragmatic and can quickly be adopted by the functional agencies for application in the various elements of the project.

The final project evaluation will be held at the completion of the project and timed so as to provide maximum inputs to any subsequent program of bridge construction USAID may wish to consider in the future. The final evaluation committee will include representation from all of the operational agencies concerned with the project as well as representation from AID/W. In addition the Mission will schedule annual internal evaluation of the Project as required.

PART V. ISSUES, DISCUSSION AND RECOMMENDATIONS.

PROJECT ISSUE

These issues have not as yet been fully resolved:

1. Should a waiver of the standard host country contribution to project costs be granted in order to allow a 15% host country contribution rather than the standard 25% contribution?

Discussion and Recommendation:

By careful analysis of the SBD proposed annual budget USAID has determined that the project, by reimbursing construction costs under the FAR system will finance approximately 85% of the costs of the total program. The GON contribution will include all administrative and support costs of the existing agency as related to the FAR bridges. Given the fact that Nepal is classified as an RLDC by UNCTAD and that the GON has continually demonstrated its strong support both financial and administrative to the proposed program, USAID strongly recommends that the standard 25% host country contribution be waivered in the case of the Trail Suspension Bridge Project and that a 15% contribution be accepted to meet the requirements of FAA Sec. 110(a); Sec. 208(e). (See Financial Analysis and Plan for complete discuss).

2. Will the maintenance procedures proposed in the project for adoption by SBD/LDD be sufficient to insure that an adequate program of bridge and trail maintenance will gradually be instituted by the GON?

Discussion and Recommendation:

The analysis of the SBD/LDD bridge and trail maintenance program conducted by USAID and EAST Consulting Engineers has resulted in a determination that the program is sorely lacking in long range institutional maintenance capability. In order to address this problem the project has proposed a number of innovations (See Technical Analysis Section) to the existing system both for SBD and LDD. Given the fact that the GON has demonstrated a great concern and willingness to improve all aspects of this vital program, USAID recommends that the innovations proposed in the project be allowed to stand. An evaluation of the initial period of implementation of these innovations will serve as the means of determining what changes, if any, should be incorporated into the maintenance proposals.

AID 1020-20 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Life of Project:
From FY 78 to FY 81
Total U.S. Funding 3,038,000
Date Prepared: April 1, 1978

Project Title & Number: Trail Suspension Bridges 367-0119

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
To enhance the quality of life of the rural agricultural sector of the population of Nepal.	-Increased per capita income of the rural agricultural population during the life of project. -Increased agricultural production in rural areas.	GON records and discussions with Local officials of GON.	-Nationally integrated and balanced development will enhance the quality of life of the rural agricultural sector of the population. -An improved nation-wide trail and bridge network will promote national integration and balance development.
Sub goal: To increase the flow of goods and services to and from the rural areas of Nepal by improving the nation-wide bridge and trail network, and thereby promote balanced integrated national development.	-Increased level of food consumption in rural areas. -Increased utilization of GON provide facilities, (ie. Health, Education Agriculture inputs & extension etc.) in rural areas. -Increased transport of goods via bridges and Trails to and from rural areas.		-Increasing construction of bridges and maintenance of approach trails will improve the nation-wide transpo and communication system.

AID 1020-25 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 78 to FY 81
Total U.S. Funding 3,000,000
Date Prepared: April 1, 1978

Project Title & Number: Trail Suspension Bridges 367-0119

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose:	**Conditions that will indicate purpose has been achieved: End of project status.**		**Assumptions for achieving purpose:**
To upgrade the GON's institutional capacity to evaluate and select future sites for bridge construction and to materially supplement the construction, maintenance and training capability of the SBD and the LDD.	X Percentage of bridges constructed by the GON utilizing agreed upon site selection criteria and costs reimbursed by USAID under FAR	GON/SBD records of construction and field surveys. USAID records of site inspections and reimbursement under FAR.	Utilization of objective site selection criteria during site surveys will upgrade GON/SBD institutional capacity to construct bridges and improve approach trails. The Planning Commission will utilize SBD survey team recomendations to prioritize the national program of bridge construction.

AID 1020-20 (2-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 78 to FY 81
Total U.S. Funding $ 3,000,000
Date Prepared: April 1, 1978

Project Title & Number: Trail Suspension Bridge 367-0119

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs**		**Assumptions for achieving outputs:**
1. A formalized, refined GON site survey system for bridge site selection; based on engineering, social and economic criteria; . Operational selection criteria. . Trained SBD staff for survey teams. . Upgraded approach trails.	1. Construction/Survey Capacity . Standard Selection Criteria established by 1979 6 SBD Survey teams assigned and in the Field by 1980. . X # of approach trails upgraded X # completed site surveys by 1980.	1. GON/SBD records	SBD will utilize selection criteria and will provide teams for survey. The GON will contract for procurement of commodities, transport, fabrication and construction of bridges in a timely manner. The GON will incorporate into its procedure the proposed innovations in procurement and material specifications.
2. A Replenished Inventory of Bridge Components Meeting Minimum Specifications;	2. Inventory; X tons of steel, cable, plates etc. fabricated, transported and used in bridge construction.	2. USAID inspection tours. GON/SBD LDD records and Mill certificates of material specifications.	
3. National Trail Network Classification Study; . Base Map of Nepal . Classification information	3. Trail Classification and Study X # of trails classified on Falt bridges 1 Map and Study including recommendations submitted by 1st project evaluation 1980	3. USAID. records . map and study . evaluation and recomendations.	Establishing a classification system of trails is possible and such classification will assist in regional and national bridge building and other development programs.
4. Displaced Trades Man study; . Study . recommendations.	4. Displaced Trades Man Study; . Study and recommendations.	4. USAID . records . study	GON will utilize the resultant recommendations of a Displaced Trades Man Study to institute an appropriate program to aid these people.
5. Operational bridge maintenance and trail improvement capacity. . Trained SBD Staff . Trained LDD Staff . Trained local technicians	5. Maintenance; X # of SB. staff trained and performing maintenance by end of 1981. X # of Local people trained, supplied and in place maintaining SBD/LDD bridges. X # of approach trails Improved.	5. GON/SBD-LDD - records.	GON/SBD - LDD will assign sufficient staff and budget to perform maintenance.

AID 1020-25 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 78 to FY 81
Total U.S. Funding $ 3,000,000
Date Prepared: April 1, 1978

Project Title & Number: Trail Suspension Bridges 367-0119

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	**Implementation Target (Type and Quantity)**		**Assumptions for providing inputs:**
1. Survey teams: -Administrative support (GON/SBD) . Personnel . Budget -Technical Assistance (SATA) . Design of Survey procedures . Mini-training course	1. GON/SBD 12 SBD staff assigned to survey team $30,000 in SBD budget. SATA: . 1 Site survey manual produced . 1 Training course completed . 3 SATA Technicians assigned to SBD	1. GON/SBD . Personnel records . Departmental budget SATA - completed manuals - personnel records	GON will continue to support the bridge building program of SBD SATA will maintain it's present level of technical support within GON.
2. Financial reimbursement for GON/SATA expenditures:- FAR (USAID) . Commodities . Transportation . Fabrication . Construction	2. USAID X quanitity of Steel, cables, plates etc. GON/SBD-LDD X # of fabrication contracts with Nepalese firms X # of transport contracts X contracts for construction	2. USAID . records of inspection tours GON/SBD-LDD . records of procurement. . records of fabrication. . records of transport. . records of construction . mill certification of minimum specification of material.	SBD will procure on a timely basis necessary bridge parts, meeting minimum specifications.
3. Trail Classification System: (USAID) . Financing of study of system.	3. USAID 1 contract for study	3. USAID . contracts . study and recommendation and map	Peace Corps will continue to provide PCV's for assignment in LDD
4. Displaced Trades Man Study: (USAID) . Financing of study	4. USAID 1 contract for study	4. USAID . contract . study and recommendation.	
5. Operational bridge maintenance Project Trail improvement capacity. . Personnel, budget and administrative, support (GON/SBD-LDD) . T.A. (SATA) . Training (SATA/PC) . Mini-tool Kits (USAID)	5. GON/SBD-LDD 30 staff people assigned $ 100,000 in budget of SBD/LDD SATA 1 Training Manual completed 1 Person assigned for training PC 12 PCVs assigned to LDD	5. GON/SBD-LDD . records and budget SATA . records and completed manual PC . 12 of PCVs assigned USAID records of purchase and distribution.	

CHECKLIST OF STATUTORY CRITERIA

A. GENERAL CRITERIA FOR COUNTRY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the department of state determined that this government has engaged in consistent patterns of gross violations of internationally recognized human rights?	1. The Project Paper clearly discusses the method in which this project will directly benefit the needy in the specific areas where bridge will be bult in rural remote areas of Nepal.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U. S Government personnel or their dependents, or from entering the U. S unlawfully?	2. No.
3. FAA Sec. 620(a). Does recipient country furnish assistance to Cuba or fail to take appropriate steps to prevent ships or aircraft under its flag from carrying cargoes to or from Cuba?	3. No, as far as known.
4. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	4. Yes.

5. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	No such indebtedness is known to exist.
6 FAA Sec. 620(e) (1) If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U. S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No.
7. FAA Sec. 620(f); App. Sec. 108. Is recipient country a Communist country? Will assistance be provided to the Democratic Republic of Vietnam Cambodia, Laos, Cuba, Uganda, Mozambique or Angola?	No.
8. FAA Sec. 620(i). In recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S assistance, or (b) the planning of such subversion or aggression?	No.

9. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U. S. property?	No.
10. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	An investment guaranty program for the specific risks cited has not been instituted. The AID Administrator has not considered denying assistance to Nepal for this reason.
11. FAA Sec. 620(o): Fisherman's Protective Act, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U. S. fishing activities in international waters,	Nepal has not seized or imposed penalities or sanctions against any U. S. fishing activities. Nepal has no navy.
a. has any deduction required by Fishermen's Protective Act been made	a. not applicable.
b. has complete denial of assistance been considered by AID Administrator?	b. not applicable.
12. FAA Sec. 620(q): App. Sec. 503 (a) Is the government of the recipient country in default on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U S. loan under program for which App. Act appropriates funds, unless debt was earlier disputed, or appropriate steps taken to cure default?	(a) No. (b) No.

13. FAA Sec. 620(s). What percentage of country budget is for military expenditures? How much of foreign exchange resources spent on military equipment? How much spent for the purchase of sophisticated weapons systems? (Consideration of these points is to be coordinated with the Bureau for Program and Policy Coordination, Regional Coordinators and Military Assistance Staff (PPC/RC).	Nepal's budget for FY 1977/78 shows 5.6% of the country's total budget devoted to defense. Little foreign exchange is used to acquire military equipment or sophisticated weapons systems.
14. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No, the first question. Second question not applicable.
15. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?	Nepal is not in arrears in its obligations to the UN.
16. FAA Sec. 620A. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism?	No.

17. FAA Sec. 666. Does the country object, basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?

No.

18. FAA Sec. 669. Has the country, after August 3, 1977, delivered or received nuclear reprocessing or enrichment materials or technology, without specified arrangements on safeguards? Has it detonated a nuclear device after August 3, 1977 although not a "nuclear-weapen state" under the non proliferation treaty?

No.

19. FAA Sec. 901. Has the country denied its citizens the right or opportunity to emigrate?

No, as far as known.

B. FUNDING CRITERIA FOR COUNTRY

1. Development Assistance Country Criteria

a. FAA Sec. 102(c). (d) have criteria been established, and taken into account, to assess commitment and progress of country in effectively involving the poor in development, on such indexes as: (a) small-farm labor intensive agriculture, (2) reduced infant mortality, (3) population growth, (4) equality of income distribution, and (5) unemployment.

The Government's commitment and progress in each of these areas is reviewed as appropriate in preparation and evaluation of projects. Criteria, when appropriate, are established within the context of each project as objectively verifiable indicators.

b. FAA Sec. 104(d) (1). If appropriate is this development activity designed to build motivation for smaller families in programs such as education in and out of schools, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?

By using the Proposed criteria for bridge site selection the GON will construct only those bridges which will facilitate the development of Programs in the rural areas that provide the elements mentioned in this question.

c. FAA Sec. 201(b)(5). (7) & (8): Sec. 208: 211 (a) (4), (7). Describe extent to which country is:

(1) Making appropriate efforts to increase food production and improve means for food storage and distribution.	The Fifth Development Plan (1975-1980) puts major stress on increased food production and improved marketing of agricultural products.
(2) Creating a favorable climate for foreign and domestic private enterprise and investment..	Nepal provides tax benefits to foreigners investing in needed development projects. The government has taken some actions to create a favorable climate for domestic private enterprise and investment, especially in the case of import substitution or export commodities.
(3) Increasing the public's role in the developmental process.	Villagers in parts of Nepal are building schools, water systems and farm-to-market roads. This is on a modest scale so far but is an appreciable start.
(4) (a) Allocating available budgetary resources to development.	69% of Nepal's total FY 1977/ 1978 budget is devoted to development.
(b) Diverting such resources for unnecessary military expenditure and intervention in affairs of other free and independent nations.	Nepal has one of the lowest per capita military expenditures of any country in the world.
(5) Making economic, social, and political reforms such as tax collection improvements and changes in land tenure arrangements, and making progress toward respect for the rule of law, freedom of expression and of the press, and recognizing the importance of individual freedom, initiative, and private enterprise.	The monarchial system in Nepal is gradually broadening. GON is allowing greater freedom of expression, although the press is still largely government-controlled. There is a Parlimanent with some, if limited, effective powers. Enterpreneurs operate fairly freely. The government is seeking Western advice in legal matters, taxation, finance, private enterprise, and information services.

(6) Otherwise responding to the vital economic, political, and social concerns of its people, and demonstrating a clear determination to take effective self-help measures.	GON has strengthened its commitment to development in recent years, and has shown a new willingness to take meaningful self-help measures in order to carry out the Fifth Five Year Plan.
c. FAA Sec. 201(b), 211(a). Is the country among the 20 countries in which development assistance loans may be made in this fiscal year, of among the 40 in which development assistance grants (other than for self-help projects) may be made?	Yes.
l. FAA Sec. 115. Will country be furnished, in same fiscal year, either security supporting assistance, or Middle East peace funds? If so, has congress specifically authorized such use of funds, or is assistance for population programs, humanitarian aid through international organizations, or regional programs?	No to first question. Second question not applicable.

A. GENERAL CRITERIA FOR PROJECT APP. Unnumbered; FAA Sec. 653 (b): Sec. 671.	A. General Criteria for Project:
1. (a) Describe how Committees on Apropriations of Senate and House have been or will be notified concerning the project;	1. (a) Notification of the proposed project has been sent to the congress as part of the annual AID congressional presentation.
(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?	(b) Yes.
2 FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the United States of the assistance?	2. FAA Sec. 611(a)(1) (a) All plans necessary to implement the assistance program are complete. (b) The costs of assistance by the U. S. is firm.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed intime to permit orderly accomplishment of purpose of loan?	3. No further legistative action is required.
4. FAA Sec. 611(b); APP. Sec. 101. If water or water-related land resource construction, has the project met the standards and criteria as per the principles and standards for planning water and related Land Resources dated October 25, 1973?	4. Not applicable.
5. FAA Sec. 611(e). If project is Capital Assistance, and all U S. assistance for it will to exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	5. Project includes a 2.4 million dollar construction component and the Mission Director has certified that the host country is capable of effectively maintaining & utilizing the project. (See Annex of Project Paper).

6. FAA Sec. 209,619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations of plans to the maximum extent appropriate?

6. A number of other international donor play a vital role in the project implementation and have been consulted throughout P.P. design.

7. FAA Sec. 601(a) Information and conclusions whether loan will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan association; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.

7. (a) The grant will have only a minimal effect on flows of international trade due to possible importation of raw materials or bridge construction.
(b) The project will foster private initiative & competition in those areas the bridge will be in. The effect will be beneficial.
(c) The project bridges are envisioned as a vital catalyst to encourage the development and use of cooperatives, credit unions etc.
(d) The project bridges will discourage monopolistic practices by enabling more businesses to trade and travel throughout Nepal.
(e) The project will increase technical efficiency of industry, agriculture and commerce by opening up previously islolated areas to such inputs.
(f) No effect on labor unions.

8 FAA Sec. 601(b) Information and conclusion on how the loan will encourage U. S. Private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise)

8. The project is not expected to directly foster US invesment abroad.

9. FAA Sec. 612(b); See 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the United States are utilized to meet the cost of contractual and other services.

9 The project Grant Agreement contains provisions which assure that the GON will utilize local currencies for support of local costs expenses of the project.

10. FAA Sec. 612(d). Does the United States own excess foreign currency and, if so, what arrangements have been made for its release?

10. No.

11. ISA 14. Are any FAA Funds for FY 78 being used in this project to construct, operate, maintain or supply Fuel for any nuclear power plant under an agreement for cooperation between the U.S. and any other country?

11. No.

FUNDING CRITERIA FOR PROJECT

B. Funding Criteria for Project

1 Development Assistance Project Criteria

1. Development Assistance Project Criteria

(a) FAA Sec. 102(c); Sec. 111;Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to eco economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

(a) The purpose of the project is to upgrade the GON bridge site selection process so as to insure the involvement of the rural poor in the selection process. Such a process will provide that bridges are choosen for construction giving major emphasis on their beneficial effects on local communities in the rural areas etc.
(b) The bridges constructed under the project are viewed as crucial catalysts of development which inturn will help development of cooperative etc.

(b) FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph -- e.g., a, b etc., -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(b) FAA Sec. 103.

(1) (103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;

(1) The project is designed so as to provided the transport and communication facilities which will improve the productivity and income of the small farmers.

(2) (104) for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;

(2) Not applicable

(3) (105) for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;	(3) Not Applicable.
(4) (106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:	(4) Not Applicable.
(a) technical cooperation and development, especially with U. S. private and voluntary, or regional and international development, organizations;	(a) Not Applicable.
(b) to help alleviate energy problem;	(b) Not Applicable.
(c) research into, and evaluation of, economic development processes and techniques;	(c) Not Applicable.
(d) reconstruction after natural or manmade disaster;	(d) Not Applicable.
(e) for special development problem, and to enable proper utilization of earlier U. S. infrastructure, etc., assistance;	(e) Not Applicable.
(f) for program of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.	(f) Not Applicable
(5) (107) by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.	(5) (107) Not Applicable.

(c) FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

(c) The GON will provide such assurances by signing a grant agreement with provisions contained there in that it will provide at least 15% of the cost of the project, a a waiver for a "relatively least developed country" has been signed.

(d) FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing or is recipient country" relatively least developed?"

(d) No, grant assistance will not be disbursed for the project over more than three years.

(e) FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

(e)
(1) The project will have a direct beneficial impact on the encouragement of democratic, economic, political and social institutions where ever a bridge is constructed.
(2) By improved transport facilities in remote areas the project bridges will aid in self-help measures aimed at meeting the country's food needs.
(3) By providing limited training in bridge maintenance the project will improve availability of trained worker power in-country.
(4) By improving transport facilities in remote areas the project bridges will assist the GON to meet the country's health needs.
(5) The project bridges will generally assist GON in all of the areas mentioned.
(6) The project bridges will have a very beneficial impact on integrating women into the recipient country's national economy.

(f) FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

(f) The GON has stated in its Five Year Plans that increasing access of rural people to services of the Government is one of its major goals. This project is viewed as crucial to the GONs ability to do this. The insitutional development envisioned in the project will utilize the country's intellectual resources. The bridges will enable the GON to more easily contact the rural population and thereby support civic education and training in skills required for effective participation in government and political processes essential to self-government.

(g) FAA Sec. 201(b) (2)-(4) and-(8)Sec. 201(e); Sec. 211(a)(1)-(3) and - (8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

(g)
(1) The project is directly related to the increase of productive capabilities and self-sustaining economic growth, and the development of institutions directed toward social progress.
(2) The project is consistent with GON's development goals and is consistent with AID mandates.
(3) The project paper and annexes contain extensive analysis of the activities economic and social soundness.

(h) FAA Sec. 201(b)(6);Sec. 211(a)(5),(6). Information and conclusion on possible effects of the assistance on U. S. economy, with special reference to areas of substantial labor surplus, and extent to which U. S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

(h) No appreciable effects.

Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?

Procurement

(1) All of the goods furnished under the project will be procured through normal GON procedures and channels and then the government will be reimbursed under the FAR system, therefore U.S. small businesses will not participate.

The services provided under the project will be made avalible in such away as to permit U. S. Small businesses to participate equitably at all stages

2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegation from him?	2. All commodity will be financed under GON normal procurement regulations and channels and reimbursement where appropriate will be through the FAR system, therefore U.S. sources will not be utilized.
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?	3. Not applicable due to use of FAR system.
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	4. Not applicable due to use of FAR system.
5. FAA Sec. 608(a). Will U. S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?	5. Not applicable.
6. MMA Sec. 901(b). (a) Compliance with requirement that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	6. Not applicable.
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	7. Yes technical assistance financed by the project will be provided from private enterprise on a contract basis. No other U. S. governmental agencies will be involved in project.

8. International Air Transport. Fair Competitive Practices Act, 1974.

If air transportation of persons or property is financed on grant basis, will provision be made that U.S. flag carriers will be utilized to the extent such service is available?

8. Yes, provided for in the individual contracts & the Grant agreement.

B. Construction

1. FAA Sec. 601(1). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?

B. Construction

1. Yes, the trail network study will be contracted to a U. S. firm.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

2. Not applicable, due to use of FAR system and GON procedures.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U. S. not exceed $100 million?

3. Not applicable.

Other Restrictions:

C. Other Restrictions:

1. FAA Sec. 201(1) If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?

Not applicable.

2. FAA Sec. 301(1). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?

2. Not applicable.

3. FAA Sec. 620(h). Do arrangements preclude Promoting or assisting the foreign aid projects or activities of Communist-Bloc countries, contrary to the best interests of the U. S. ?

3. Not applicable.

4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U. S. or guaranty of such transaction?

4. Not applicable.

5. Will arrangements preclude use of financing:

(a) FAA Sec. 114. to pay for performance of abortions or to motivate or coerce persons to practice abortions?

5. (a) Not applicable.

(b) FAA Sec. 620(g). to compensate owners for expropriated nationalized property?

(b) Not applicable.

(c) FAA Sec. 660. to finance police training or other law enforcement assistance, except for narcotics programs?

(c) Not applicable.

(d) FAA Sec. 662. for CIA activities?

(d) Not applicable.

(e) App. Sec. 103. to pay pensions, etc., for military personnel?

(e) Not applicable.

(f) App. Sec. 105. to pay UN assessments

(f) Not applicable.

(g) App. Sec. 106. to carry out provisions of FAA Sec 209(d) and 251 (h)? (transfer to multilateral organizations for lending).

(g) Not applicable.

(h) App. Sec. 112: to finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields

(h) Not applicable.

(i) App. Sec. 501. to be used for publicity or propaganda purposes within U. S. not authorized by Congress?

(i) Not applicable.

Nepal - Trail Suspension Bridge Project
Certification Pursuant to Section 611(e)
of the F.A.A. of 1961 as amended

I, Samuel H. Butterfield, Principal Officer of the Agency for International Development in Nepal, having taken into account, among other things, the demonstrated capacity of the Suspension Bridge Division of the Roads Department of G.O.N. to design and carry out bridge construction projects throughout Nepal, the emphasis placed on designing construction elements to minimize maintenance requirements, the ability of local governmental organizations to carry out routine maintenance and their interest in doing so, the overall plans to assist in training local populace for routine maintenance while providing centralized special maintenance support, and the positive performance of the Government in maintaining previously constructed AID funded bridges, do hereby certify that in my judgement Nepal has both the human and financial resources to effectively maintain and utilize the inputs of the Trail Suspension Bridge Project.

This judgement is based in part on the project analysis as detailed in the Trail Suspension Bridge Project Paper and the annexes attached thereto and is subject to the conditions imposed therein.

Samuel H. Butterfield
Mission Director
USAID/Nepal

May 8, 1978
Date

ACT: UNCLASSIFIED CN:6854 270FEB 77 PRM
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AIDAC

E.O. 11652: N/A

TAGS:

SUBJECT: TRAIL SUSPENSION BRIDGES - APAC REVIEW OF PRP

REF: STATE 033105

1. SUMMARY. ASIA PROJECT ADVISORY COMMITTEE (APAC) APPROVED SUBJECT PRP ON JANUARY 14. COMMITTEE AGREED TO REQUIRE, PRIOR TO SUBMISSION OF PP, A SPECIAL INTERIM REPORT, FOR AID/W REVIEW, EVALUATING PRIOR AID-FUNDED BRIDGE PROGRAMS IN NEPAL AND IDENTIFYING SPECIFIC ECONOMIC/SOCIAL BENEFIT CRITERIA TO BE APPLIED IN BRIDGE SITE SELECTION UNDER NEW PROJECT. END SUMMARY.

ACTION
CI - 2

INFO
D - 1
AM - 1
FM - 1
AD - 2
EMB - 5
RF - 2

2. EVALUATION, BENEFITS, SELECTION CRITERIA.
(A) PROJECT COMMITTEE AND APAC DISCUSSIONS REVIEWED AT LENGTH DEVELOPMENTAL BENEFIT AND SITE SELECTION CRITERIA QUESTIONS WHICH BOTH PANELS FELT WERE ABSENT FROM PRP AND CRITICAL TO ANALYSIS AND JUSTIFICATION OF INVESTMENT IN BRIDGE/TRAILS ACTIVITY OVERALL AND SELECTION OF BRIDGE SITES WITHIN THIS ACTIVITY IN PARTICULAR.

APAC WAS PARTICULARLY CONCERNED WITH:

(1) LACK OF IDENTIFIED DEVELOPMENT BENEFITS ACCRUED TO [illegible] BRIDGES AND CONSEQUENT ABSENCE OF JUSTIFICATION [illegible] INVESTMENT IN SUSPENSION BRIDGES;

(2) ABSENCE OF CRITERIA OTHER THAN POLITICAL FOR [illegible] SELECTION;

(3) USE OF NATIONAL ECONOMIC RETURNS CALCULATED PRIMARILY [illegible] TIME SAVINGS TO JUSTIFY INDIVIDUAL [illegible] EXAMINATION OF [illegible] STATES [illegible]

(A) WITH ASSERTIONS IN GERMAN FEASIBILITY REPORT THAT IDENTIFIED BRIDGES DID NOT SEEM TO BE PART OF COORDINATED DEVELOPMENT PLAN AND WOULD APPEAR TO HAVE ONLY LIMITED DEVELOPMENT BENEFITS WITHOUT CONCOMITANT PROVISION OF NON-TRANSPORT INPUTS.

(B) . APAC WAS ALSO CONCERNED WITH LACK OF PIP PROMISED EVALUATION OF EARLIER AID FUNDED BRIDGE PROGRAM WHICH HAD NOT ALWAYS PROCEEDED SMOOTHLY. APAC BELIEVES SUCH EVALUATION WOULD FACILITATE IMPLEMENTATION CURRENT PROJECT AND IDENTIFICATION OF PROBABLE ECONOMIC AND SOCIAL IMPACT OF BRIDGES.

(C) : HAVING IDENTIFIED THESE AREAS AS CRITICAL LINKS BETWEEN INPUT REQUIREMENTS AND PROJECT PURPOSE, APAC CONCLUDED THAT THESE WEAKNESSES NEED TO BE ADDRESSED PRIOR TO SUBMISSION OF PROJECT PAPER. ACCORDINGLY, NECESSARY STUDIES TO CLOSE THESE GAPS SHOULD BE UNDERTAKEN IMMEDIATELY AND INTERIM REPORT SUBMITTED AID/W BEFORE PROCEEDING WITH FURTHER WORK ON PROJECT PAPER.

(D) APAC AGREED AID/W SHOULD BE PREPARED RENDER ASSISTANCE TO MISSION IN CARRYING OUT THE STUDY OR STUDIES. ACCORDINGLY, AS FIRST STEP ASIA BUREAU WILL DRAFT PRELIMINARY SCOPE OF WORK FOR STUDIES AND CABLE TO MISSION FOR REVIEW AND COMMENT. ONCE SCOPE FINALIZED AND DECISION REACHED ON HOW STUDIES ARE TO BE CARRIED OUT, BUREAU STANDS READY PROVIDE HELP IN ANALYTIC WORK AND REPORT PREPARATION.

3. . IMPLEMENTATION, MAINTENANCE ASPECTS. APAC ENDORSED MISSION POSITION IN PAP THAT ADDITIONAL ANALYSES ARE REQUIRED OF THE CAPACITY (AND CAPABILITY) OF THE TWO HMG ENTITIES (DEPARTMENT OF ROADS, SUSPENSION BRIDGE DIVISION AND PANCHAYAT MINISTRY LOCAL DEVELOPMENT DIVISION) TO IMPLEMENT THIS PROPOSED BRIDGE/TRAILS WORK. THIS CONCERN PARTICULARLY HEIGHTENED IN CASE OF SUSPENSION BRIDGE DIVISION SINCE GERMAN FEASIBILITY STUDY REMARKS THAT BRIDGE DIVISION FULLY OCCUPIED WITH OWN FIVE YEAR PLAN REQUIREMENTS. APAC ALSO CONCLUDED THAT PROJECT PAPER SHOULD INCLUDE DISCUSSION AND SET OUT PLANS FOR ASSURING ADEQUATE MAINTENANCE PROGRAM FOR ALL PROPOSED BRIDGES WILL BE IN PLACE AT APPROPRIATE POINT IN PROJECT IMPLEMENTATION SCHEDULE.

4. PROJECT COST ELEMENTS. PROJECT COMMITTEE ALSO DISCUSSED WITH MISSION TEAM VARIOUS ASPECTS OF PROJECT COSTS PICTURE WHICH WERE UNCLEAR FROM PAP MATERIALS. BOTH REVIEWS NOTED THAT COST PROJECTIONS AND COMPOSITION WERE AT THIS STAGE ROUGH ESTIMATES AND COULD ONLY BE CLARIFIED WITH DECISIONS REACHED ON NUMBERS OF BRIDGES

AND TRAILS TO BE FINANCED AND PARAMETERS OF TRAIL STUDY. ALSO, MISSION TEAM WAS ADVISED THAT THE PORTION OF PROJECT FUNDING ASSOCIATED WITH LOCAL COSTS (APPARENTLY MORE THAN 50 PERCENT) MUST BE IDENTIFIED AND JUSTIFIED IN PP AND SHOWN SEPARATELY ON PP FACESHEET. IN DISCUSSIONS WITH MISSION TEAM ON MAGNITUDE OF LOCAL COST COMPONENT AND HHG CONTRIBUTION IT WAS AGREED THAT WAIVER OF HOST COUNTRY CONTRIBUTION OF 25 PERCENT PROJECT COSTS AS INITIATED IN PRP WOULD NOT BE APPROPRIATE AND TEAM AGREED THIS PROPOSAL WOULD BE DELETED FROM

PROJECT DESIGN ASSISTANCE: WITH RESPECT NEED FOR TDY ASSISTANCE FOR PREPARATION OF STATEMENTS ON ENVIRONMENTAL IMPACT, STATUS OF WOMEN AND FINANCIAL ANALYSIS, MISSION TEAM WAS BRIEFED ON NATURE OF REQUIREMENTS AND PROVIDED EXAMPLES OF ACCEPTABLE FORMATS. BASED THIS UNDERSTANDING, APAC CONCLUDED THAT ADDITIONAL TDY ASSISTANCE WOULD NOT BE REQUIRED AND MISSION WILL BE ABLE TO DEVELOP ADEQUATE STATEMENTS MEETING THE REQUIREMENTS##

6. LOGICAL FRAMEWORK: THE PRP LOG FRAME SHOULD BE REVISED FOR THE PP AS FOLLOWS:

(A) THE LOG FRAME SHOULD INCLUDE DETAILED STATEMENT OF BEGINNING AND END OF PROJECT CONDITIONS. THE APPROPRIATE PLACE FOR IDENTIFYING THESE CONDITIONS IN THE LOG FRAME

IS THE OBJECTIVELY VERIFIABLE INDICATOR BOX OF THE PURPOSE LINE (END OF PROJECT STATUS) AND THE ASSUMPTIONS BOX OF THE INPUT LINE (BEGINNING OF PROJECT CONDITIONS);

(B) MANY OF THE ASSUMPTIONS IDENTIFIED IN THE PRP LOG FRAME SUCH AS QUOTE THAT HHG MAKES ADEQUATE BUDGETING PROVISION... UNQUOTE ARE EITHER CONTROLLABLE UNDER THE PROJECT OR MUST BE DETERMINED PRIOR TO GRANT AUTHORIZATION SINCE THEY CAN BE DETERMINED AND ARE ESSENTIAL TO ACHIEVEMENT OF PURPOSE, AND THEREFORE SHOULD NOT REMAIN AS ASSUMPTIONS;

(C) THE OBJECTIVELY VERIFIABLE INDICATOR COLUMN OF PROJECT INPUTS SHOULD BE DOLLAR COSTS.

7. BOTH PROJECT REVIEW COMMITTEE AND APAC WELCOMED PRESENTATION BY MISSION TEAM AND OPPORTUNITY EXCHANGE VIEWS AND DISCUSS ABOVE AND OTHER ISSUES/ASPECTS OF PROJECT PROPOSAL. DISCUSSIONS WERE FRUITFUL AND USEFUL ALL PARTIES.

VANCE

ANNEX E. SCOPE OF WORK FOR EAST CONSULTANT's CONTRACT (AID-367-166) DATED JULY 27 1977

A. Objectives

The objectives of this project are for EAST to:

1. Complete a study, as further described below and in attachment "A" which is made part of this contract, of the effects suspension bridges constructed under former USAID projects have had on people served by the bridges and to define to what extent these effects may influence the selection of sites for future bridges.

2. Study the processes and procedures involved in an apparently successful suspended bridge program in a particular area and determine the extent to which the measures employed in that area may be applied to a future USAID Trail Suspension Bridge Program.

B. Categories of Study

For the period set forth in Article V - "Reports", EAST shall perform the specified study(s) in the following general areas: social anthropological, institutional (government and administration) economics and engineering.

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

1. Phase I

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

a) Describe the institutional, economic, sociological and technical processes that contributed to the site selection, construction and maintenance of the above bridges; special attention will be paid to the nature and level of local participation as well as the local benefits being drawn therefrom.

b) Develop a generalized set of criteria which can be used by relatively unskilled personnel for future selection of bridge sites and their construction priority.

c) Perform a detailed study of the processes and results of the suspended bridges being constructed in the Baglung District using local initiative and government resources. EAST will use the technical report "Traditional Trail Suspended Bridges in Baglung District" written by Mr. Robert Groeli in July 1977 and made part of this contract as attachment 'C', as the starting point for this portion of the interim report. Elements, methodology and personnel of the Baglung portion of the Interim Report are further described in Attachment 'B' which is made part of this contract.

2. Phase II

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

a) Resurvey the four bridges covered in Phase I with a view to expand the monsoon season data base into dry season coverage and refine the interim report findings.

b) Select in conjunction with USAID and survey nine additional bridges using the analysis described in a) and b) in Phase I.

c) Apply the criteria developed in Phase I and mentioned in Phase II to four bridges (two meeting the IRR criteria and if possible, the other two not meeting it) selected from the UNDP "Trail Suspension Bridge Study" and include the results obtained from the four bridges in the final report.

d) Prepare an annotated bibliography of available materials and studies on trail networks, foot-bridge construction and use in Nepal.

C. Guideline Methodology.

1. Collection and Review of Existing Data

Directly following mobilization of EAST's staff, a review of existing suspension bridge data will be carried out. The data to be reviewed will encompass all the disciplines of the study.

As a starting point, USAID will provide a limited amount of relevant data to EAST. From time to time, USAID and EAST will engage in meetings to discuss progress, problems and any changes in the methodology.

2. Training and Monitoring Field Studies

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

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

3. Social Anthropological Studies

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

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

a) Field Studies

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

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

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

b) Analysis of Data

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

4. Institutional Studies

a) Micro Political

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

b) Micro Political

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

The above qualitative data on the system of Nepal's (village, district and zone) government and administration and relationship to the planning process will be identified by EAST using the best research methods available by studying the formal decisional structure (and persons) in the bridge site selection process.

c) Field Studies

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

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

5. Economic Studies

a) General

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

- Processes of Nepal's economic and development planning in connection with trail bridge construction.
- Project planning especially in trail bridges which gives social benefits to local hill people.
- Effectiveness of bridge building on rural development and use of agricultural inputs.
- Definition of major, secondary and minor trail networks.
- Role of women in relationship to trails and trail bridges.
- Development of generalized criteria as a simplified guide for future bridge site selection.
- Environmental impact caused by bridges being built.
- Agricultural production increase or decrease because of bridges built.
- Necessary proposals for improving the planning processes for location, construction and maintenance of trail bridges.

b) Field and Desk Studies

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

- Influence area: Local and far reaching trails.
- Population: size, structure, activity rates, migration and social life.
- Agriculture: area under cultivation, irrigation facilities, cash crops, cereal grains and livestocks.
- Forest: area under forest, use of forest and afforestation.
- Industry: cottage industry, trade and porters.
- Social Services: schools, health centres, banks and post offices.
- Trade: major trading centres, principal goods imported and exported.
- Transport: major secondary and minor trails, suspension, suspended bridges and traffic volumes.
- Roles of women.
- Environmental effects.

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

6. Engineering Studies

a) General

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

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

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

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

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

b) Desk Research

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

c) Field Studies

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

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

d) Analysis

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

AGREEMENT between Switzerland and Nepal concerning technical and financial cooperation for the construction of suspension and suspended bridges in Nepal

(exchange of letters, dated 6.12.1977)

HIS MAJESTY'S GOVERNMENT

Ministry of Finance
Kathmandu
Nepal

December 6, 1977

Excellency,

I have the honour to acknowledge the receipt of Your Excellency's Note of today's date which reads as follows:

"I have the honour to refer to the discussions held between representatives of our two Governments concerning the technical and financial cooperation for the construction of suspension and suspended bridges in Nepal.

As a result of these discussions the following understandings have been reached:

1. The Government of the Swiss Confederation will make available to His Majesty's Government of Nepal a grant of 3 mio Swiss francs with the aim to support the on-going construction programme for suspended and suspension bridges of the Suspension Bridge Division.

2. His Majesty's Government of Nepal will provide all necessary funds to complete at least 20 bridges in each fiscal year 1977/78 and 1978/79 - taking into consideration the Swiss contribution.

3. Out of the Swiss contribution the following goods and services can be paid by His Majesty's Government:

   - cables for Suspension Bridge Division and the Local Development Department (approx. SFR. 0.7 mio);

   - steel construction (steel parts and manufacturing costs) of the workshops constructed by the Suspension Bridge Division and cement (approx. Sfr. 1.8 mio);

   - transportation costs of cables to the Nepalese border, air transport to the very remote areas within Nepal and others as mutually agreed (approx. Sfr. 0.5 mio).

4. a) For the awarding of contracts in Nepal the rules and regulations of His Majesty's Government of Nepal will be applied. Before such awards take place the Government of the Swiss Confederation shall be informed of the nature and values of the contract.

   b) Except as the Government of the Swiss Confederation and His Majesty's Government of Nepal may otherwise agree the awarding of contracts financed out of the Swiss grant outside Nepal shall be made on basis of international competition. Quotations shall be asked from at least three different suppliers after consultation with the Director of the Swiss Technical Cooperation in Nepal SATA (hereinafter called Director SATA). The award must be approved by the Government of the Swiss Confederation.

5. No proceeds of the grant shall be used for the payment of any taxes (import duties, levies, fees, duties of any kind) imposed under the law of His Majesty's Government of Nepal on goods or services, or on the importation, manufacture, procurement or supply thereof.

6. a) Immediately after the present understanding has entered into force, the Government of the Swiss Confederation shall open with the Swiss National Bank an account denominated: "Suspension bridge Nepal" in favour of the Nepal Rastra Bank which is designated as the agent of the Ministry of Finance, His Majesty's Government of Nepal. This account shall immediately be credited with three millions Swiss francs.

   b) The Rastra Bank shall, when making payments from this account to suppliers in countries other than Switzerland or Nepal, request the Swiss National Bank or another Swiss Bank if the Swiss National Bank so prefers to make payments in other appropriate currencies.

   All payments due to suppliers and consultants in Switzerland and other countries outside of Nepal shall be made by means of irrevocable letters of credit opened on the request of the Nepal Rastra Bank by the Swiss National Bank in favour of the suppliers, with a correspondent bank of the Swiss National Bank located in the country of residence of the said suppliers. This correspondent Bank is authorized by such a letter of credit to pay the suppliers the amount expressed therein, under the condition that the latter presents to this correspondent bank the documents provided for in the supply contract for such payment. Requests of the Nepal Rastra Bank have to be accompanied by a letter of recommendation of the Director SATA.

c) For payments to be made in Nepal His Majesty's Government of Nepal can request the Swiss National Bank through the Nepal Rastra Bank to transfer amounts not exceeding 200'000. -- Swiss francs to the Nepal Rastra Bank. Such requests have to be recommended by the Director SATA.

After prior approval given in writing from the Director SATA, the Nepal Rastra Bank can make payments to the workshops and other suppliers in Nepal on request of His Majesty's Government out of this account.

7. The Government of the Swiss Confederation and His Majesty's Government of Nepal shall cooperate fully to ensure that the purpose of the grant will be accomplished. To that end the two Contracting Parties shall from time to time, at the request of either Contracting Party:

- exchange views through their representative with regard to the performance of their respective obligations under this understanding, the administration and operations in respect of the programme of construction financed by the grant;

- furnish to the other Contracting Party all such information as it shall reasonably request with regard to the execution of the programme.

His Majesty's Government of Nepal shall in particular enable the representatives of the Government of the Swiss Confederation to inspect the goods financed out of the proceeds of the grant and any relevant records and any relevant records and documents.

The two Contracting Parties shall promptly inform each other of any condition which interferes with, or threatens to interfere with, the accomplishment of the purpose of the grant or the performance by either of them of its obligation under this understanding.

8. The Director for Development Cooperation and Humanitarian Aid on the Swiss side (cable address: Politique, Berne) and the Ministry of Finance, His Majesty's Government of Nepal, Kathmandu (cable address: ARTHA) on the Nepalese side, will be responsible for the implementation of the present understanding.

9. The present understanding is drawn up within the framework of the Agreement on Technical Cooperation between the Swiss Federal Council and His Majesty's Government of Nepal signed at Kathmandu on August 18th, 1972.

Upon receipt of a note from Your Excellency indicating that the foregoing provisions are acceptable to His Majesty's Government, the Government of the Swiss Confederation will consider that this note and your reply thereto constitute an Agreement between our two Governments on this subject, the agreement to enter into force on the date of your note in reply and remain valid until December 31, 1982."

I have further the honour to confirm the foregoing arrangements on behalf of His Majesty's Government of Nepal and to agree that Your Note and this Note shall be regarded as constituting an agreement between His Majesty's Government of Nepal and the Government of Swiss Confederation.

Please accept, Excellency, the assurances of my highest consideration.

Sincerely yours,

/s/

Nara Kanta Adhikary
Secretary

His Excellency Mr. Etienne Suter
Ambassador Extraordinary and Plenipotentiary
Embassy of Switzerland for Nepal.

(TM 3:19)
App 8A Ch 8 HB 3

AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: [A] A = ADD, C = CHANGE, D = DELETE — P/F
2. DOCUMENT CODE: 5

3. COUNTRY/ENTITY: NEPAL
4. DOCUMENT REVISION NUMBER:
5. PROJECT NUMBER (7 digits): [367-0119]
6. BUREAU/OFFICE: A. SYMBOL: ASIA; B. CODE: [04]
7. PROJECT TITLE (Maximum 30 characters): [TRAIL SUSPENSION BRIDGES]
8. PROJECT APPROVAL DECISION — ACTION TAKEN: [A] A = APPROVED, D = DISAPPROVED, DR = REAUTHORIZED
9. EST. PERIOD OF IMPLEMENTATION: YRS. [78] QTRS. [4]

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 78 F. GRANT	E. 1ST FY 78 G. LOAN	H. 2ND FY 79 I. GRANT	H. 2ND FY 79 J. LOAN	K. 3RD FY 80 L. GRANT	K. 3RD FY 80 M. LOAN
(1) FN	133B	829		3,000					
(2)									
(3)									
(4)									
TOTALS				3,000					

A. APPROPRIATION	N. 4TH FY 81 O. GRANT	N. 4TH FY 81 P. LOAN	O. 5TH FY ___ Q. GRANT	O. 5TH FY ___ R. LOAN	LIFE OF PROJECT S. GRANT	LIFE OF PROJECT T. LOAN
(1) FN			3,000			
(2)						
(3)						
(4)						
TOTALS			3,000			

11. PROJECT FUNDING AUTHORIZED (ENTER APPROPRIATE CODE(S)): 1 = LIFE OF PROJECT, 2 = INCREMENTAL, LIFE OF PROJECT

	U. GRANT	V. LOAN
	1	

12. PROJECT FUNDING AUTHORIZED THRU: FY [81]

13. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000)

B. ALLOTMENT REQUEST NO. ___

A. APPROPRIATION	C. GRANT	D. LOAN
(1) FN	3,000	
(2)		
(3)		
(4)		
TOTALS	3,000	

14. FUNDS RESERVED FOR ALLOTMENT
TYPED NAME (Chief, AID/W/PPC/PAD)
SIGNATURE
DATE

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [ ] 000 [ ] 941 [ ] LOCAL [ ] OTHER ___

16. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

FOR PROGRAM AND PROJECT DEVELOPMENT ONLY	18. AUTHORIZING OFFICE SYMBOL	19. ACTION DATE MM DD YY	20. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE MM DD YY

AID 1330-1 (10-80)

Project Authorization and Request for Allotment of Funds Part II

Name of Country: Nepal Name of Project: Trail Suspension Bridges

Number of Project: 367-0119

Pursuant to Part , Chapter , Section of the Foreign Assistance Act of 1961, as amended, I hereby authorize a grant to Nepal the "Cooperating Country of not to exceed three million United States Dollars ($3,000,000) the "Authorized Amount" to help in financing certain foreign exchange and local currency costs of goods and services required for the project as described in the following paragraph.

The project consists of reimbursement by USAID for the costs associated with the procurement of raw materials for bridge construction, the fabrication of bridge components from the raw material, the transport of components to agreed upon bridge sites and the construction of the bridges. The Fixed Amount Reimbursement system will be utilized. Another element of the project includes costs associated with the contracting by USAID for a Trail Classification study of Nepal's Trail Network, as well as the costs associated with the contracting for a study of possible alternative employment for the tradesmen that are occupationally displaced by the construction of bridges. The entire amount of the AID financing herein authorized for the project will be obligated when the project agreement is executed.

I hereby authorize the initiation of negotiation and execution of the project agreement by the officer to whom such authority has been delegated in accordance with AID regulations and delegations of authority su subject to the following essential terms and convenants and major conditions; together with such other terms and conditions as AID may deem appropriate.

The following waiver to AID regulations is hereby approved; a 10% waiver on the standard required 25% host country contribution to the cost of the project.

Clearance:

Signature

Typed Name of Authorizing Officer

Office Symbol

Date

ANNEX

SCOPE OF WORK FOR
NATIONAL TRAIL CLASSIFICATION, MAP AND STUDY

1. General Description

Working from recent aerial photography of 1/20,000 the contractor will plot the visible, currently used Nepal trails, on an existing topographic base map of one inch to a mile utilizing the coordinates of identifiable map points to rectify the stereo model. The accuracy of the base map will not be the responsibility of contractor. The contractor will however correct the trail system as shown on the map and show all of the existing trail bridges visible on the photography.

2. Data Supplied to the Contractor

One set each of available aerial photographs of 1/20,000 and of 1/50,000 will be provided at no cost to the contractor. Two copies of an existing topographic map will be provided at no cost to the contractor. In addition one map of Nepal will be provided to the contractor showing existing and planned; airstrips, road networks, ropeways, and major service centers where government centers, health centers, schools or other services are available, and one map showing the 1971 population distribution.

3. Services by the Contractor

Working at their home office or other location at the option of the contractor, the contractor shall plot by photography machine all visible trails of over one mile in length on the topographic base map. All trail bridges shall be shown on the base map, and shall be coded to indicate the type of bridge construction (suspension bridge - wood cantilever - or log bridge). Trails shall be plotted within an allowable horizontal tolerance of two hundred feet. After the trails and bridges have been plotted on the base map the contractor will provide these maps to a qualified transportation planner who will be hired and paid by the contractor. This employee will deliver the maps to the SBD, SATA and the US Peace Corps in Kathmandu. Working in conjunction with the SBD, SATA, PC, the transportation planner will select those trails which appear to serve as the trunk trail system taking into account other existing or planned infrastructure. This review process will not exceed eight calander weeks.

The transportation planner will then return one copy of the base map print to the photography lab where the trunk trails will be plotted using a separate symbol so they can be clearly distinguished from the satellite trail systems which feed into them.

After the plotting is completed the transportation planner shall number all of the trails using a transportation numbering code which allows the satellite trails to be identified with their parent trunk trails. The numbering system should be flexible enough so that trails can be added or subtracted from the system without upsetting the numbering scheme.

Final Products

After completion of the base map master the contractor will ship to USAID/Kathmandu, at his expense, the following products.

1. The original pencil copies produced by the Photogrammetry Machine.

2. Original scribe sheets.

3. Two reproducable transparencies of base maps.

4. One hundred copies of the final base map.

ANNEX

PLAN OF ACTION

A STUDY OF DISPLACED TRADESMAN AFFECTED BY THE CONSTRUCTION OF SUSPENSION BRIDGES IN NEPAL

Primary Purposes:

To gather information regarding the ferrymen of Nepal that are displaced by the construction of suspension bridges and investigate what happened to them and their families and to recommend viable strategies for providing them with alternative employment possibilities.

Secondary Purpose:

To strengthen Nepal's capacity to conduct applied social research and to provide the opportunity for a Nepalese graduate student or young researcher to develop his skills in this area.

Rationale:

The suspension bridge study prepared by EAST Consulting Engineers for USAID/Nepal has documented the fact that the construction of suspension bridges often deprives traditional ferrymen of their source of livelihood. In one of the cases studied, the ferrymen were able to adjust to this loss by developing a rope-making cottage industry; in another case they were forced to migrate out of the area and it is not known what happened to them. While it is known that many of the ferrymen belong to an ethnic group known as Majhis, who speak a Tibeto-Burman language, there have been no studies conducted on these people and there is no information available on them. Without basic knowledge regarding these ferrymen, it is impossible to recommend what kind of special programs should be devised to provide them with alternative employment. For example, if they have no agricultural skills, it is not viable to resettle them on land in the Tarai; while if they possess special craft skills associated with boating, fishing, netmaking etc. it would be possible to develop programs which capitalize on these areas of expertise.

Methodology:

A sociological-anthropological methodology should be used which combines the collection of survey data with in-depth case studies and background ethnography. Specific research activities should include:

a) Survey of related literature and detailed design of questionnaires and methodology.

b) Survey of approximately 10 sites where ferrymen existed prior to the construction of a bridge to conduct case study investigations of what happened to displaced ferrymen and their families.

c) Survey of approximately 10 sites where the construction of bridges is planned and where there are currently ferrymen providing crossing services to gather preliminary information on their economic and social situation.

d) Analysis of survey data and progress report.

e) In depth study of two representative ferrymen groups to investigate economic strategies, professional skills, income and expenditure, social organization, patterns of interaction with other groups in society, etc.

f) Preparation and submission of final report, which will include:

i) profile of ferrymen in Nepal,

ii) case studies of displaced ferrymen

iii) detailed ethnographic description of economic and social aspects of ferrymen's culture

iv) recommendations for appropriate strategies for assisting displaced ferrymen.

Schedule and Personnel:

The principle investigator for the study would be a sociology or anthropology graduate student or young researcher working under the direct supervision of a senior Nepalese anthropologist-social scientist. Guidance in research design and analysis would also be provided by USAID/N's Economic and Social Analysis staff.

While an exact schedule cannot be determined in view of the uncertainties of site locations and transportation time involved, the study can be broken into two major phases. Phase I would include activities A through D above and should be completed within 6 months. Phase II would include activities E and F and would be completed within an additional six months. Thus, the total study would be completed within 12 months, with a Phase I progress report due after 6 months, and the Final Report due after 12 months. The Final Report and Recommendations will be submitted to the GON for consideration and the initiation of appropriate action programs.

Method of Execution:

The study would be financed either through a local currency purchase order for the final report or through a local currency research grant. It is anticipated that the contract arrangements would be made with an appropriate institution within Tribhuvan University such as the Research Centre for Nepal and Asian Studies or the Institute of Humanities and Social Sciences -- however it is possible that it may have to be arranged on an individual basis.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas 1/	Impact Identification and Evaluation 2/
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	N
c. Land clearing	L
d. Changing soil character	N
2. Altering natural defenses	L
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
5. Other factors	
B. WATER QUALITY	
1. Physical state of water	N
2. Chemical and biological states	N
3. Ecological balance	N
4. Other factors	

1/ See Explanatory Notes for this form.

2/ Use the following symbols: N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

IMPACT IDENTIFICATION AND EVALUATION FORM

C ATMOSPHERIC

1.	Air additives	N
2.	Air pollution	N
3.	Noise pollution	N
4.	Other factors	

D. NATURAL RESOURCES

1.	Diversion, altered use of water	N
2.	Irreversible, inefficient commitments	N
3.	Other factors	
	Altering use of forest/pasture resources	M

E. CULTURAL

1.	Altering physical symbols	N
2.	Dilution of cultural traditions	L
3.	Other factors	

F. SOCIOECONOMIC

1.	Changes in economic/employment patterns	M
2.	Changes in population	L
3.	Changes in cultural patterns	M
4.	Other factors	

IMPACT IDENTIFICATION AND EVALUATION FORM

G. HEALTH

1.	Changing a natural environment ----------	N
2.	Eliminating an ecosystem element ----------	N
3.	Other factors	
	a) Access to Health Facilities ----------	M
	b) Reducing loss of life ----------	M

H. GENERAL

1.	International impacts ----------	N
2.	Controversial impacts ----------	N
3.	Larger program impacts ----------	N
4.	Other factors	

I. OTHER POSSIBLE IMPACTS (not listed above)

Serving as catylist for environmental conservation programs.	M

See attached Discussion of Impacts.

ANNEX L

HMG NEPAL ROADS DEPARTMENT
SUSPENSION BRIDGE DIVISION
AND
SWISS ASSOCIATION FOR TECHNICAL ASSISTANCE
(SATA)

BRIDGE SURVEY GUIDELINES

KATHMANDU, MARCH 1978

Pg 1

P R E F A C E

The purpose of this booklet is to give the surveyor clear guidelines about the work which has to be done during bridge survey. All necessary information about how to fill in the survey check list can be found here. The nummeration of the different chapters corresponds with the nummeration of the survey check list. Information about the theoretical knowledge, possible bridge types, bridge cost, operation of instruments, content of the survey box is compiled in the Annex part I to VII.
We hope that with the help of these guidelines, our survey work will improve radically.

C.B. Pradhanang
Superintending Engineer
Suspension Bridge Division

Juerg Kraehenbuehl
Civil Engineer
Swiss Association for
Technical Assistance

INDEX

Survey - Guidelines

ANNEX

1. Preparatory work

1.1 Check the contents of the survey box according to the list in annex Part VI. You will also find this list inside of the survey-box.

1.2 If possible, check the tacheometer of your theodolite already in Kathmandu according to chapter 4.5.

2. Feasibility

2.1 Draw a sketch of the area influenced by the bridge, with the following information (see example 1) :

- Existing trail system and trails to be built in future
  classification of the trails :
  main trail from ..... to .....
  secondary trail from ..... to .....
  local trail serving for .....

- Existing and future roads, air strips within the area
- Indication of all distances (miles or km) to :
  road heads, important villages or towns,
  District headquarters, nearest wireless station, nearest Post office, air strips.
- Present and future river crossing facilities : bridges (local/sophisticated), ferries, temporary bridges.
- Distribution of population (how many people are living in the villages), situation of schools, bazars, religious sites, industrial plants and handicraft centers, health-posts or hospitals, social service facilities, district administrative headquarters within the area influenced by the bridge.

2.2 Traffic - Estimate

Count the traffic crossing the river at the traditional crossing point for at least one day.
What kind of goods are transported?
What is the proportion of goods - traffic?
Are animals crossing?

2.3 Classification of the river to be crossed by the bridge :

- Perennial and unfordable in all seasons
- Perennial but fordable in dry season:
  How many months per year is the river fordable?
- Wet weather river only: When and how long is crossing not possible?

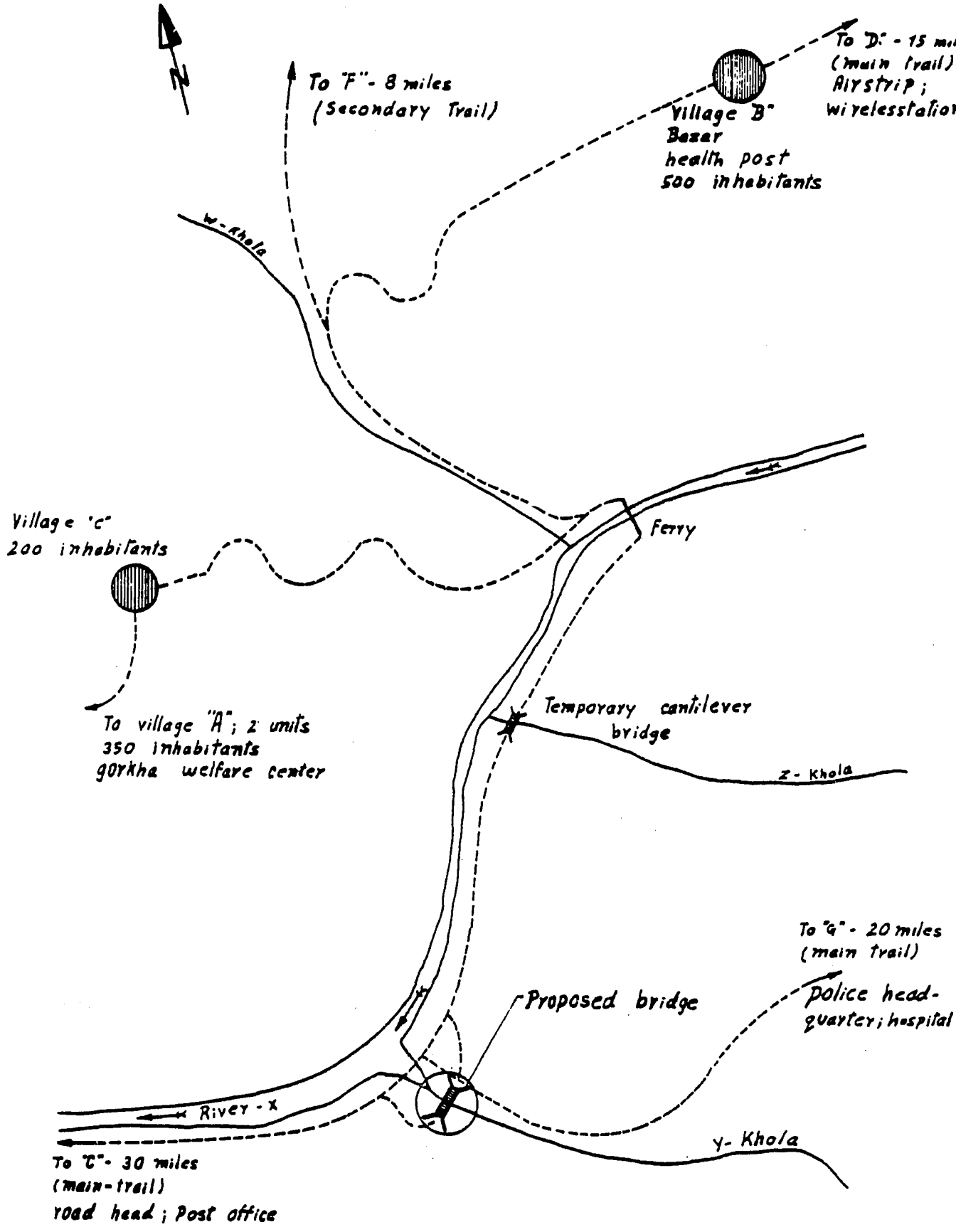
2.4 According to your personal opinion : is this bridge feasible or not feasible

2.5 Are there alternative possible crossing facilities, which would serve the needs at a lower cost :

- Temporary bridge
- Ferry for all seasons
- cable car

2.6 Local bridge - construction

- Did you find locally constructed bridges in the area ? If yes, find out the names of the bridge-constructors.
- Is it possible from the technical point of view, for a local bridge to be built at this site?
- Would local people be ready to build the bridge themselves, if we provided them technical advice and material (e.g. cables)?



Example 1: Overall sketch of the area influenced by the bridge

3. Bridge site selection

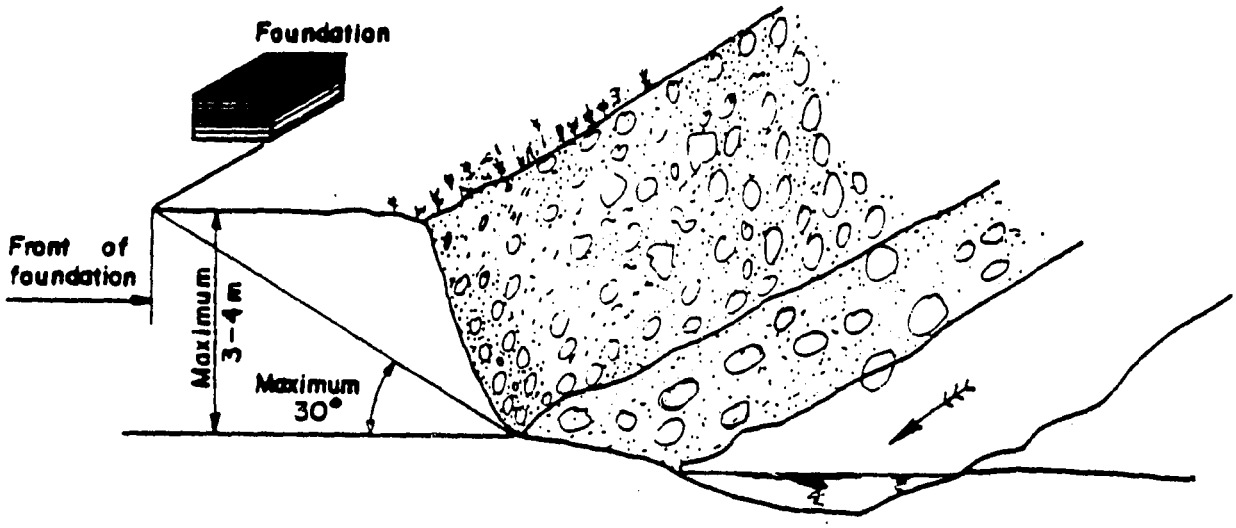
3.1 Study the river condition and the condition of the banks at all possible crossing points very carefully. This analysis has to be done at least 400 - 500 m downstream and upstream of the proposed bridge site.

The following criteria have to be considered :

- Width of the river
  - o during low flow
  - o during high flow
- High flow level
- Flow direction and speed of water flow
- Danger of the bank erosion
- Condition of the banks :
  - o rock (hard, medium, bad)
  - o scil mixed boulders
  - o soil
  - o gravel wall
  - o possibility of landslides or rock falls
  - o rivulets
- Approximate span of the bridge and possible bridge type
- Localisation of the bridge site within the trail - system
  - are new trails necessary ?
  - are round about ways acceptable to the people?

Bridge - sites are not possible, if :

- Foundations would lie in landslide areas or below rock fall areas.
- Foundations lie in or near rivulets
- Foundations lie above vertical gravel-walls higher than 3 - 4 m



If there is no possibility other than foundations above gravel walls (lower than 3 - 4 m !) set the foundation back according to the above drawing

In such cases gabion walls of about 30 m length are necessary.

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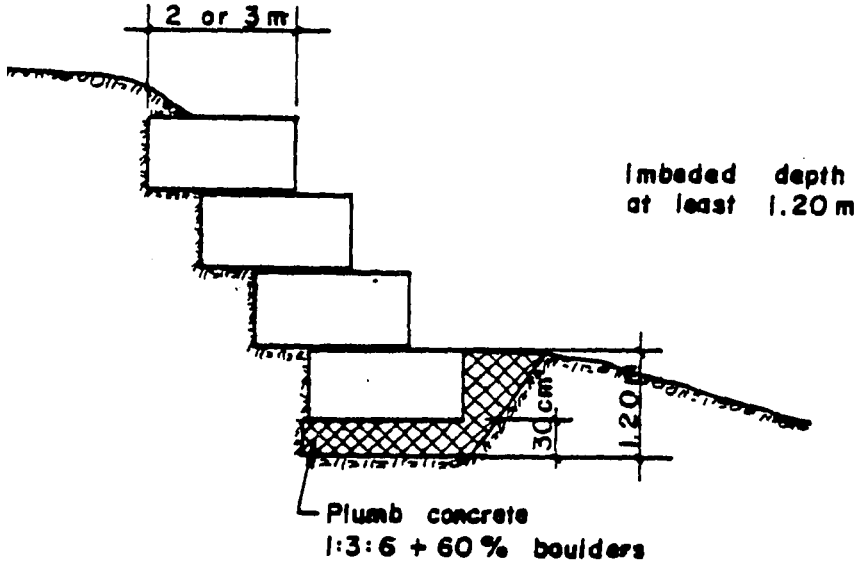


- Whenever possible use rock for the foundation. Rock is natural concrete !

3.2 If several crossing points are possible within the 800 - 1000 m of the studied river, you proceed in the following manner :

3.2.1 Draw an overall sketch showing each possible crossing point, the concerned trail system and necessary new trails, with indication of type and approximate span of the bridges (Example 2).
If new trails are necessary, indicate their length.

3.2.2 Draw a profile of each possible site. As a basis for these sketches, distances and elevations can be measured by the tachimetrical method from one river bank. Measure only the most important points in one profile (Example 3).

Indicate the soil condition :
- hard sound rock (rock anchorage possible)
- medium rock (mixed rock/gravity anchorage possible)
- soil mixed boulders (only gravity anchorage possible)
- soil

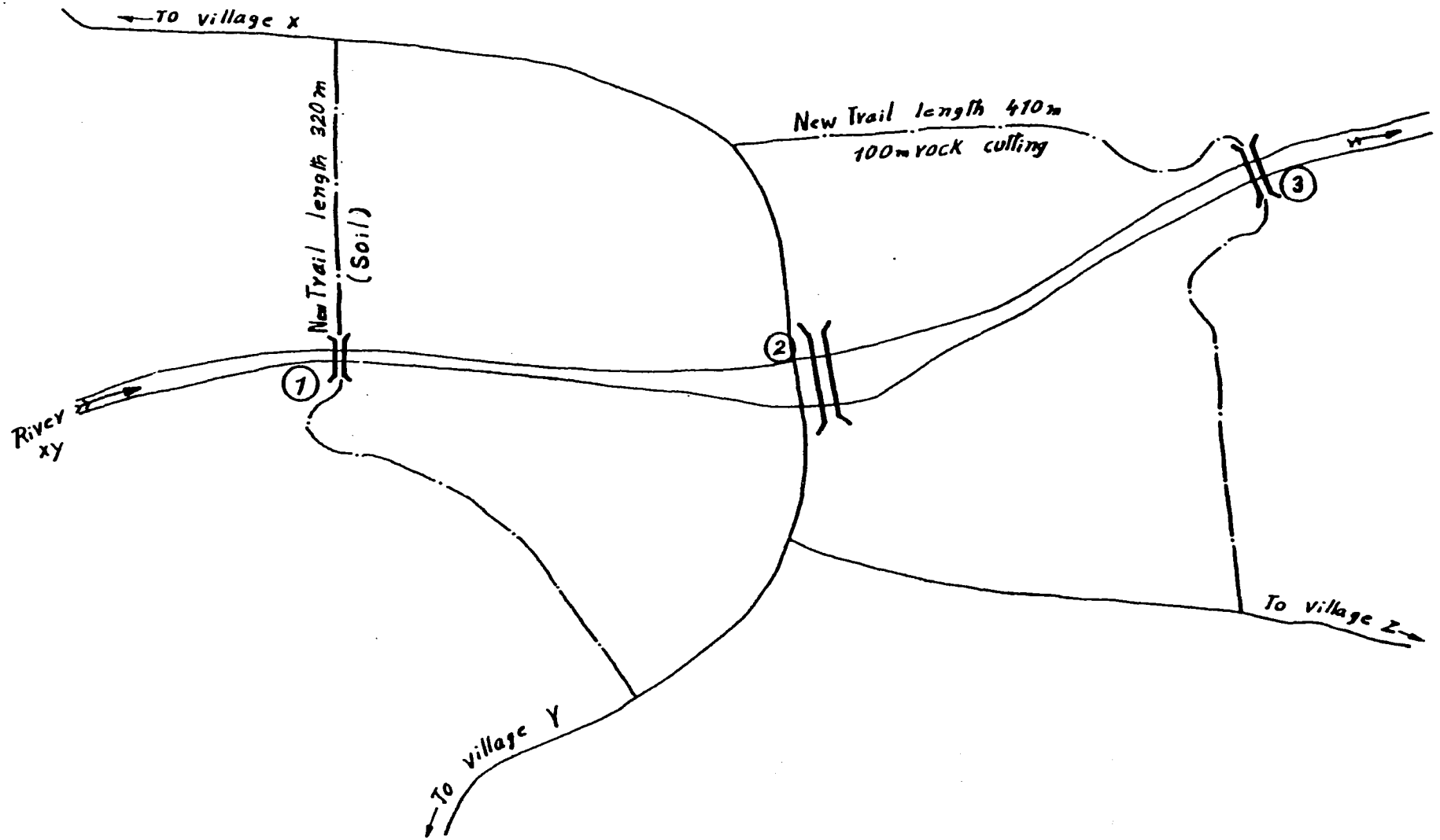
3.2.3 Determine the bridge type :
- suspended bridge
- suspension bridge with pylons
- suspension bridge with direct anchorage

Example 2: Overall sketch of the possible bridge sites

① : Suspension ; span ~ 66 m ; river very speedy ; danger of erosion → gabion wall necessary

② : Suspension ; span ~ 100 m → traditional crossing point ; both banks flat

③ : Suspended ; span ~ 86 m ; rock on both banks



3.2.4 draw a sketch (cross section) of the proposed bridge in profile, with position and elevation of foundations and anchorage blocks, approximate span, dead load sag(onlysuspended bridge) for each site. (Example 3)

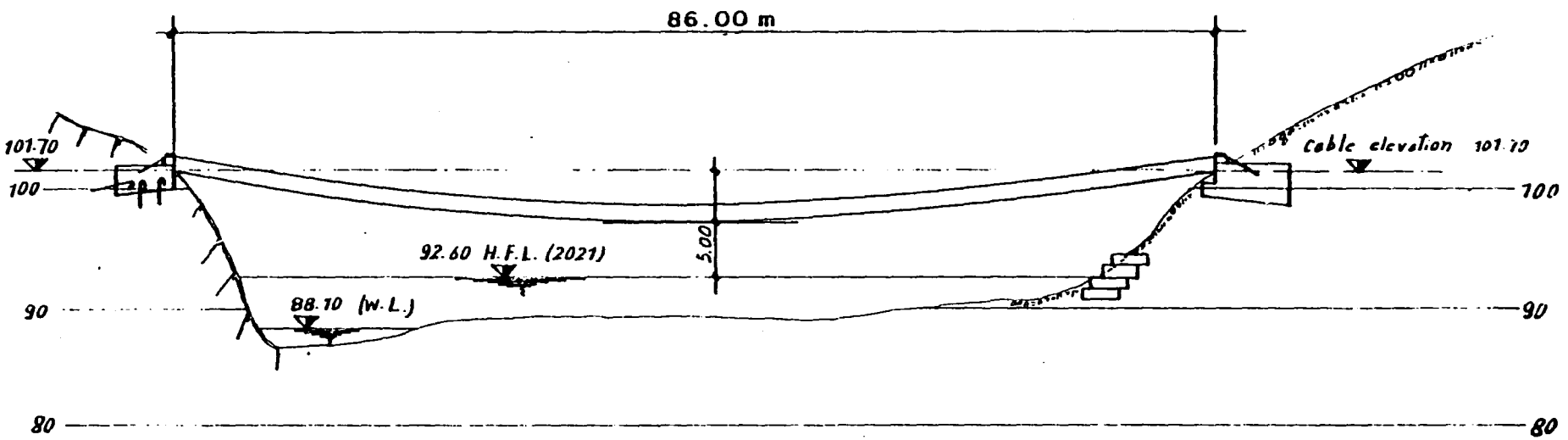
3.2.5 Make a rough cost - estimate for each possible site, using the diagrams in the annex Part II.

3.2.6 Decide the definitive bridge site and the bridge type.

Example 3: Sketch of possible bridge site and bridge

Bridge site no 3

Cross section - 1:500
Bridge type : Suspended
Span : Approximately 86.00 m
Sag dead load : 4.10 m
Free board line : 5.00 m



Left bank :

Hard rock
mixed gravity - rock anchorage

Right bank :

Soil mixed boulders,
Gravity block
Gabion wall necessary. $L = 30$ m
Gabions : 1/1/3 ; Height = 4 m.

4. Topographic survey

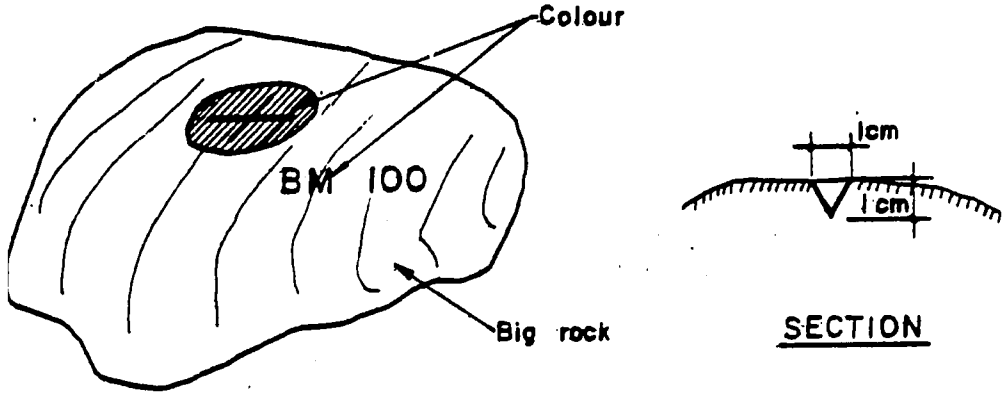
4.1 Situation of the bridge : give an exact description of the situation of the bridge

4.2 Pegs and bench mark

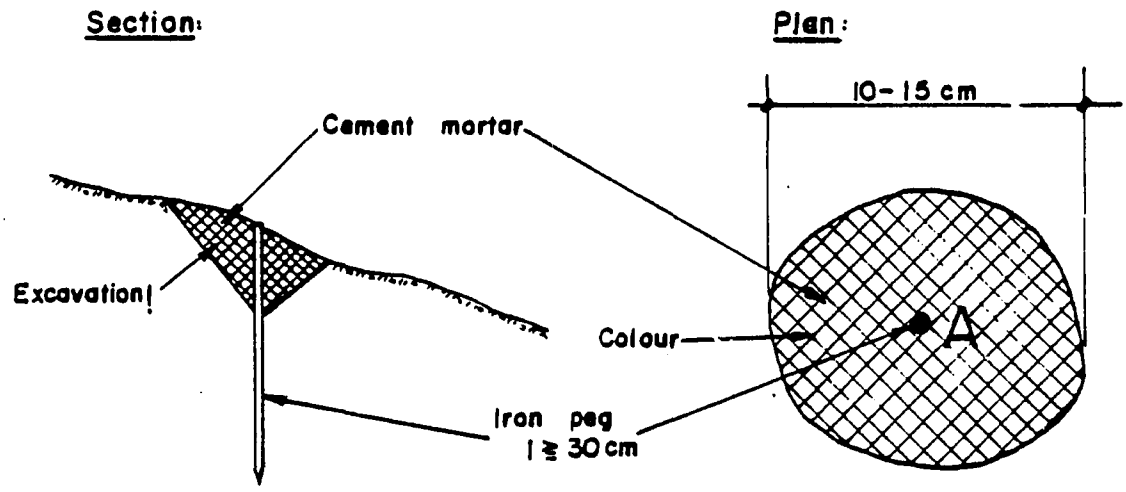
Fix the axisline with two permanent pegs A and B, choose a bench mark BM 100
It is very important that pegs and bench mark can be found, also 1 to 2 years after the survey.

Two possibilities :

- make permanent pegs and benchmark with a chisel on rocks



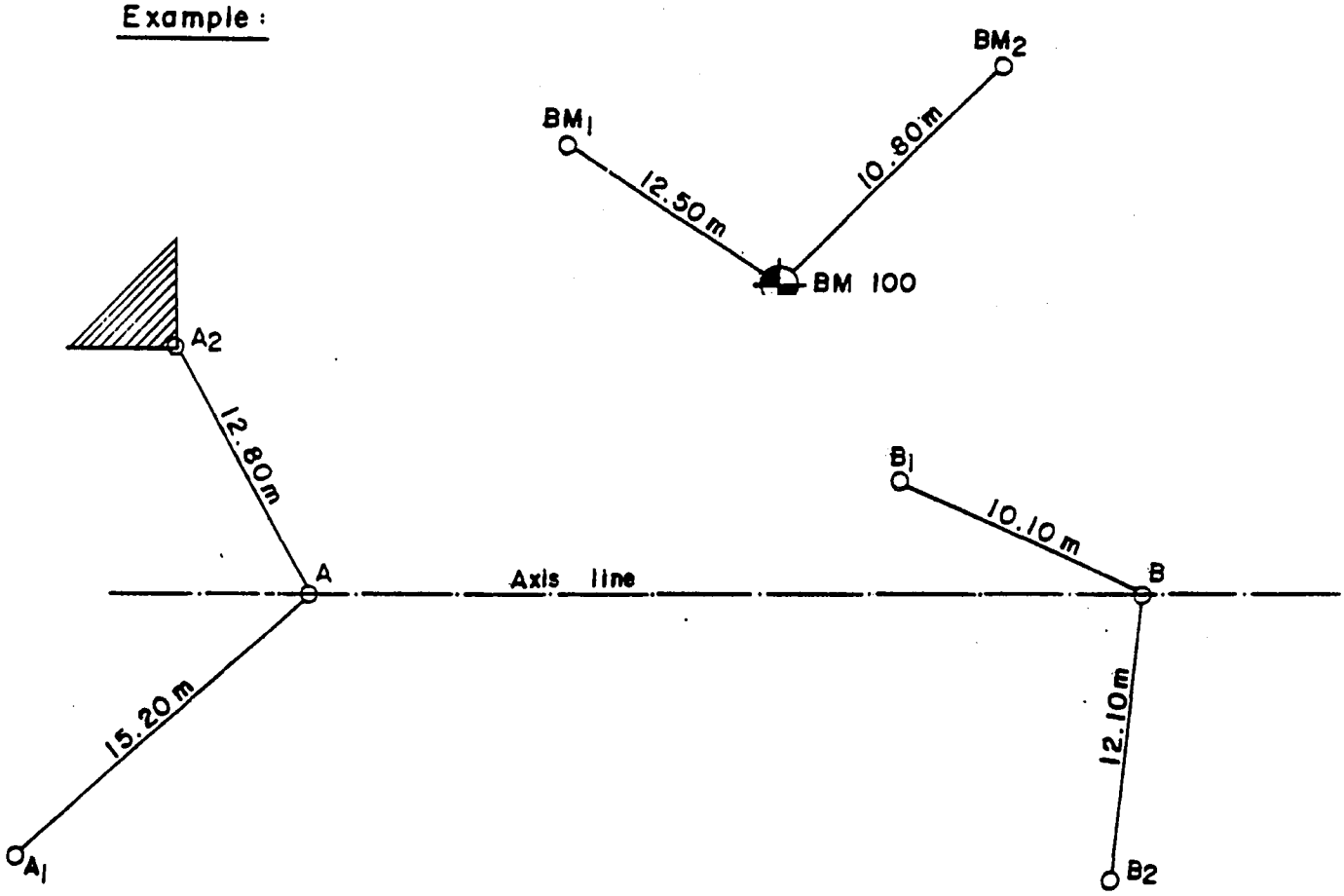
- make pegs and benchmark by using iron pegs :



For all three points (A,B, BM
reference at least 10 m away.
Measure the distances.

The points of reference have to be fixed in the same manner as pegs and benchmark : by chisel on rock or by using iron pegs and cement mortar. If present, you can also use trees, edges of houses, etc. Indicate the signification in colour (A_1/ A_2/ B_1/ B_2/ BM_1/ BM_2).

Example :



4.3 Triangulation

- Choose 4 - 8 additional points (1,2 .....) in the axisline A - B, according to the span and the topographical situation. Make temporary pegs.
- Measure all distances between the pegs by triangulation, and all verical angles :
  - by two independent measurements
  - by measuring in both positions of the telescope.
  - measure distance "e" and angels ε as exactly as possible.
  - calculate the distances and elevations for all points (A,B, 1, 2, ...) (Example see annex Part IV/3)

1/5

4.4 Sketch of the bridge

4.4.1 Draw a sketch of the bridge site and the bridge in scale 1 : 500 or 1 : 200 in plan and cross-section with all important information :

- o Permanent pegs (A,B), benchmark (BM 100), points of reference with distances, temporary pegs.
- o High flow level, possible back flow near confluences, water level during survey.
- o Span, dead load sag (suspended bridge), position of foundations and anchorage-blocks, windbracing, windguy-anchorage .
- o Indicate the points from where you took soil and rock samples (see chapter 6).
- o Indicate the points from where you took photographs (see chapter 5).
- o Indicate the north-direction.

- Position of rivulets, landslide areas, rockfall areas and all other important information concerning topography, hydrology, soil and rock conditions. (see Example 4)

4.4.2 Descriptions

- Describe the river. Is it calm or turbulent, very errosive or filling up or only averagely so, is the riverbed flat or sloping , give the direction of the flow near the bridge and the approximate longitudinal inclination of the riverbed.

- Describe the bank condition with special attention to erosion.

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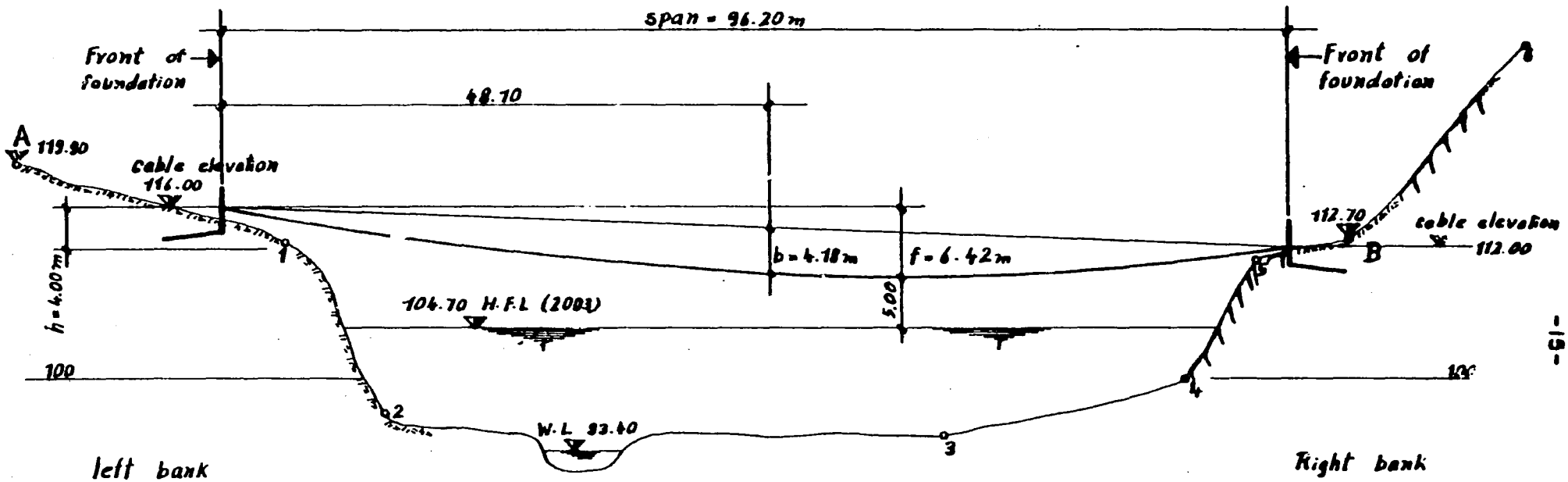
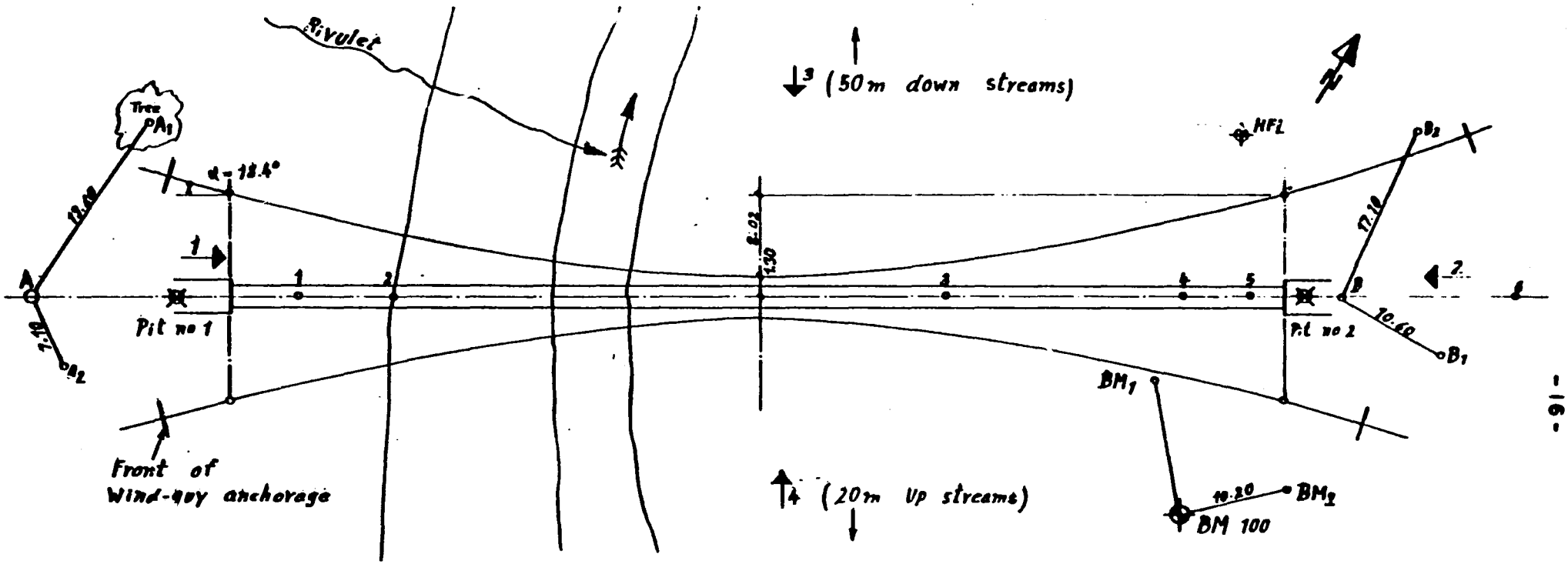


Dead load sag $b = \frac{96.20}{23} = 4.18\ m$

Low point $f = 2 + 4.18 + \frac{16}{16 \cdot 4.18} = 6.42\ m$

Example 4: Sketch of the bridge (scale 1:200 or 1:500)

Cross – section



Windguy-cable :

$Sag = \frac{96.20}{12} \approx 8.02$ m

$Tg\alpha = \frac{4 - 8.02}{96.20} = 0.333$

$\alpha = 18.4°$

Photographs : →

Additional : Inside of the pits

Soil investigation pits : ✱

Example 4 : Sketch of the bridge (scale 1:200 or 1:500)

Plan

4.5 Tacheometic survey

4.5.1 Check your tacheometer by measuring a distance of about 40 m by tacheometer and by tape.

4.5.2 If the difference between the two measurements is bigger than ± 1% you have to plot the Δ- correction-line according to annex part IV/2

4.5.3 In order to draw the contour-lines make a tacheometric survey according to annex part IV/4.

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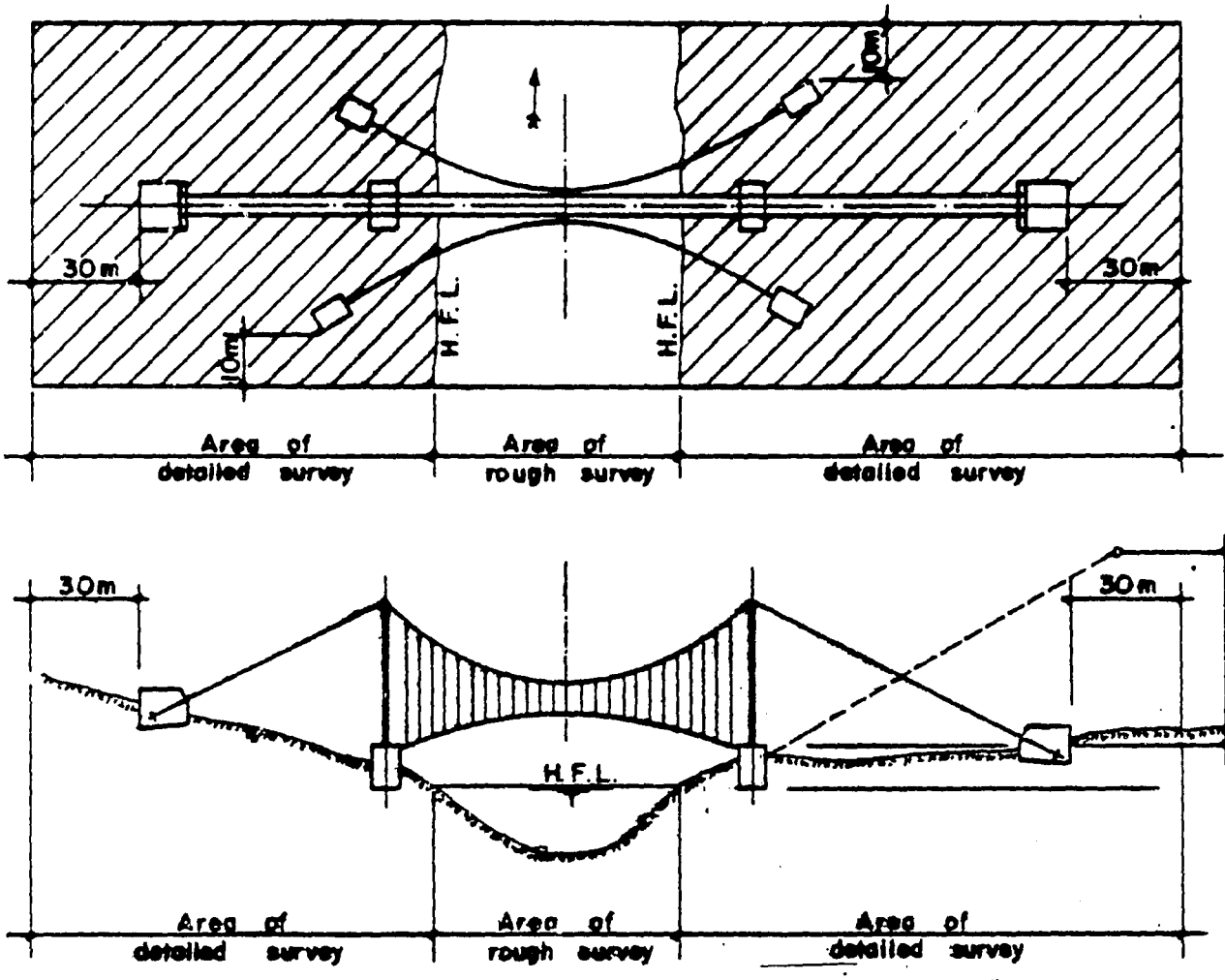
- Survey area

  10 m upstream and 10 m downstream of the proposed windguy anchorage blocks, 30 m behind the proposed maincable anchorage block (suspension bridge) or main foundation (suspended bridge), when ground is flat or 20 m higher when the ground is steep.



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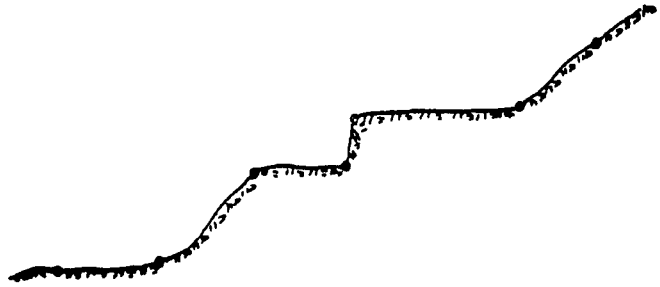
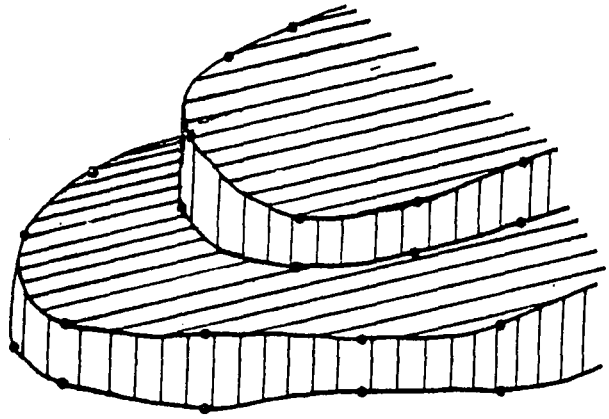
- Use pegs A,B or 1, 2, ... to put the instrument
- Maximum distance for measurements :
  50 m !
- As a check, measure at least one other peg of the axisline from each peg where you put your instrument.

- In the area of detailed survey, measure a lot of points, especially :
  - o near foundations and anchorage blocks.
  - o at breaking points of the ground (points where the angle of slope is changing)



- o paddy - field terraces

(8)

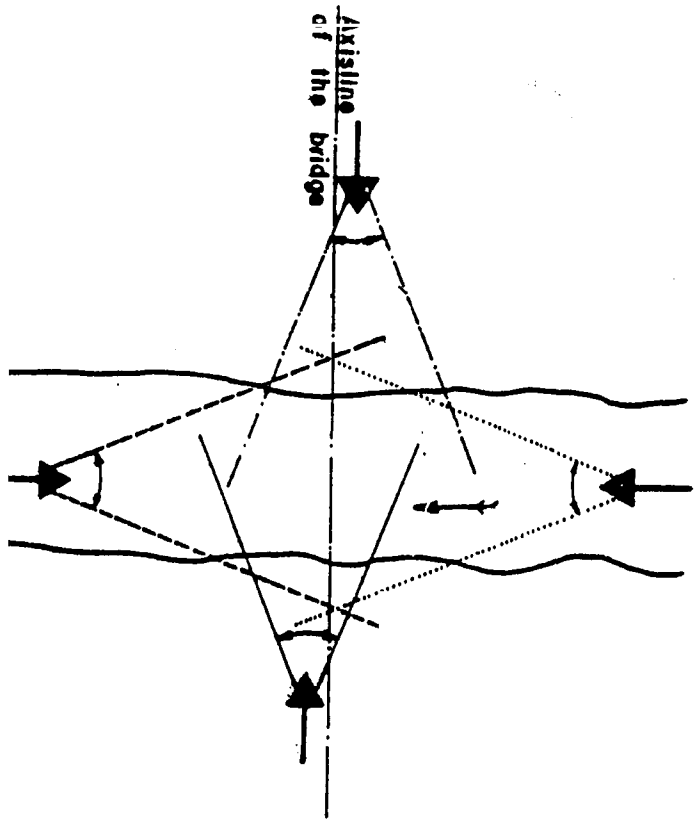


- A <u>tacheometric survey cannot be made across the riverbed</u>

5. Photographs

The following photographs have to be taken :

- Bridge-site from downstream and from upstream.
- Right bank and left bank :
  Position of main anchorages, foundations, windguy anchorage.



- Rock faces for rock anchorage
- Details of soil and rock conditions.
- Inside of exploratory shafts

<u>Whenever you take a photograph, put a staff or a scale in visible position</u>.

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If one picture doesn't cover the necessary area, take several pictures from the same position with sufficient overlapping.

Indicate the position from which you took photographs in the drawing made under chapter 4.4 .
All necessary information on how to operate the camera Olympus Pen EES - 2 can be found in the annex part V.

6. Soil-and rock-investigation

In order to design foundations and anchorage blocks, it is very important to have information about the condition and quality of soils and rocks.

6.1 Soil investigation

An analysis of grain size -distribution and Atterberg-Limits in the laboratory enables the values of internal friction (Ø) and cohesion (c) of the soil to be estimated. This analysis can be done on disturbed samples.

6.1.1 Soil sampling

Take soil samples out of exploratory pits :

- place of the pits:
  * suspension bridge: at the estimated position of pylon foundations and main cable anchorages (4 pits)
  * suspended bridge : at the estimated position of the main anchorage blocks (2 pits).
- Size of the pits minimum 80 x 150 cm
- Depth of the pits: at least down to the estimated bottom of the foundation, or down to the rockface.
- In each pit two samples have to be taken out:

  • one mixed sample according to the description and picture given below

  • one sample from the bottom of the excavation.

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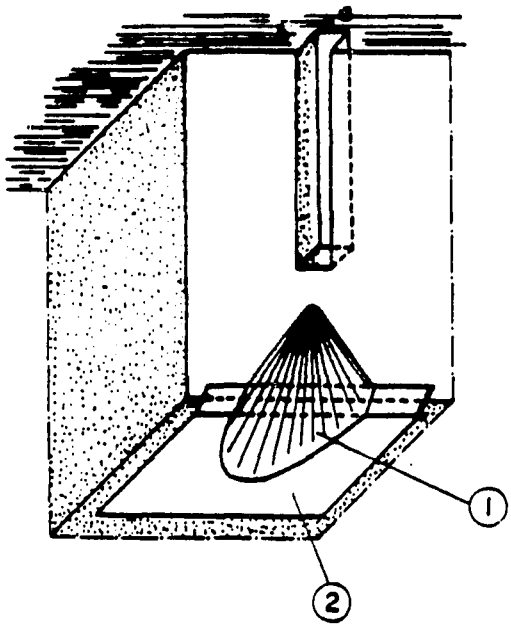

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Taking out mixed soil samples:

a) Make a slit in the exavation wall with constant cross-section axb.

b) Collect the material on a canvas (excluding top soil !)

c) Mix the material well.

d) Take a sample.

- Approximate weight of each sample : 1.5 kg
- Pack the samples separately in airtight plastic bags.
- Fix a label to each bag and write down the identification number.
- System of numeration
  Example :

2 . 2

No. of the pit

No. of the sample in this pit

1 : mixed sample
2 : bottom sample

- If you find rock in a pit, proceed according to 6.2.
- Indicate the positions of the pits and their numbers in the drawing made under § 4.4.

6.1.2 Exploratory report

All findings have to be compiled in a exploratory report for each pit according to the example below :

* classification and colour of the strata. (see Annex part VII)
* size and content of boulders bigger than 60 mm
* position of ground water level.
* position of possible springs.
* position of possible rockface
* position and identification numbers of the soil samples.
* Compactness of the strata.
* any other information

For the report use printed forms

After completion of the exploration, the excavated pit has to be refilled.

Example :

Soil - investigation

Main anchorage block, left bank

Bridge name: *Chutya besi* Date: *20-Feb-1978* Bridge type: *Suspension* Investig. by: ... District :	Bridge no	Pit no
		1

	Depth (m) 0.00	Sample no.	Classification* and colour of stratum	Boulders > 60mm		Remarks
				Size (mm)	% of Volume	
	0.30		*Humus brown*			*Top soil*
	1.00	*1:1 mixed*	*Fine grained Sand*	-	-	*dry*
	1.40		*sand / gravel / boulders*	*80-120*	*40%*	
	1.60		*Fine grained sand*	—	—	*wet*
	1.80		*clay yellow/ brown*			*Ground water level*
	2.10	*1.2*				
	2.20					
			Rock medium Quality			*Classification and description see 6.2*

* See Annex part VII : Unified soil classification chart

6.2 Rock Investigation

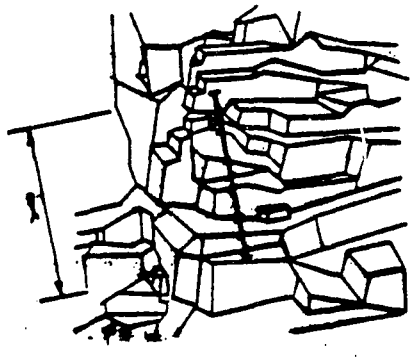
Whenever you propose to use rocks for foundations (direct rock anchorage, mixed rock gravity blocks) you proceed in the following manner :

6.2.1 Take overall and detailed photographs of the concerned rockface, do not forget to put a scale in visible position.

6.2.2 Classify the rock (igneous,metamorphic , sedimentary rock) and take rock samples.

6.2.3 Describe the fissures.

- measure and calculate the fissure density index k according to the following description :



$$k = \frac{N}{l} \ (m^{-1})$$

$$= \frac{\text{number of fissures}}{\text{measured length}}$$

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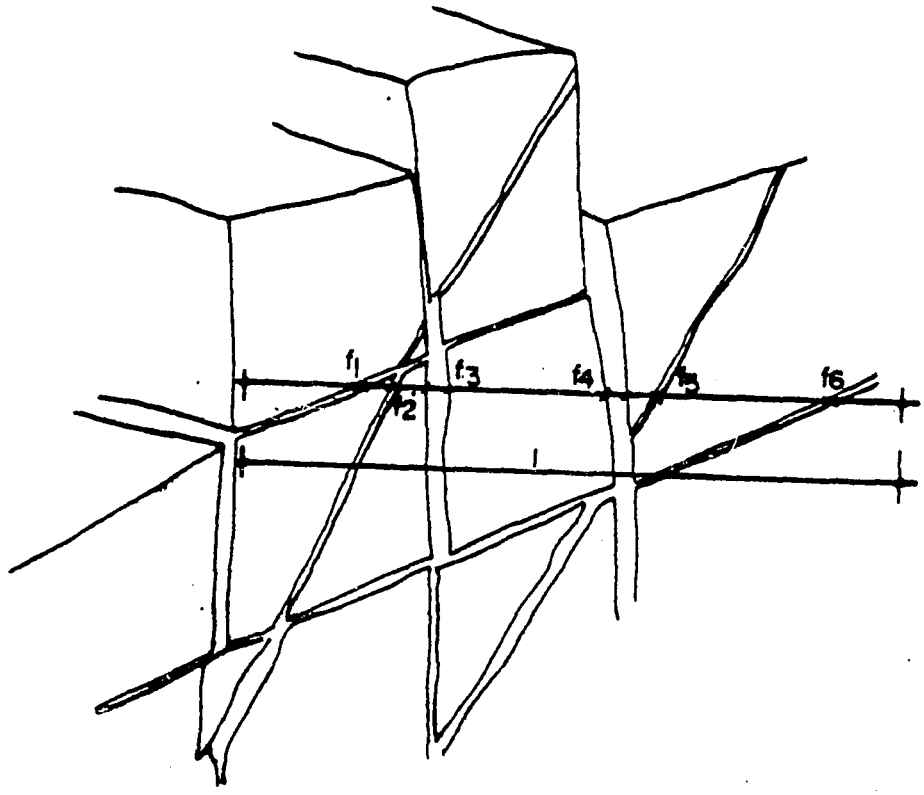
- measure and calculate the bulking degree according to the following description :



$$\text{Bulking degree } a = \frac{f_1 + f_2 + f_3 + \cdots f_n}{l} \times 100\ \% = \frac{\text{Sum of fissure openings (cm)}}{\text{Total length (cm)}} \times 100\ \%$$

Give a description of the material filling the fissures :

clay
silt /sand } approximate percentage
gravel
crystals

- write down all other important information like
  * moisture content
  * fissure springs
  * rock formation : stable or unstable
  * rockfalls
  * etc, etc.

7. Material

Find out where construction material is available.

- Wood : sal for decking
  salla or others for shuttering
  bamboo

  make sure that we can really get wood from the proposed site by discussing it with the concerned authorities.

- Sand : take a sand sample (approximate weight 1.5 kg)

  If according to your opinion the grain of the sand is too fine or too clayey, look for other sands. Take a sample of each quality. The decision which sand can be used will be made after analysing the grain size distribution in the laboratory.

- Natural gravel :

  Give the approximate grain size distribution :

  % 1 - 5 mm
  % 5 - 20 mm
  % 20 - 40 mm
  % > 40 mm

- Boulders : for plumb concrete
  for breaking gravels

Compile all this information in a list with indication of the locality (name) and transport distances to the bridge site.

8. Labour

8.1 Inquire through District authorities the official labour-rates for:

- skilled labour
- unskilled labour
- porters :
  - o per day
  - o per maund (37,5 kg) from road head/airstrip to site
  - o for cable transportation from road head to site.

8.2 Find out whether local leaders could organise labour for us (district officials, members of district/village panchayats, Pradhan Panchas, other local people).

Indicate the names and position of these local leaders.

Find out during which time local people could work.
(These labourers will be paid according to district rates.)

/3/

9. Final Work in the office

9.1 Calculate distances and elevations of the tacheometric survey.

9.2 Plot the bridge site in plan and cross-section with contour lines, position of pegs, benchmark and points of reference in scale 1 : 200 or 1 : 100; add a sketch of the bridge site-situation (approximate scale 1 : 10 000 / 1 : 25'000).

9.3 Complete the survey check list including all annexes.

9.4 Hand over the whole set to the design section.

A N N E X

Part I :

S U R V E Y C H E C K L I S T

S U R V E Y - C H E C K - L I S T

Bridge name: .....

Bridge number: .....

Place: .....

River: .....

Trail: from ..... to .....

Panchayat: .....

District: .....

Zone: .....

One inch map: .....

Co-ordinates: .....

Altitude: .....

Date of survey: .....

<u>This check - list can only be filled in with the help of the information given in the "Survey Guidelines".</u>

1. Preparatory work

1.1 Check the contents of the survey-box.

1.2 If possible, check the tacheometer of the theodolite. (See paragraph 4.5)

2. Feasibility

2.1.1 Draw a sketch of the area influenced by the bridge. (Example 1)

2.1.2 Table of important distances

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	Distance		Name of the locality
	miles	porterdays	
nearest road head (served by trucks)			
nearest airstrip			
nearest wireless station			
nearest post office			

2.1.3 Is it possible, that in the near future a new road/airstrip will be built? If yes, give the same information (2.1.2) for this possibility.

	Distance		Name of locality
	miles	porterdays	
nearest road head (served by trucks)			
nearest airstrip			

Approximate date of completion: .....

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2.2 **Traffic counting .**

Date						
Time (from .... to ....)						average per day
goods-traffic	porters/day 1)					
	pack-animals/day 2)					
non goods-traffic	persons/day					
	animals/day 3)					

1) kind of goods .....

2) kind of packanimals .....

3) kind of animals .....

2.3 Classification and description of the river:

2.4 This bridge is

feasible ☐ not feasible ☐

according to your personal opinion.

2.5 Alternative crossing facilities:

temporary bridge ☐

cable car ☐

ferry for all seasons ☐

Why is this alternative more feasible?

2.6 Local bridge construction

2.6.1 Are there locally constructed bridges in the area?

yes ☐ no ☐

2.6.2 Could this bridge be constructed locally (from technical point of view)?

yes ☐ no ☐

2.6.3 Name(s) of local bridge constructor(s):

.....

.....

.....

.....

2.6.4 Would local people be ready to build the bridge themselves, with our technical advice?

yes ☐ no ☐

Name of the man who would be ready to take the initiative:

.....

3. Bridge site selection

If only one bridge site within a reasonable distance from the traditional crossing point is possible:

continue with paragraph 4

If several bridge sites are possible:

3.2.1 Draw overall sketch of the possible bridge sites, trail system, necessary new trails.

(Example 2)

3.2.2 } Draw a cross-section of each possible bridge.
3.2.3 }
3.2.4 } (Example 3)

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3.2.5 Cost-analysis

Bridge site No		1	2	3	4
Bridgetype					
Span					
Weight of steel construction					
Weight of cement and reinforcementst.	right bank				
	left bank				
Gabion work: weight of cement and wire					
Total transportation weight					
Cost of transportation					
Cost of steel construction					
Cost of concrete work incl. material collection and cement costs	right bank				
	left bank				
Cost of gabion work	heigth:				
	constr.				
	length:				
Cost of trail cutting	rock: length=				
	soil: length=				
Total costs					

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3.1.6 Decide on the definitive bridgesite and bridgetype:

Bridgesite No. : .....

Bridgetype : .....

Span : .....

4. Topographic survey

4.1 Description of position:

_____

_____

_____

_____

_____

4.2 Description of pegs and Bench Mark

	Description	Distance (m)
peg A		
reference point A_1		
reference point A_2		
peg B		
reference point B_1		
reference point B_2		
Bench Mark 100		
reference point BM_1		
reference point BM_2		

*e.g.: chisel on rock/iron peg/ edge of a house/ tree/ etc.

4.3 Triangulation

Measure and calculate distances and elevations of Peg A and B and temporary pegs 1, 2, 3 .....

Use printed form "Triangulation".

Peg	Intermediate distance	Elevation (DM = 100)

4.4 Sketch of the bridge

4.4.1 Draw a sketch of the bridge in plan and cross-section in scale 1 : 200 or 1 : 500. For cross section use the points measured by triangulation.

(Example 4)

4.4.2 Description of river and banks:

4.5 Tacheometric survey

4.5.1 Check the instrument

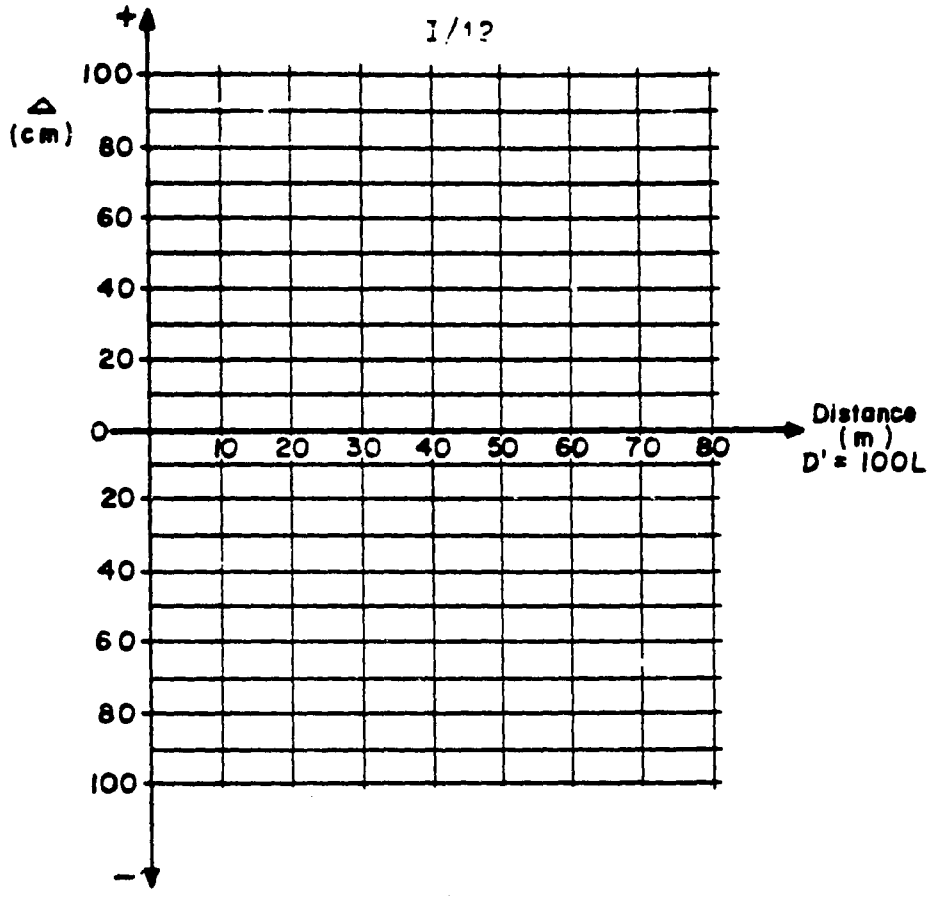
	Distance	
	measurement by tape	measurement by tacheometer
1st meas.		
2nd meas.		
3rd meas.		
4th meas.		
Mean		
Difference Δ	cm	% of distance

If Δ is smaller than 1% go on to 4.5.3

4.5.2 Δ -corrections (only if necessary)

- Type and No. of instrument: .....

Draw the staight line of the Δ -corrections :



4.5.3 Tacheometric survey

- Fix the survey area
- Make a tacheometric survey on both riverbanks
- Use pegs A and B or temporary pegs 1, 2, ... to place the theodolite
- Use printed form

Photographs

- You will find a description of the camera in the annex part V of the "Survey Gidelines".
- Do not forget to put a staff or a scale in visible position.
- When you take the film out of the camera, note the film No. and the name of the bridge site on the film.

- Indicate the place from where you took photographs (position No.) in the drawing made under paragraph 4.4 ..

position No	identification No		description
	film No	picture No	

1X2

6. Soil and rock investigation

6.1 Soil investigation

Open exploratory pits and take soil samples.

identification		localisation *	Soil classification
pit No	sample No		
1	1		
	2		
2	1		
	2		
3	1		
	2		
4	1		
	2		

* eg pylon foundation right bank,
maincable anchorage left bank, etc.

- Make a detailed exploratory report for each pit, using the printed forms.

- Indicate the pit-numbers on the drawing made under paragraph 4.4 .

6.2 Rock investigation

6.2.1 Make detailed and overall photographs

6.2.2 Classification and sampling

6.2.3 Fissures

identification No *	rock-classification	fissure density index (m^{-1})	bulking degree (%)	filling material				other findings
				% clay	% sand	% gravel	cristals	

* equal to sample No

Take a sample from each place and mark the identification No.

Indicate the identification numbers on the drawing made under paragraph 4.4.

7. Material

Material			Name of the locality	Distance from bridge site
wood	saal for decking			
	for shuttering: salla			
	others:			
	bamboo			
sand	quality 1	sample No S/ ...		
	quality 2	S/ ...		
	quality 3	S/ ...		
natural gravel				
boulders	for breaking gravels			
	for plumb concrete			

Take a sample of each sand quality, pack it in a plastic-bag, label it with the sample No.

If you propose to use natural gravels, give the approximate grain size-distribution:

.....% 1 - 5 mm

.....% 5 - 20 mm

.....% 20 - 40 mm

.....% > 40 mm

8. Labour

8.1 Rates

Kind of labour		Rates
skilled labour Rs/day		
unskilled labour Rs/day		
porters	Rs/day	
	for 1 maund from roadhead/airfield to site Rs	
	for cable transportation from roadhead/airfield to site Rs	

/5/

8.2 Local contribution

(Rates according to 8.1)

Number of labourers for construction work : skilled .....
: unskilled .....

Number of porters : .....

Time when local people are able to work : .....

Name(s) of local leader(s) : .....
.....
.....

9. Final work in the office

9.1 Calculation of tacheometric survey.

9.2 Plan (contourlines)and cross-section in the axis line of the selected bridgesite 1 : 200 or 1 : 100 with sketch of the bridgesite position 1 : 10'000 or 1 : 25'000.

ANNEXES:

1. Sketch of the area influenced by the bridge (according chapter 2.1.1)
2. * Overall sketch of possible bridgesites (acc. chapter 3.2.1)
3. * Cross-sections of all possible bridges (according chapters 3.2.2/3.2.3/3.2.4)
4. Filled in forms for triangulation (acc. chapter 4.3)
5. Sketch of the bridge in plan and cross-section (according chapter 4.4.)
6. Filled in forms for tacheometric survey (according chapter 4.5.3)
7. Photographs (according chapter 5)
8. Filled in forms for soil investigation (according chapter 6.1)
9. Plan and cross-section of the bridgesite 1 : 200 / 1 : 100 (according chapter 9.2)
10. Soil samples, sand samples, rock samples with identification No.

* only if several sites are possible

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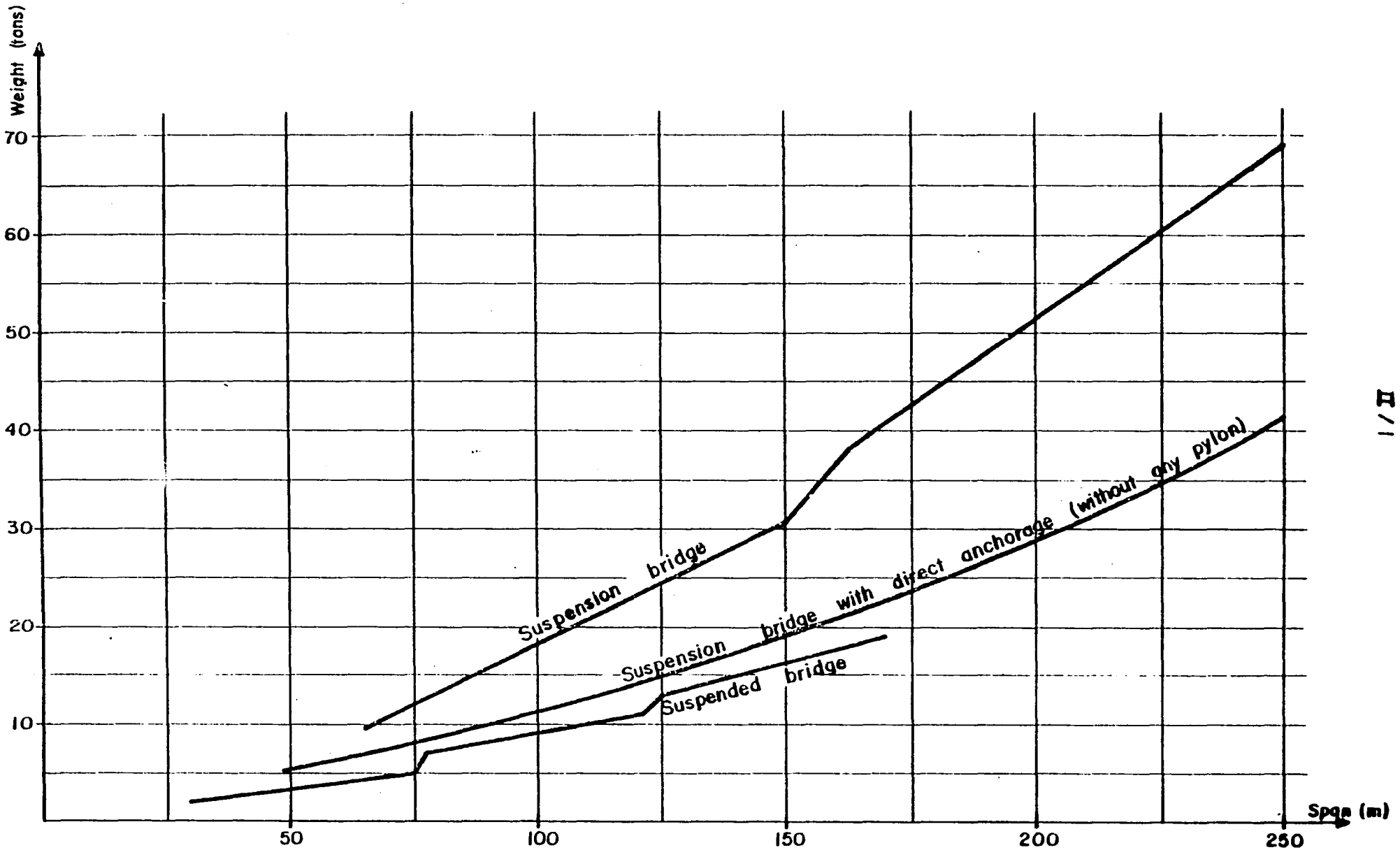
A N N E X

Part II :

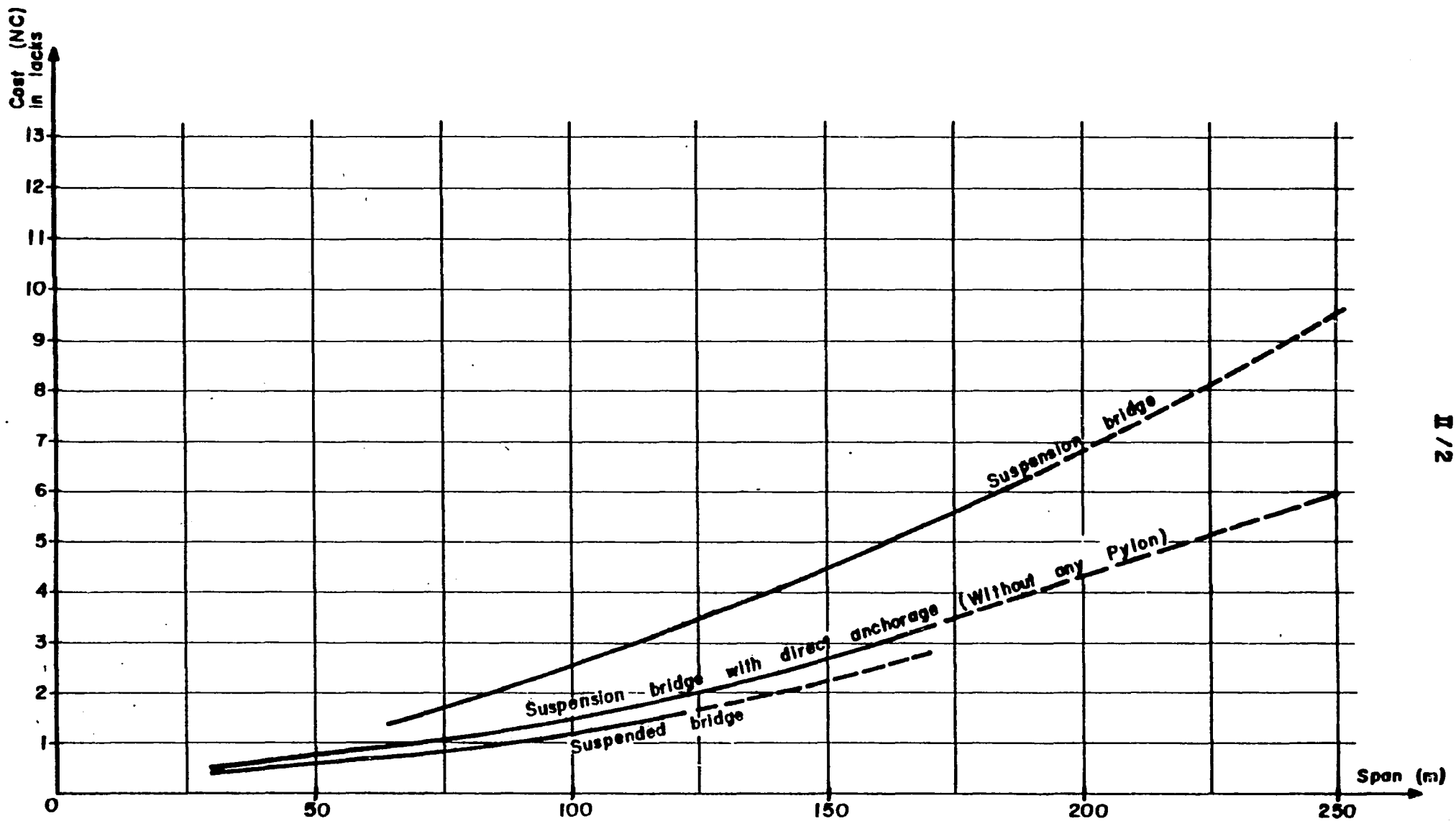
D I A G R A M S F O R C O S T A N A L Y S I S

The diagramms given in this part are average curves based on constructed bridges or bridges being under construction and on average labour rates. That means, they indicate only the relation between the different factors of cost. The total cost which results by using this curves may not be correct. Thats why these diagramms can only be used for cost-analysis during bridge site selection and not for preliminary cost estimates. Such estimates have to be based on correct labour rates.



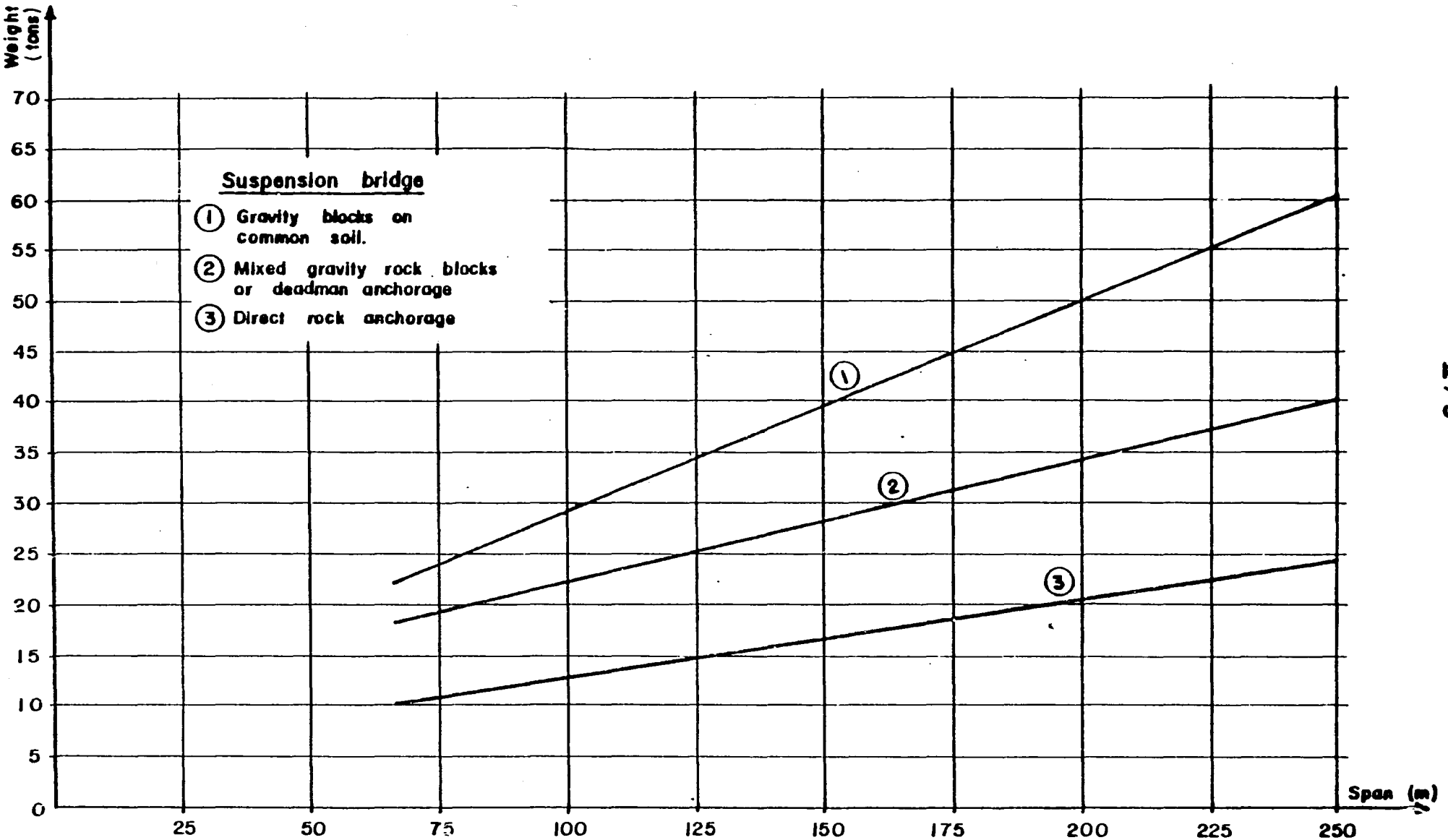
II/1

II/1 Weight of steel construction including cables



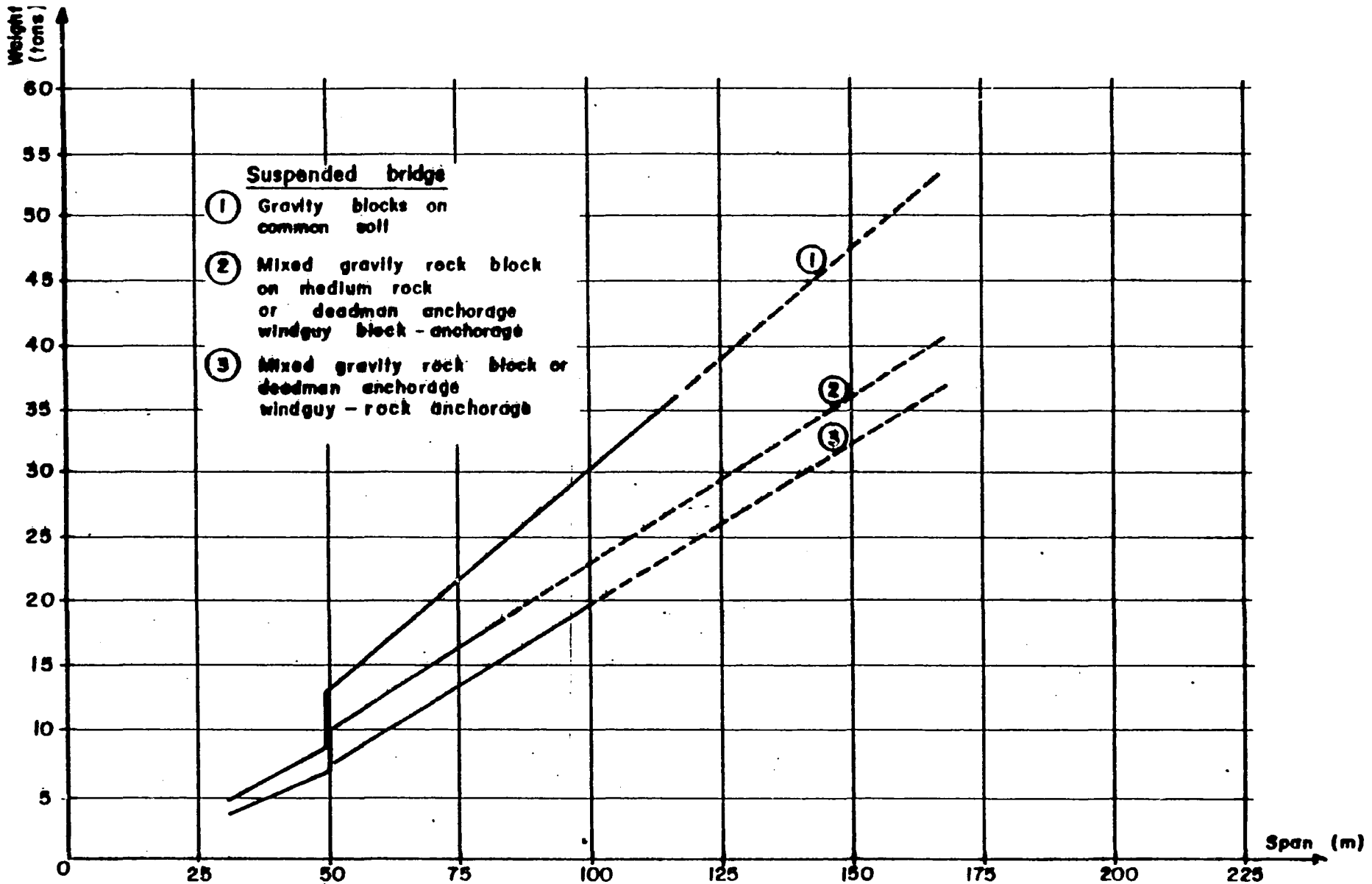
II/2 Cost of steel construction including cables

II/2

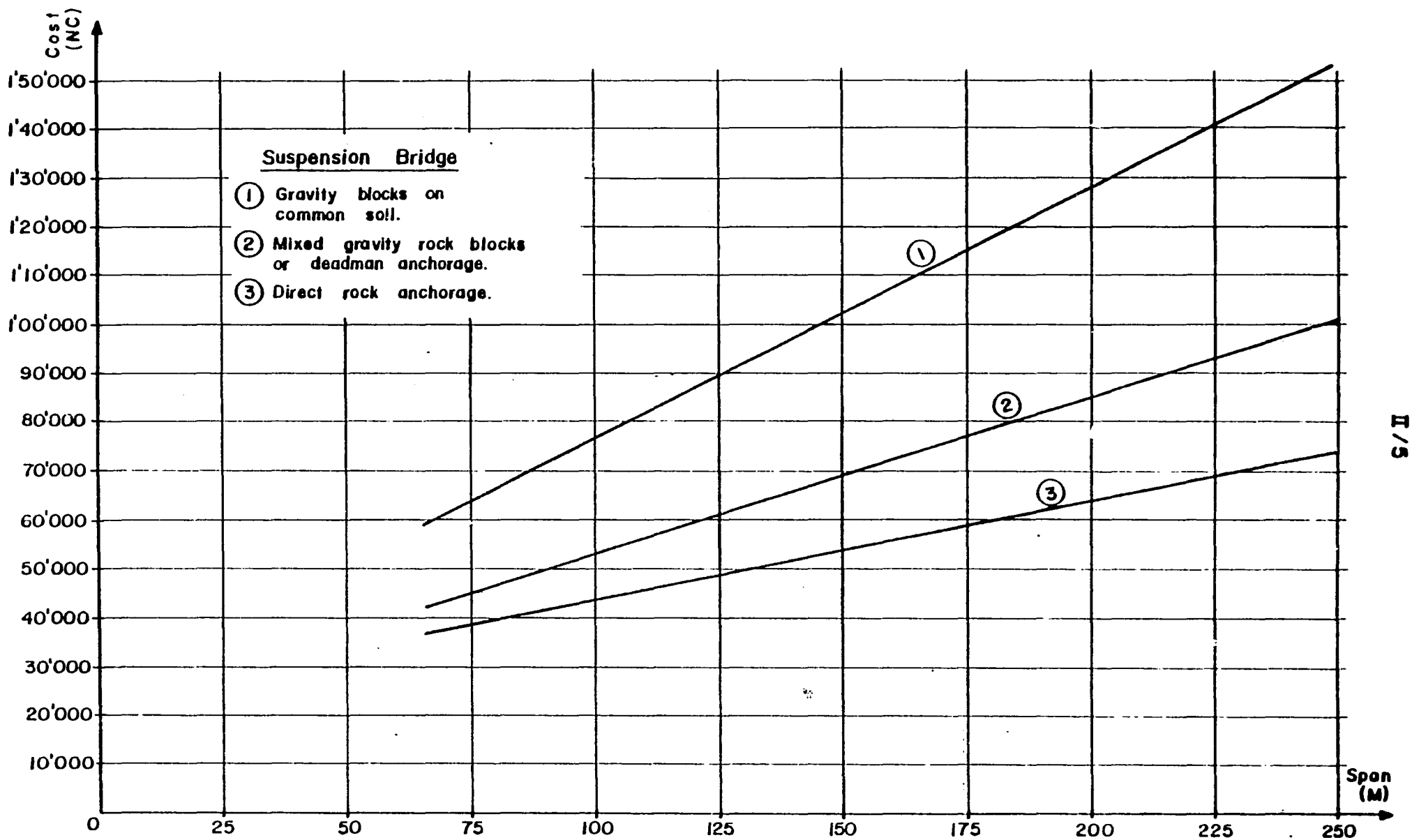


II / 3

II / 3 Suspension bridge : Weight of cement and reinforcement steel for Pylon foundation, Main cable and Windguy anchorage on one river side

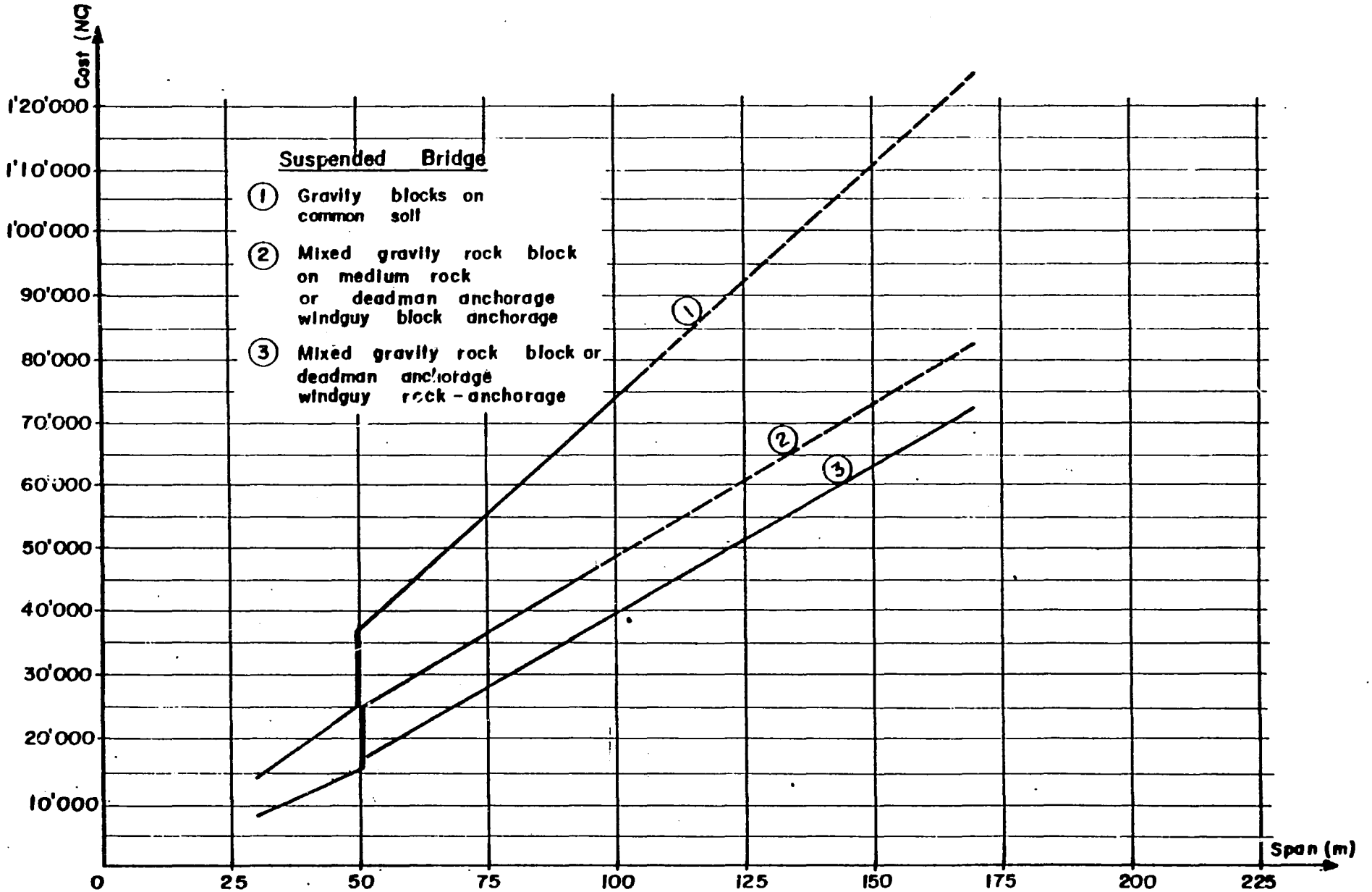


II/4 Suspended bridge : Weight of cement and reinforcement steel for Main anchorage and Windguy anchorage on one river side



II/5

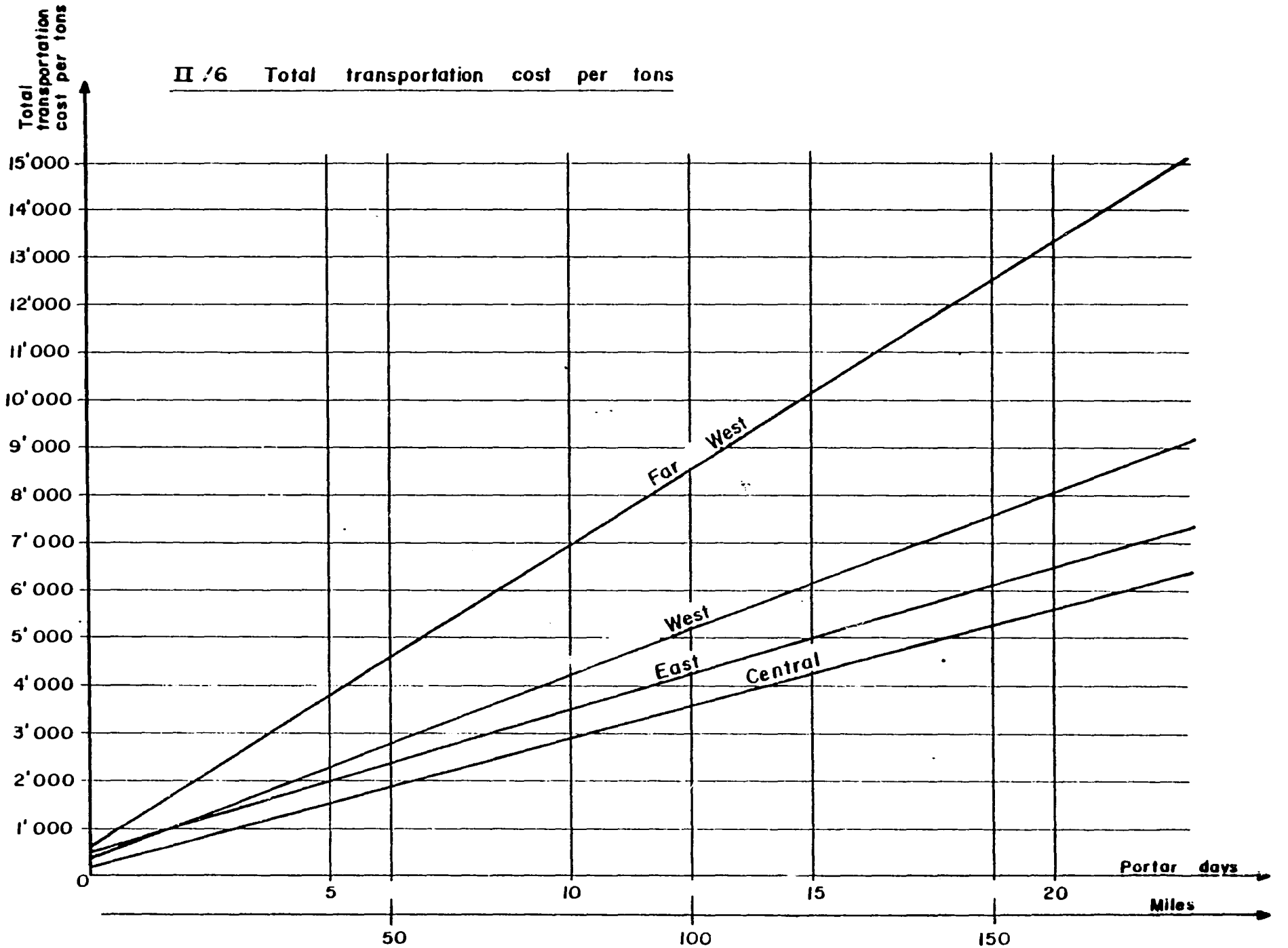
II/5 : Suspension bridge : Construction cost for Pylon foundation, Main cable & Windguy anchorage on one river side (including cost of cement & reinforcement steel)



II/6 Suspended bridge : Construction cost for main anchorage and windguy anchorage on one river side (including cost of cement & reinforcement steel)

II/6

II /6 Total transportation cost per tons



II /7

II/8 Cost and total transportation weight of gabion work per m length (including cement and wire)

Height (m)	1	2	3	4	5	6	7	8
Construction	1/1/3 longitudinal		1/1/2			1/1/3		
Total cost per. m^1 (NC)	500	700	1500	1900	2200	3700	4200	4800
Total transport. weight per m^1 (kg)	120	140	240	280	320	510	570	630

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II/9 Cost of new trails per m^1

Ground condition	Rs / m^1
In hard rock	110
In soft rock	70
In common soil	40

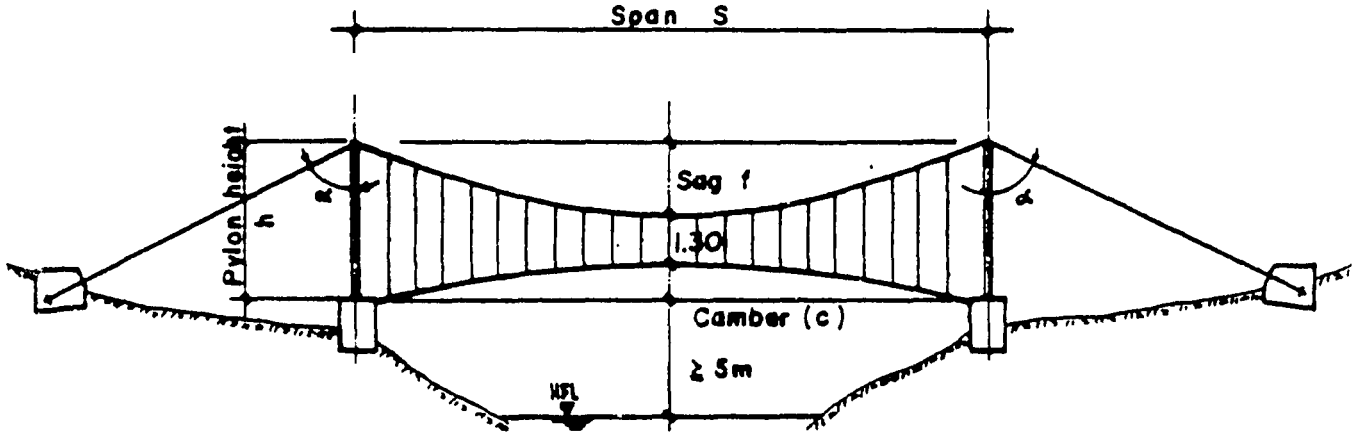
A N N E X

Part III :

B R I D G E T Y P E S

III/1 Suspension Bridges.

A. Standart Design Suspension Bridge.



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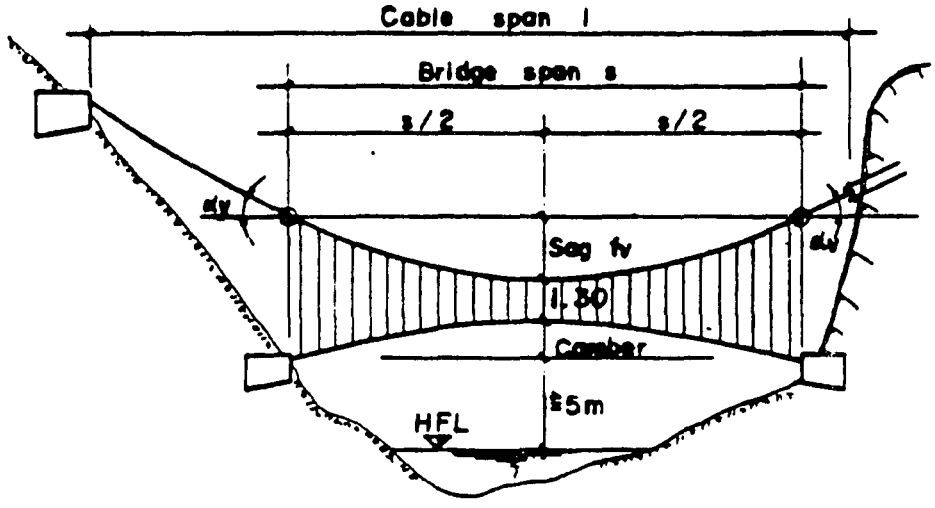
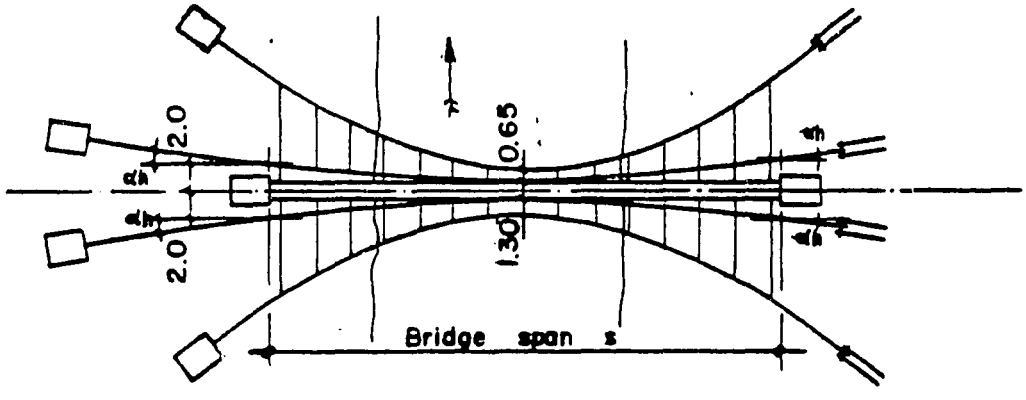
All spans: Backstay angle $\alpha = 26.56^{\circ}$, tangα
Free board min. 5.00m.

Span s (m)	Pylon heigth h (m)	Dead load sag f (m)	Camber c (m)
66	11.00	7.57	2.13
78	12.80	9.18	2.32
90	14.70	10.99	2.41
102	16.50	11.96	3.24
114	18.30	13.51	3.49
126	18.30	13.94	3.06
138	21.90	15.54	5.06
150	21.90	17.30	3.30
162	25.50	19.20	5.00
174	25.50	20.65	3.55
186	29.10	22.10	5.70
198	29.10	23.80	4.00
210	32.70	24.65	6.75
222	32.70	25.70	5.70

B. Suspension Bridge with direct Anchorage, including Windbracings.





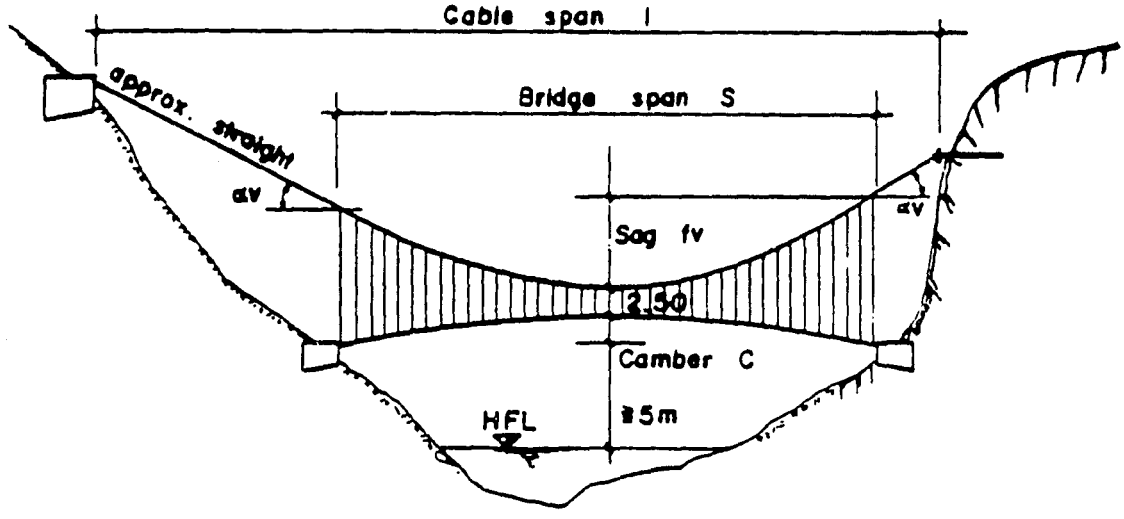
Span range : 30 - 250 m

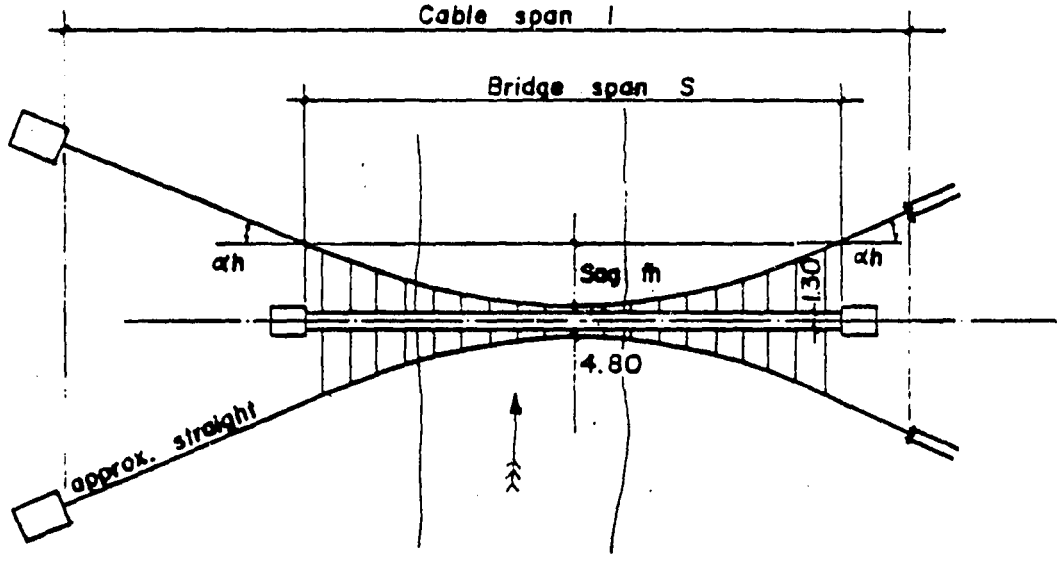
Free spans

Dead load sag : $f_v = \frac{s}{16} - \frac{s}{24}$

Backstay angles : $\tan\alpha_v = \frac{4\,f_v}{s}$, $\tan\alpha_h = \frac{5.4}{s}$

C. Suspension Bridge with direct Anchorage, without any Windbracing.





Span range : 30 - 250 m

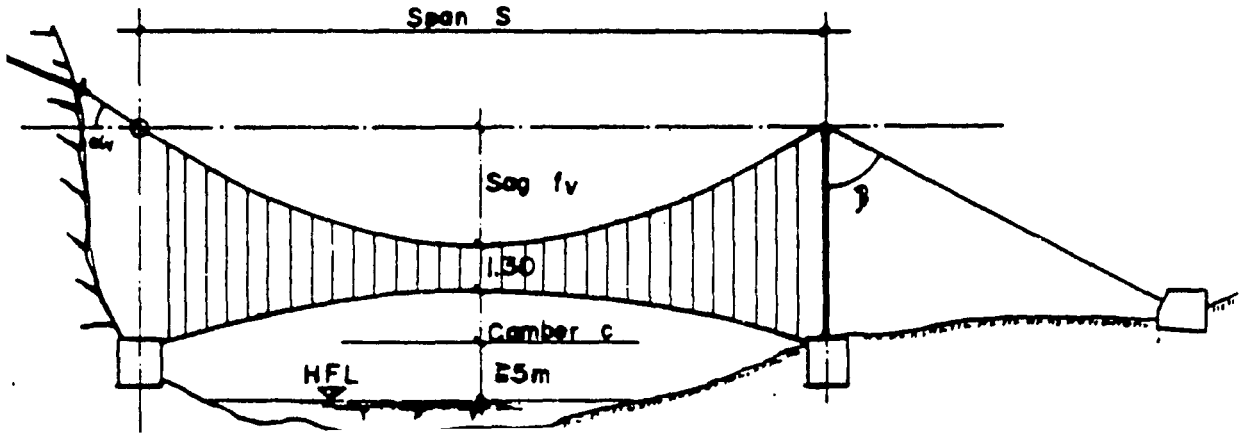
Free spans

Dead load sag : $f_v = \frac{s}{16} - \frac{s}{24}$ $f_h = 0.7\ f_v$

Backstay angles : $\tan \alpha_v = \frac{4\ f_v}{s}$, $\tan \alpha_h = \frac{4\ f_h}{s}$

No windbracings necessary

7. Suspension Bridge with one Pylon.



Spans s, dead load sags f_v , pylon heigths h, cambers c according to chapter III/1 B. : Standart Design Suspension Bridge.

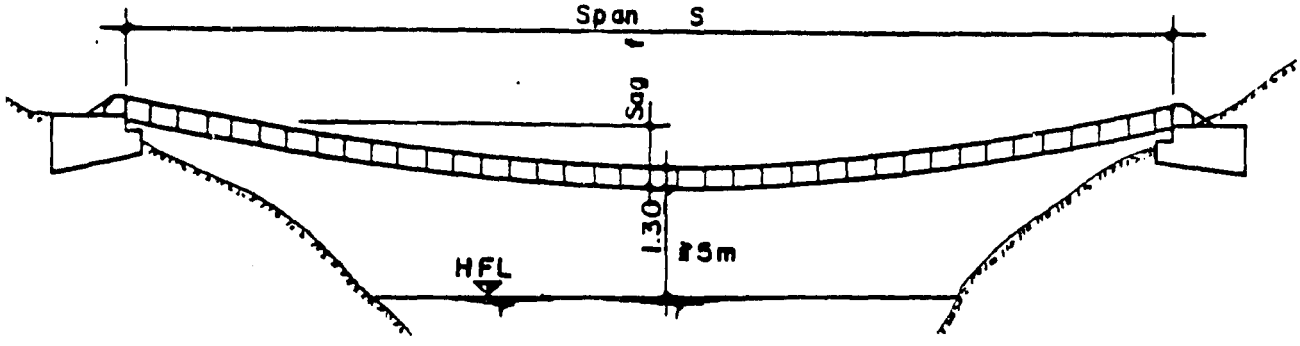
Backstay angles : $\tan \alpha_v = \frac{4 f_v}{s}$, $\tan \alpha_h = \frac{5.4}{s}$

$$\tan \beta = 0.5, \quad \beta = 26.56^\circ$$

III/14

III/2 Suspended Bridges

A. Level span



Span range : 31.40 - 175.40 m
Standart spans: 31.40 + n·2.40 m (n = 1, 2, 3, ... 60)
e.g. 31.40, 33.80, 36.20, ...
Free spans possible
Dead load sag : f = $\frac{s}{23}$

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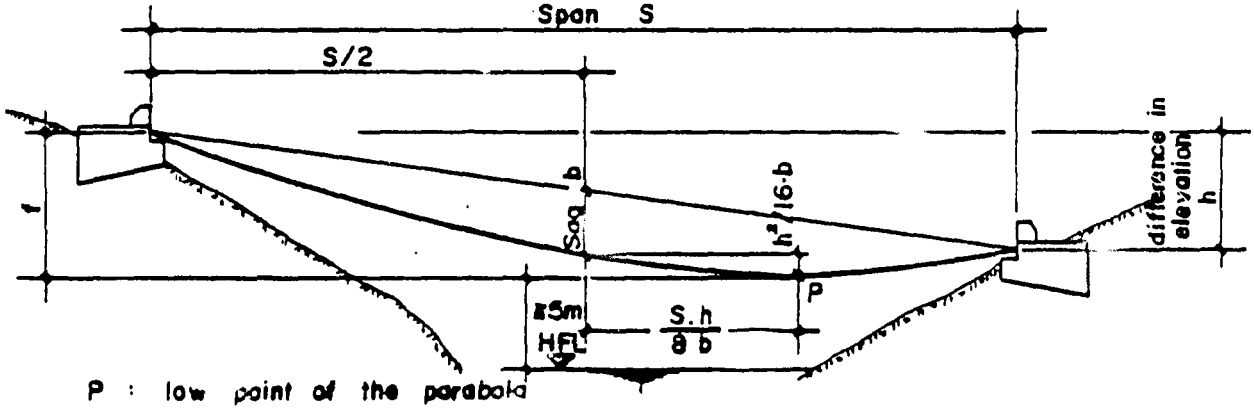
B. Inclined span



P : low point of the parabola

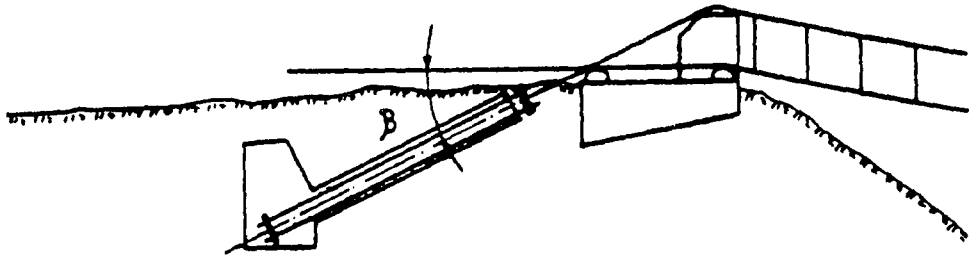
Span range : 30 - 170 m
Free spans possible
Dead load sag : $b = \frac{s}{23}$; $b = \frac{s}{17} - \frac{h}{4}$ } the smaller of the two values

Lowpoint of the parabola : $f = \frac{h}{2} + b + \frac{h^2}{16b}$

C. Suspended bridge with dead man anchorage.

Span s, sag f, span range, standart spans according to III/2 A.

Anchorage:



Back stay angle β $\quad tg\,\beta = 0.5$

$\beta = 26.56°$

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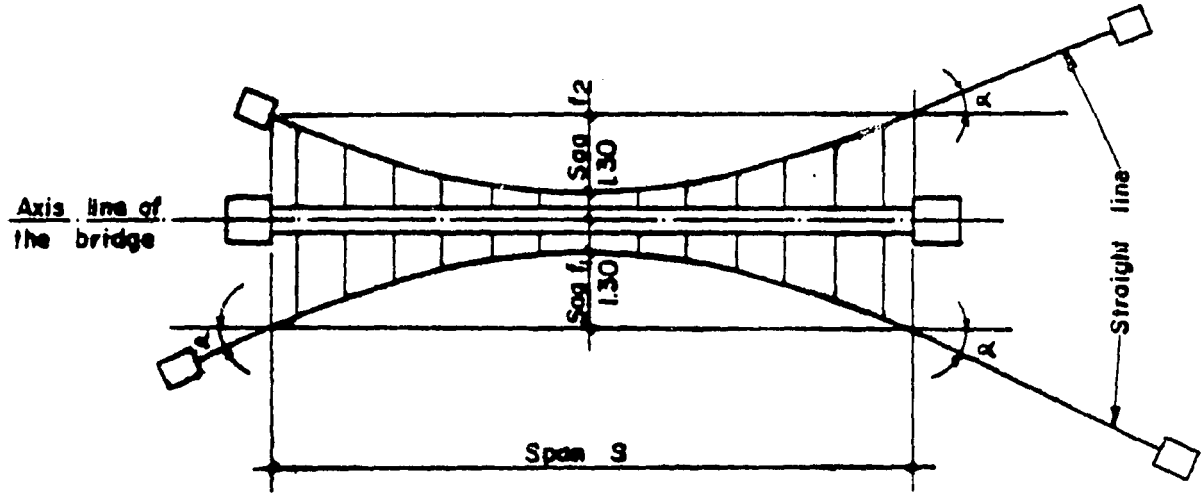
III/3 Windbracings

Suspension bridge: always windbracings necessary, except bridge type III/1 C.

Suspended bridge : up to 48 m span no windbracings necessary.



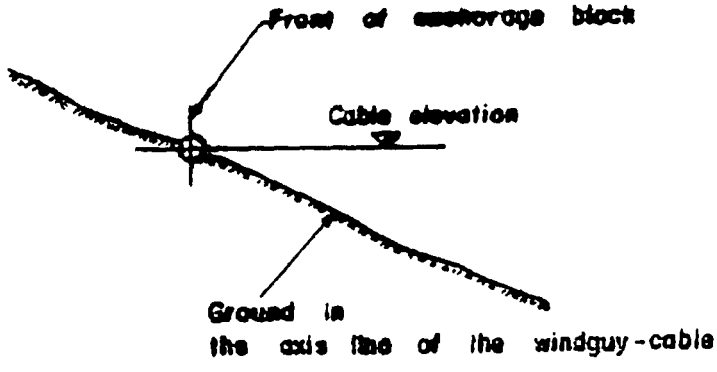
Sag : $f_1 = f_2 = \frac{s}{12} - \frac{s}{14}$

Angle α : $\tan\alpha = \frac{4\,f}{s}$

Windguy cable elevation at the anchorage blocks:

- suspension bridges : equal to the elevation of the pylon base (top of foundation).
- suspended bridges : equal to the elevation of the lowpoint of the parabola (dead loa

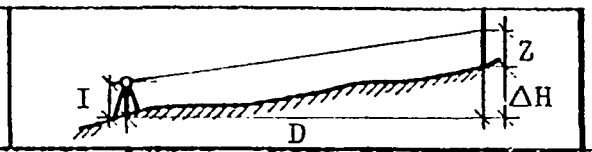
The position of the anchorage blocks in plan can be found with the following condition:



$D = 100 \cdot L \cdot \cos^2\alpha \quad (L = L_1 - L_2)$

$V = 100 \cdot L \cdot \sin\alpha\cos\alpha = 50 \cdot L \cdot \sin 2\alpha$
or $V = D \cdot \tan\alpha$

$\Delta H = V + I - Z$
$H = H_{Stn.} + \Delta H$

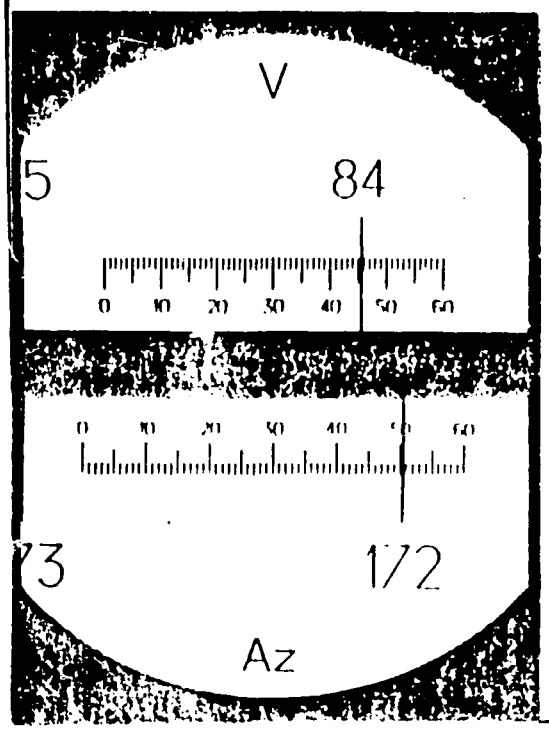


STATION / HT. OF INSTR. I ft/m	STAFF STATION	HORIZ. CIRCLE ° / '	VERTICAL CIRCLE α ± ° / '	TOP HAIR L_1 ft/m	MIDDLE HAIR Z ft/m	BOT. HAIR L_2 ft/m	STAFF INTERC. L ft/m	HORIZ. DISTANCE D ft/m	VERT. DIST. V ± ft/m	DIFF. IN ELEV. ΔH ± ft/m	RED. LEVEL H ft/m
Station	1	172 50.4	84 45.6	1.410	1.249	1.087	0.323	32.00	+ 29.5	+ 3.15	103.15
Reg A	2										
(R.L. = 100.00)	3										
(I = 1.46 m)											

From the tables "TACA":

$100 \times \sin^2 84^\circ 45.6' = 100 \times \cos^2 5^\circ 14.4' = 99.2$

$100 \times \sin\alpha\cos\alpha = 50 \times \sin 2(5^\circ 14.4') = + 9.09$



Example:

Horiz. circle = 172°50'4

Vert. circle = 84°45'6

Top Hair = 1.410 m

Middle Hair = 1.249 m

B. Hair = 1.087 m

(I = 1.46 m)

Remark:

As that theodolite has 0° in the zenith the vertical circle reading of 84°45'6 gives an angle α of + 5°14'4

A N N E X

Part IV :

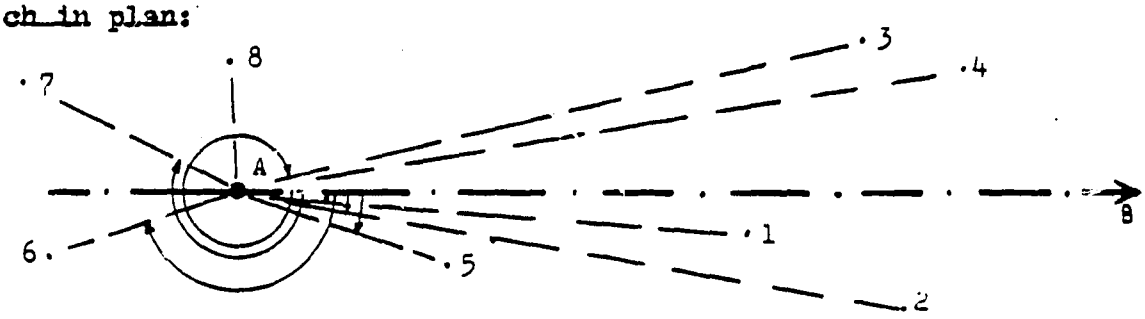
S U R V E Y

IV/4 Tacheometric Survey

Material required: Theodolite with tripod and levelling-staff

Summary: With the aid of the theodolite and the staff, horizontal distances and differences in elevation between the theodolite-station and the staff-points are determined, independent of the uneveness of the ground between the points.

Sketch in plan:



Description:

1. Set the theodolite on point A, measure the height of instrument.
2. Bring the 0°-reading of the horizontal-circle in coincidence with the bridge axis (Direct the telescope towards point B with the horizontal-circle clamped in 0°-position).
3. After proper alignement take for every staff-point the readings of the horizontal circle, the vertical circle, the top hair, the middle hair, the bottom hair and note it down
4. The staff should be placed at well-defined points in order to describe the shape of the ground as accurately as possible.
   e.g. changes in the gradient, in the slope, other breaks in the ground; details such as houses, big stones, trees, foot-trail, rock, river-bank, high-flood level, pegs B,C,D, B.M. etc.
5. Using the tables "TACA" calculate the horizontal and vertical distances. Also pocket calculators and ordinary tables for the trigonometrical values can be used.)

Note: - The staff must be kept in a vertical position. A slight inclination from the vertical will result in a large error in the calculated distances!

- In the calculations the horizontal distances are rounded off to ± 0.10 m and the differences in elevations to ± 0.05 m .

Tacheometric Survey with Theodolite Kern K 1 - RA

This survey can be done in the same way as shown on page IV/41. There are only some differences in the reading and calculations. With this instrument you will get directly the horizontal distance. No more calculation for that is necessary. You can also get directly the difference in elevation ΔH. This difference you can also get by the calculation $\Delta H = D \cdot \tan$. When the slope of the line of sight is small, this method yields better results than direct reading on the rod.

TACHYMETRIC SURVEY with KERN K 1-RA

BRIDGE NR.

JOB: _____ DATE: _____

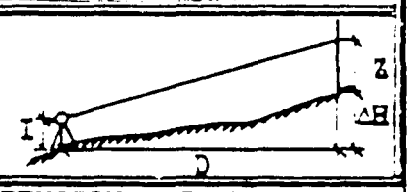
INSTR.MAN: _____ NOTE-KEEPER: _____

STATION / TARGET	HORIZ. CIRCLE g	HORIZ. CIRCLE c	VERTIC CIRCLE ± tang	HORIZ DIST. D m	HEIGHT: INSTR. I / SIGHTED Z m	DIFF. IN ELEV. ΔH ± m	ELE-VATION m	REMARKS
PEG					1.50		100.00	
1	170	6553	+0.2047	15.60	1.50	+ 3.19	103.19	Bridge Axis

DIFFERENCE IN ELEVATION:

Selector ring on ΔH: I = Z: ΔH = Reading
I ≠ Z: ΔH = Reading + I - Z

With vertic. angle : ΔH = D·tang + I - Z



HMG NEPAL, ROADS DEPARTMENT — SUSPENSION BRIDGE DIVISION

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e.g. Horizontal circle 170.6530

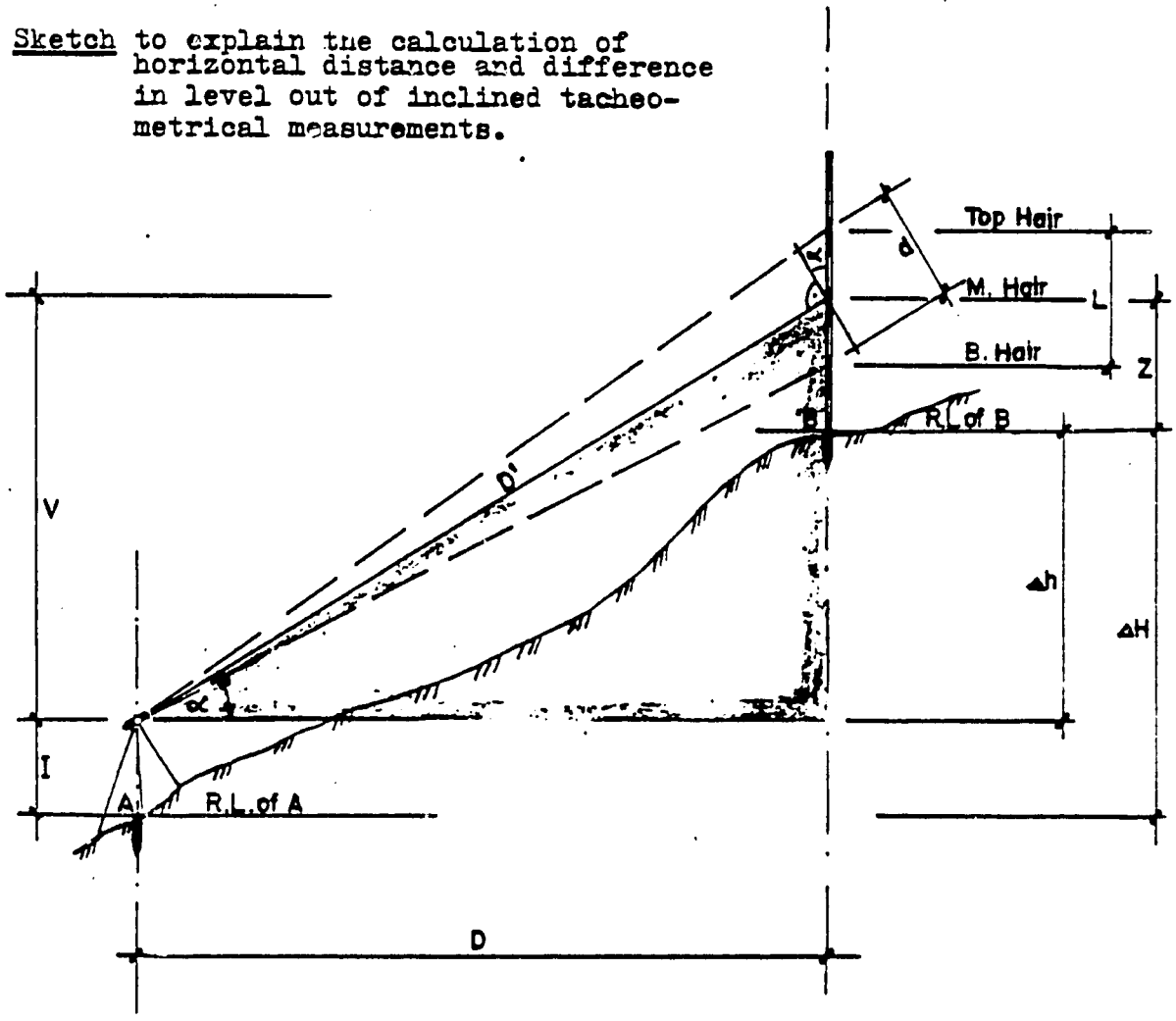
Vertical circle (tang) -0.2047

Distance (direct reading) 15.60 m

Difference in elevation 0.2047 x 15.60 = 3.19 m

or direct reading

Sketch to explain the calculation of horizontal distance and difference in level out of inclined tacheometrical measurements.



Instrument station A — Staff station B

Readings: L_1 = Top Hair; Z = Middle Hair; L_2 = Bottom Hair

α = Vertical angle; I = Height of instrument

Calculation: $L = L_1 - L_2$

$d = L \times \cos\alpha$

$D' = 100 \times d = 100 \times L \times \cos\alpha$

$D = D' \times \cos\alpha = \underline{100 \times L \times \cos^2\alpha}$

$V = D \times \sin\alpha = \underline{100 \times L \times \sin\alpha \times \cos\alpha}$

or $\frac{V}{D} = \tan\alpha$, $V = D \times \tan\alpha$

$\Delta h = V - Z$

$\Delta H = \Delta h + I = V + I - Z$

R.L. of B = R.L. of A + ΔH

IV/5 "Step method" for profile measurements, Distance measurement

A. "Step Method" for Profile Measurements

Material required: Levelling-staff (4.00 m), Carpenter's level (spirit level), Steel-tape (2.00 to 3.00 m).

Summary: After the measurement of distances and differences in elevation between the pegs A,B, 1,2,3,... ,the profile between these pegs is measured in "steps". The levelling-staff will be the horizontal line and the steel-tape the vertical line of such a step. The staff is kept horizontal with the aid of the carpenter's-level, the steel-tape vertical with a plumb bob.

Description

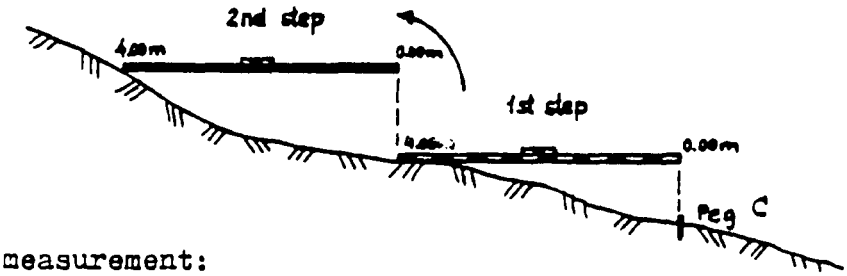
The measurement starts from a peg.
The first one or two steps should be measured from this peg uphill and then only downhill.

Four persons are needed; one to watch the bubble and, together with a second one, to keep the staff in horizontal position, a third one to read and measure horizontal and vertical distances and the fourth one to note down the measurements.
The carpenter's-level must be attached to the levelling-staff.

Uphill measurement:

- Move the staff (0.00 m - end in the air, 4.00 m - end on the ground) uphill until the zero-end is directly above peg C.
- For the next step the staff must again be moved uphill until the zero-end is now directly above the point touched by the 4.00 m-end of the first step, and so on.

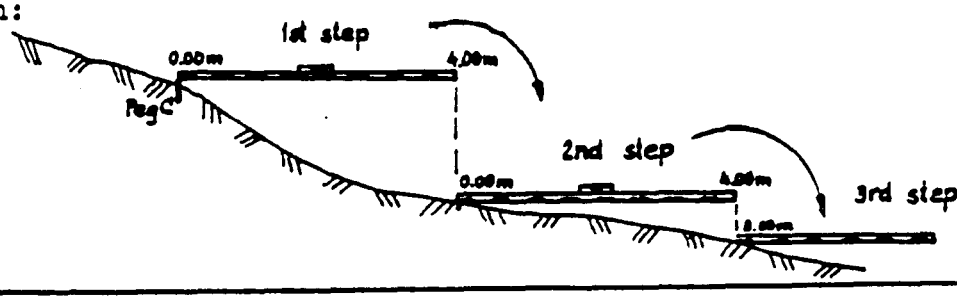
Sketch:



Downhill measurement:

- Set the zero-end of the staff on the peg (4.00 m - end in the air) and mark the end of the step directly down to the ground.
- Now bring the zero-end down to this mark; the 4.00 m - end will then give the origin of the next step, and so on .

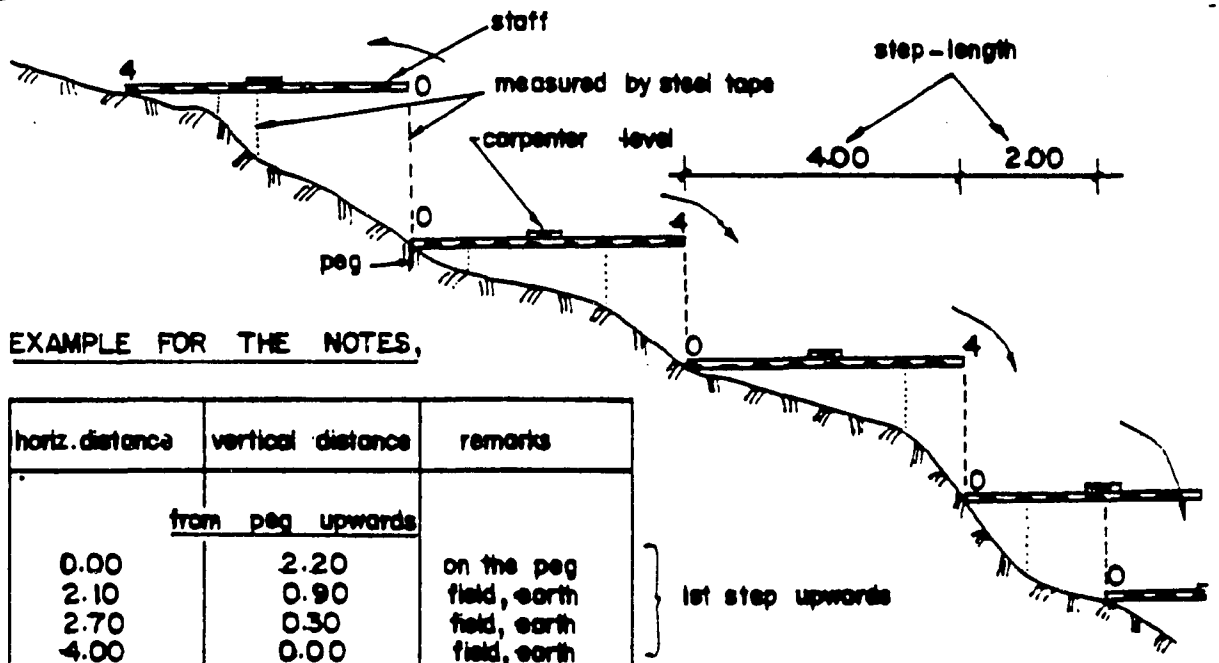
Sketch:



Detail measurements:

- In addition to the "step-heights" at the zero-end and 4.00 m - end, vertical distances are also measured at breaks in the gradient of the ground.
- For all these points the horizontal distances are read on the staff (always starting from the zero-end) and the vertical distances measured with the steel-tape.
- In steep places the "step-length" may be reduced to 3.00 m , 2.00 m or 1.50 m .

Sketch:



EXAMPLE FOR THE NOTES,

horiz. distance	vertical distance	remarks	
	from peg upwards		
0.00	2.20	on the peg	1st step upwards
2.10	0.90	field, earth	
2.70	0.30	field, earth	
4.00	0.00	field, earth	
	from peg downwards		
0.00	0.00	on the peg	1st step downwards
0.80	0.40	field earth	
2.80	0.90	field mixed	
4.00	1.80	field with	
0.00	0.00	field stones	2nd step downwards
3.10	0.90	"	
4.00	1.90	bushes, stones	
0.00	0.00	" , stones	3rd step downwards
0.90	1.10	" "	
2.00	1.40	" "	
0.00	0.00	bushes , stones	

Note: The measurements between two pegs should be checked.

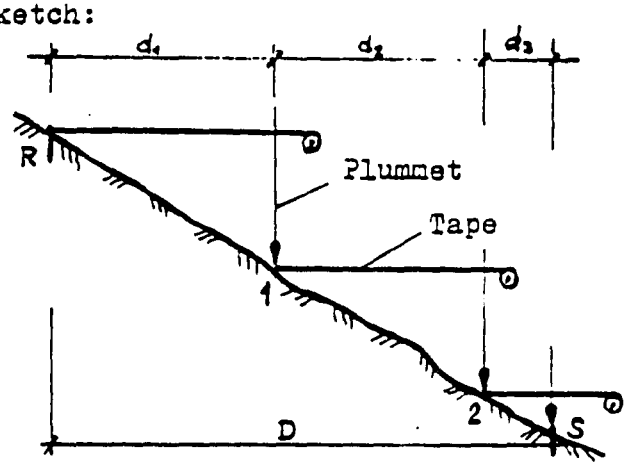
- The sum of all the step-lengths should give the horizontal distance between the pegs.
- The sum of the vertical distances at the step-ends (zero-end and 4.00 m - end) should give the difference in elevation between the pegs.

3. Measurement of Horizontal Distances on Slopes, with Measuring Tape and Plummet.

Judging by eye the tape is kept horizontal.
At least two persons are needed, one at each end of the tape.

If the difference in elevation becomes too great (more than 1.80 m) the distance should be divided into two, or more parts.

Sketch:



$D = d_1 + d_2 + d_3$

Note: The zero-end of the tape should always be on the side touching the ground.
Start measuring from the higher point towards the lower one.
For greater accuracy put a peg at every intermediate point.
(at the points 1,2 ...)

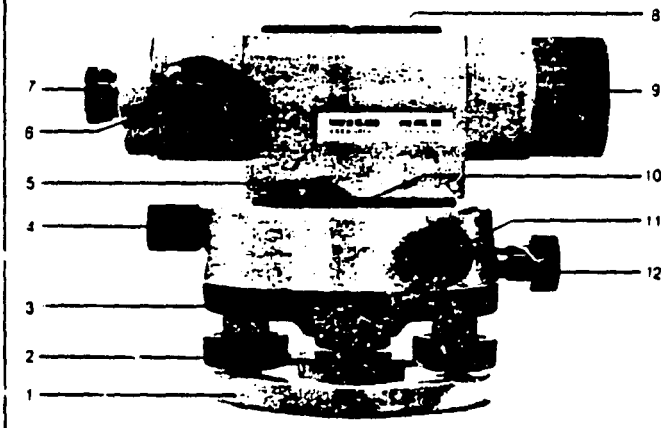


Fig. 1a Wild NK2 Engineer's Level with horizontal circle

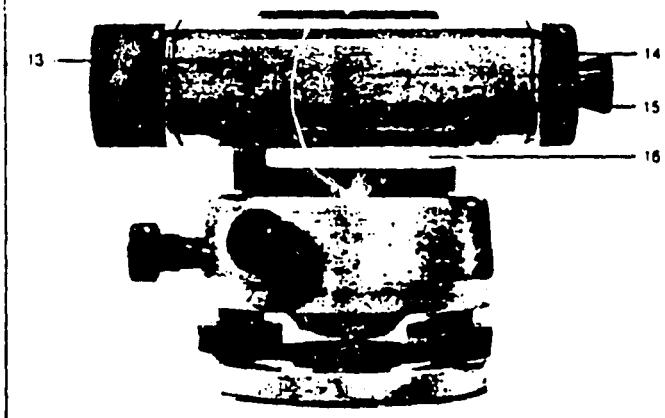


Fig. 1b Wild N2 Engineer's Level without horizontal circle

WILD N2

Engineer's Level with rotatable telescope and reversible tubular level

Figs. 1a and 1b

1 Base plate
2 Footscrew
3 Milled ring for setting the horizontal circle (only on NK2)
4 Reading microscope for circle (only on NK2)
5 Release lever for rotating the telescope and reversing the level
6 Focussing knob
7 Telescope eyepiece
8 Open sight, with notch marking instrument centre for centring under a roof point
9 Telescope objective
10 Circular level
11 Endless horizontal drive with knob at each end
12 Tilting screw

13 Protective cover for tubular level
14 Eyepiece for observing the split bubble
15 Adjusting screw for the split tubular (tubular level)
16 Fixed reflector

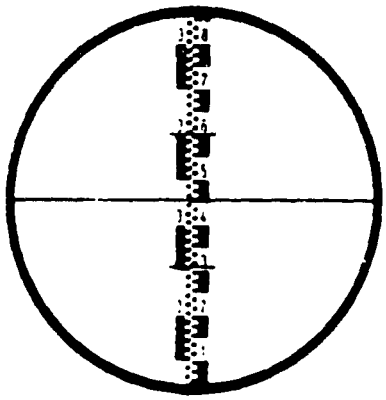


Fig. 4 Staff reading with the Wild N2 Height 3.456 m Distance 79 ...

The circle, divided into either 360 or 400 intervals, is viewed through a scale microscope (4) left of and below the telescope eyepiece. The circle graduations and the scale are brought into focus by turning the eyepiece of the reading microscope (4). The numbered degree (360° model) or grade (400° model) graduation lines of the circle are on the left of the image, the scale is on the right. The scale is divided into 6 intervals of 10' each (360° model) or 10 intervals of 10° each (400° model). The zero of the scale is the long upper line with two short index lines.

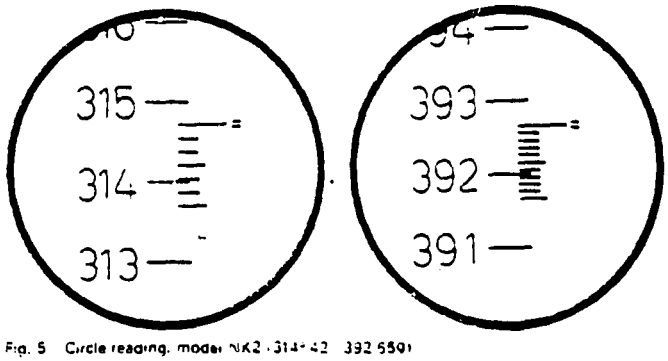
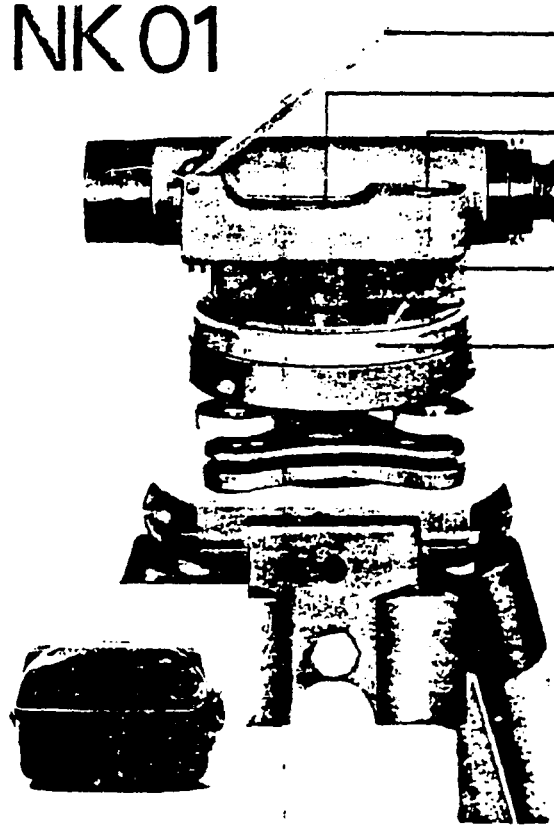


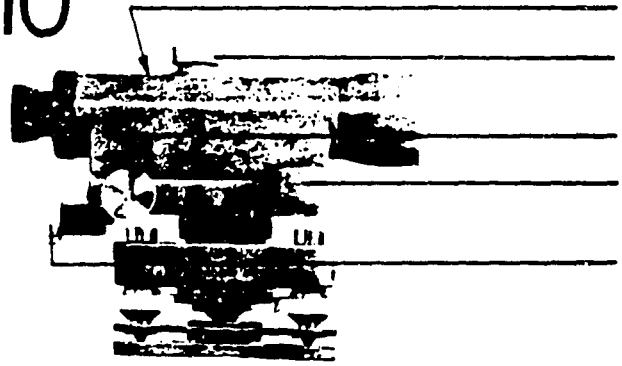
Fig. 5 Circle reading, model NK2: 314°42' 392.6591

NK01



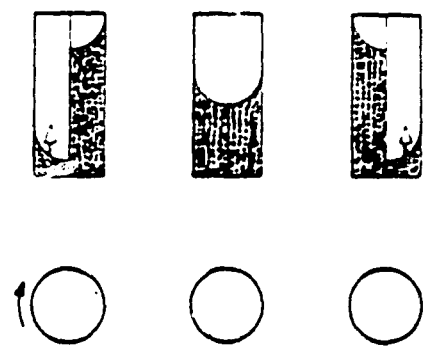
The Wild NK01 Dumpy Level is a most convenient level for the building site. The telescope rotates under a friction-braked action thus requiring no horizontal clamp. Fine pointing is completed by means of a drive screw. Readings on the metal horizontal circle are made by eye against a fixed index mark with estimation possible to a tenth of a degree or grade according to the circle division. The circle itself can be turned by hand to set any desired initial bearing. Four dots around the circle indicate rapidly the right angle settings. The circular and tubular level bubbles are seen free from parallax in the hinged observation mirror which when closed protects the glass vials.

N10



The Wild N10 (NK10) Engineers' Level is small in size but big in performance. It has all the qualities of a larger level and gives accurate results under all conditions. It is suitable for general levelling, route surveys, irrigation works, civil and constructional engineering. When fitted with a glass circle (NK10) it can be used in flat terrain for tacheometric work and for measuring and setting out horizontal angles. Rotation is friction-braked and an endless drive screw is used for fine pointing. The line of sight is levelled with the aid of a tilting screw and the well known Wild "split-bubble" image system. The tubular level is ventilated in order to avoid excessive accumulation of internal heat and it is also well protected against damage. The N10 has an extremely short minimum focussing distance of 1 m (3.3 ft.), which is most useful in restricted spaces.

Containers. The smaller instruments (NK01, N10 and NK10) have a shock-proof plastic container which is exceptionally strong and long lasting, although very light and easy to handle. The lid of the container can be used to protect the instrument at the working site.



"Split-Bubble" – Image of the tubular level bubble

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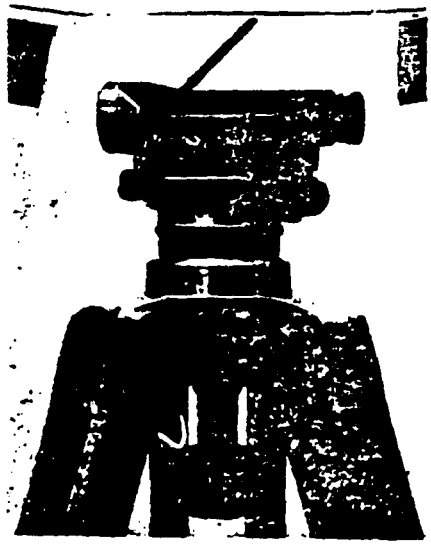
Kern GK0
Simple Construction Level



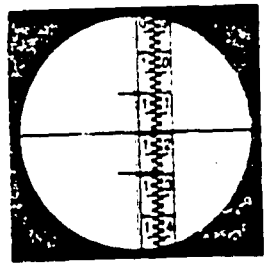
The operation of the GK0 is extremely simple and, therefore, no special skill is required to use it. This manual shows how reliable results may be obtained in the simplest way

Measuring

Height

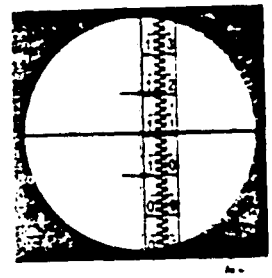
- Open the bubble mirror (6)
- Center the vertical hair on the rod using the horizontal slow-motion screw (7)
- Use the tilting screw (8) to center the telescope bubble

- Take the reading of the horizontal haw on the rod: 1.195 m (Fig. GK0)



Distance

- Set the upper stadia hair (the lower stadia hair in the case of the GK0-E) on the nearest decimeter using the tilting screw (8)
- Read the rod intercept between the two stadia hairs
- Multiply the rod intercept by 100 to obtain the horizontal distance: 20.5 m (Fig. GK0-E)

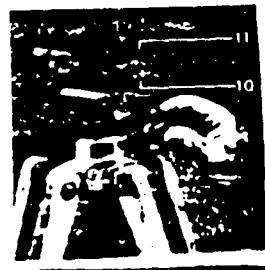


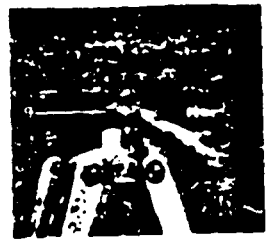
Specifications

Mean error in 1 km (double run)		± 0.02 ft/7 mm
Telescope magnification		18 ×
Objective aperture		0.94 in (24 mm)
Shortest focusing distance		3 ft (0.9 m)
Sensitivity of bull's-eye level		12–15' per 2 mm
Sensitivity of telescope level		40–50" per 2 mm
Centering precision, telescope level		± 4"
Circle reading, by estimation		0.1°/0.1°
Weight of instrument	GK0	1.8 lb (0.8 kg)
Weight of carrying case	GK0	1.1 lb (0.5 kg)
Dimensions of carrying case	GK0	6.7 × 3.9 × 3.9 in (17 × 10 × 10 cm)

Testing and Adjusting

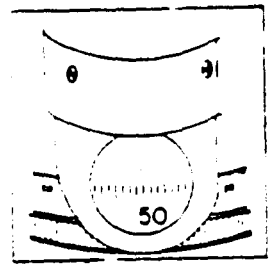
- To lower the reticule (negative correction), first loosen the lower adjusting screw (10), then tighten the upper adjusting screw (11)
- To raise the reticule (positive correction), first loosen the upper adjusting screw (11), then tighten the lower adjusting screw (10)





Angle (GK0-C, GK0-EC)

- Suspend the plumb bob (found in the carrying case) from the hook within the fastening screw (1)
- Center the instrument over the ground point by lengthening or shortening the telescoping tripod legs
- Level the instrument roughly
- Set the vertical haw on the initial point
- Orient the graduated circle, i. e., set it to zero, by turning the knurled ring (9)
- Turn the telescope to sight the second point
- Read the circle: 51.3°

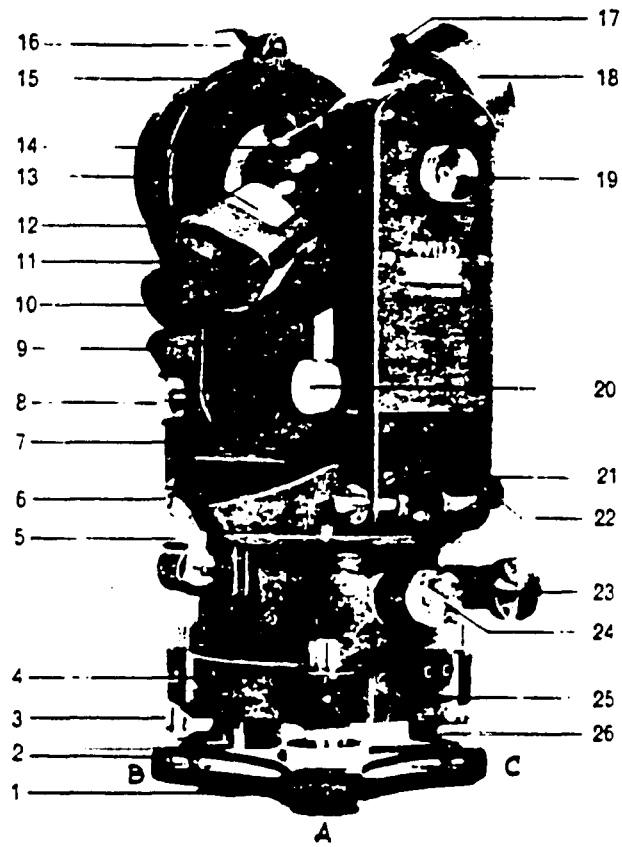


Kern & Co. Ltd.
Optical and
Mechanical Precision Instruments
5001 Aarau Switzerland

Kern SWISS

WILD T16 Direct Reading Theodolite (face left position)

1 Base plate
2 Spring plate
3 Swivel locking device for tribrach
4 Tribrach
5 Circle locking lever
6 Resting and holding bolt
7 Plate level
8 Index level setting screw
9 Illumination mirror
10 Telescope eyepiece
11 Bayonet holding ring for 10
12 Reading microscope eyepiece
13 Focussing sleeve
14 Knob for reticle illumination, with pin for rear sight and roof centring
15 Vertical circle housing
16 Index level mirror
17 Fore sight
18 Objective
19 Vertical clamp
20 Vertical drive screw
21 Adjusting screw for plate level
22 Optical plummet eyepiece
23 Horizontal drive screw
24 Horizontal clamp
25 Adjusting screw for 26
26 Footscrew

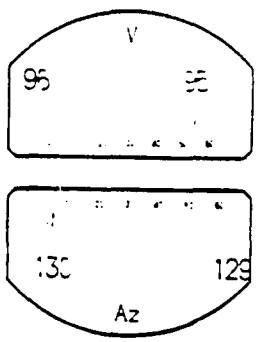


The Wild T16 (T16E) Direct Reading Theodolite is a tacheometric theodolite suitable for all low-order triangulation, tacheometric detail and traverse surveys, mine surveys, property surveys, building site measurements, marking out, etc.

The easily read scales of the horizontal and vertical circles, with estimation to one tenth of a minute of arc (0.2c), allow work to be carried out quickly. All clamps and drive screws are placed logically so that they can be manipulated safely and comfortably. The combination of the simple circle scale reading and the operation of the instrument itself makes the T16 a most useful instrument for use by trainees.

The detachable tribrach ensures that the T16 can be used with all Wild traversing equipment and, of course, the normal accessories and attachments all provide additional uses.

Example for the reading of the circles



Vertical circle 95°54.4'
Horizontal circle 130°04.6'

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Reading example 400° model horizontal or vertical circle. Graduation lines at coincidence reading 105 8224°

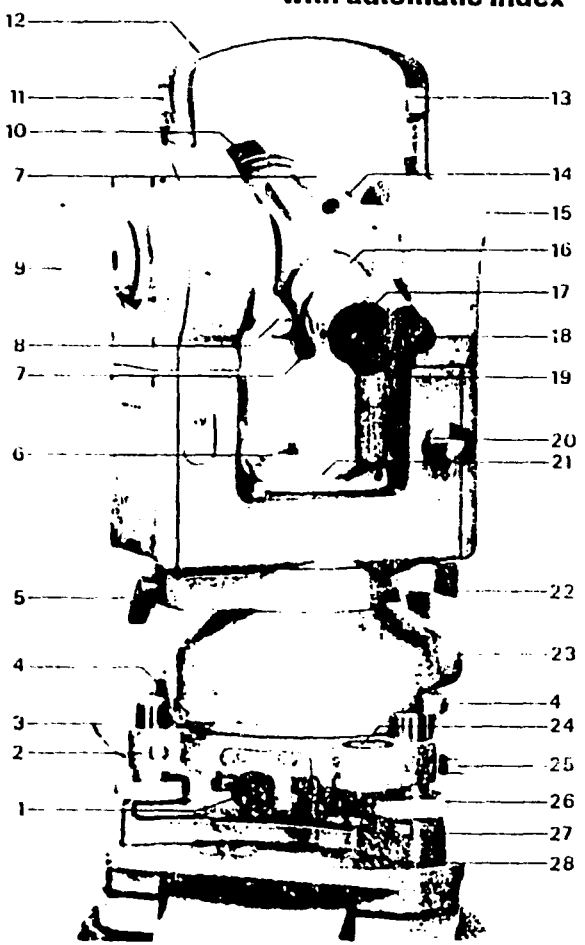
400° model
Field of view of the reading microscope before setting the graduation lines at coincidence

Wild T2 Universal Theodolite

1 Optical plummet
2 Tribrach GDF6
3 Illumination mirror for horizontal circle
4 Support point. When in container instrument rests on three support points
5 Horizontal clamp
6 Vertical drive screw
7 Optical sight with point for centring under tool points
8 Vertical clamp
9 Illumination mirror for vertical circle
10 Telescope objective
11 Safety catch for carrying handle
12 Carrying handle
13 Locking screw for carrying handle
14 Lever for field of view reticule illumination. When using electric lighting move lever towards objective until it reaches its stop
15 Micrometer knob
16 Focussing sleeve
17 Eyepiece locking lever in open position
18 Eyepiece of reading microscope
19 Telescope eyepiece with diopter scale
20 Selector knob for Hz and V reading
21 Plate level
22 Horizontal drive screw
23 Circular level
24 Circular level adjusting screws
25 Swivel locking knob
Arrow DOWN locked
Arrow UP unlocked
Knob is secured in arrow DOWN position by recessed screw when instrument leaves factory
26 Footscrew
27 Base plate
28 Spacing disc

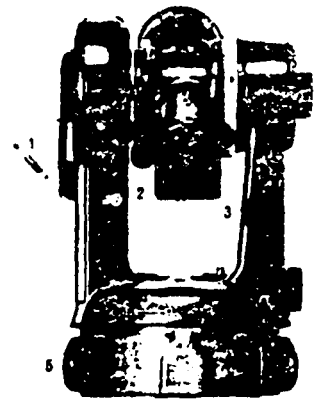
WILD T2

Universal Theodolite with automatic index



Self-reducing Engineer's Tachymeter Theodolite K1-RA

1 Illuminating mirror
2 Circle reading eyepiece
3 Vertical slow-motion screw
4 Coarse-fine circle orienting drive with safety cover
5 Leveling knob
6 Focusing knob
7 Selector ring for horizontal distance or difference in elevation
8 Finder-collimator
9 Switch-over knob for clockwise or counterclockwise reading on the horizontal circle
10 Terminal for electric illumination
11 Horizontal slow-motion screw
12 Micrometer knob



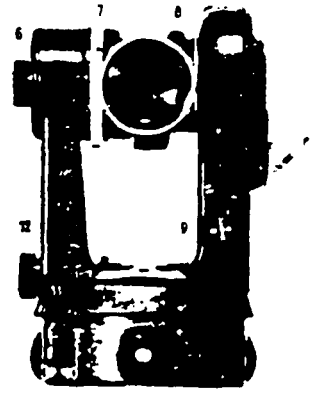
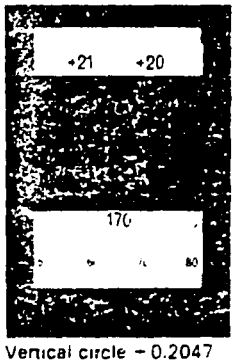


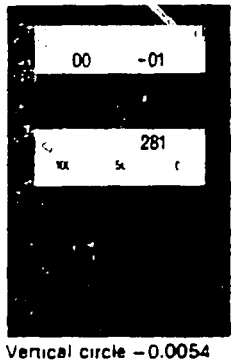
Fig. 3 Centering tripod

1 Centering socket
2 Instrument support plate
3 Tripod head
4 Release button
5 Centering rod
6 Guard ring
7 Bullseye level housing
8 Bayonet locking lever
9 Spherical zone
10 Tripod plate
11 Clamping grip
12 Centimeter scale (height of instrument above station point)
13 Bullseye level

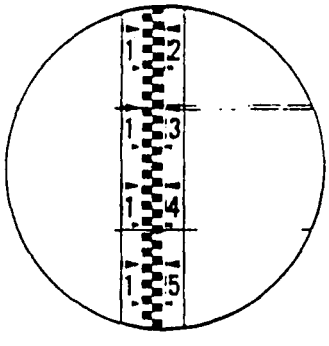
Fig. 5 Examples of circle readings



Vertical circle −0.2047
400ᵍ Horizontal circle
with micrometer. Clockwise scale 170ᵍ 65ᶜ 30ᶜᶜ



Vertical circle −0.0054
400ᵍ Horizontal circle
with scale microscope.
Counterclockwise scale 281ᵍ 22ᶜ



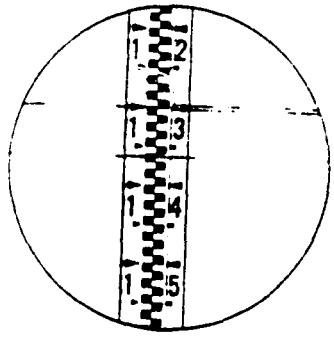
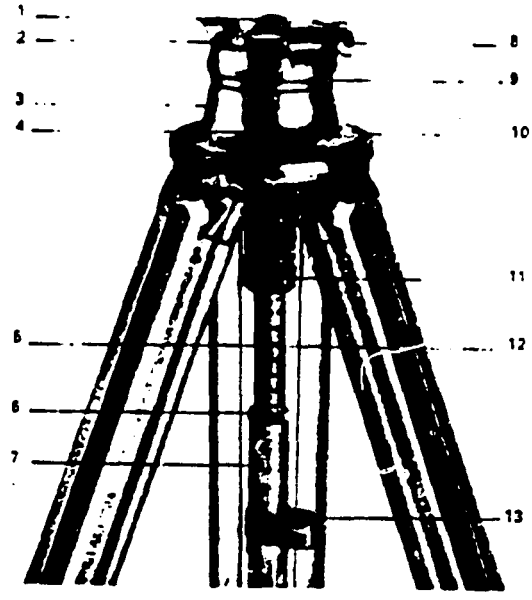


Fig. 6 Horizontal distance reading 15.6 m
Setting of selector ring D

Fig. 7 Difference in elevation reading 6.4 m
Setting of selector ring ΔH
Sighting height on rod 1.30 m



WILD T0

Compass Theodolite

3. Description

(In this booklet, face left (right) position means that the vertical circle is left (right) of the line of sight)

3.1 The Instrument

3.1.1 The Lower Part (fig. 1 at the end of the booklet)

The lower part of the instrument is firmly secured to the base plate (1) of the metal container by means of three screws inserted from below. It has the usual three footscrews (3), each of which can be regulated by an adjustment screw (4). The lower part also contains the compass circle with a jewel bearing (fig. 4). By pressing down the lever (2) and then moving it slowly left (clockwise) until it reaches the stop, the compass circle is lowered onto a sharp steel pivot and is free to rotate. Moving the lever to the right (anticlockwise) lifts the circle from the pivot and, before moving the instrument, the lever must always be raised and pushed into the small notch.

3.1.2 The Alidade (figs. 1 and 2)

The lower part of the alidade, together with the horizontal clamp (21) and drive (23), is fastened to the upper part by means of three capstan-headed screws (5) which are screwed into the circular housing from below. The upper part of the alidade has the telescope standards, the telescope and the vertical circle reading microscope (17). One of the standards holds the vertical circle housing (13), the vertical circle illumination window (fig. 2, 29), the vertical circle index lever (12), the setting screw (8) for the index lever, and the two reading eyepieces (10) for the horizontal circle. The change-over knob (9) enables readings to be made from the observer's side of the instrument in either the face left or face right position. The other standard holds the vertical clamp (15), the vertical drive (16), and the micrometer drum (19) which is graduated in one minute (1') intervals and is used for setting the horizontal circle graduations in coincidence. Between the standards there is a circular bubble (20) and two windows (6) for the illumination of the compass or horizontal circle. The telescope has 28 x magnification, coated optics and internal focusing which is controlled by the focussing sleeve (11). The telescope can be transmitted via the objective end and has a vertical sighting range of + 45° to – 55° in both face left and face right positions. The reticle (fig. 3) has two sets of stadia hairs with numerical base constants 30 and 100.

3.1.3 The Compass Circle and its Reading System (figs. 2 and 3)

Below the horizontal circle, there is a strong magnet (29), which brings the zero of the freely-swinging circle to Magnetic North, so that the subsequent horizontal circle reading is a magnetic bearing. Depending on the earth's magnetic flux the inclination of the compass circle will vary, but inclination from the horizontal can be counter-balanced by moving the balance weights (31) along their slots. For adjustment see 6.2.3. To eliminate the influence of eccentricity, as the circle swings on a pivot instead of being rigidly centred, it is read at two diametrically opposed positions. As in a precision theodolite (T2 or T3), the images of the diametrically opposed graduation lines, which are observed in the eyepiece (10), are brought into coincidence by turning the micrometer drum (19). On turning the change over knob (9) for face right readings, the combined images of the diametrically opposed parts of the circle is inverted with the result that the same images is seen in face right as in face left; i.e. the circle readings are the same in both positions and do not differ by 180° as is usually the case.

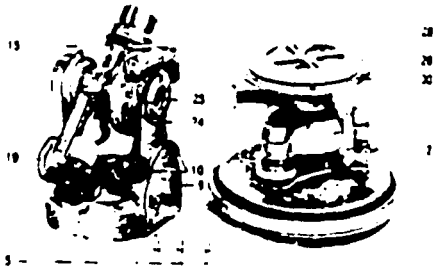


Fig. 2 T0 with the upper part of the alidade removed

2 Lever for clamping and freeing the compass circle	28 Adjustment screws for index lever
5 Fastening screws	29 Illumination window for the vertical circle
8 Changeover knob for 10	30 Compass circle
10 Reading eyepiece for compass circle	31 Bearing (jewel point) for the compass circle
15 Vertical clamp	32 Adjusting position of flange
19 Micrometer drum	

Measuring Methods

The Wild T0 allows the measurement of

- an individual magnetic bearing to each target
- sets of directions with the circle oriented to magnetic north
- angles or sets of directions with the circle not oriented.

For accurate measurements, readings should be taken in both positions, i.e. face left and face right. Note that the two readings will not differ by 180° (200g) as is the case with other theodolites (see 3.1.3).

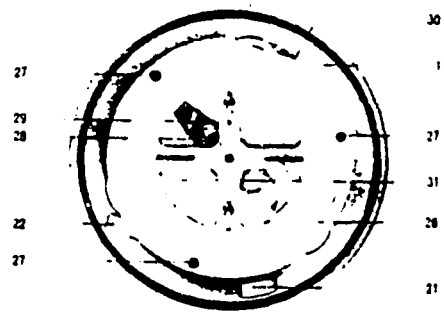


Fig. 3 The Compass Circle

1 Base plate	28 Compass housing
21 Horizontal clamp	29 Magnet
23 Horizontal drive screw	30 Adjusting position of flange
26 Compass circle	31 Balance weights
27 Capstan screw heads	

6.2.2 The Horizontal (Compass) Circle (fig. 5)

On each side of the standard carrying the vertical circle there is a reading eyepiece (10) for viewing and reading the compass circle. The change-over inverter knob (9) always allows the reading to be made from the observer's side of the instrument. The circle reading is made by reading adequate diametrically opposed lines from a distance of about 6 in (10 cm) (i.e. the distance from the telescope eyepiece). Two images are seen, corresponding to the diametrically opposite parts of the circle one being inverted and on top of the other. For accurate observation the eye level must be moved until the upper and lower graduation lines appear to be the same length. As the images cover fairly large sectors of the circle, only the lines in the centre of the field of view appear to be parallel (fig. 3) and are used for coincidence setting. The micrometer drum (19) is turned until the upper and lower lines in the centre of the field coincide. The first upright number of the lower image, to the left of the centre of the field of view, gives the tens of degrees (grades).

The inverted number of the upper image differing from this value by exactly 180° for 200g represents the corresponding diametrically-opposite graduation line and each interval between the two numbers represents 10° (10g). The intervals are counted and are added to the tens of degrees (grades). The inverted number will always be to the right of the upright one except when the circle reading is an exact number of tens of degrees (grades), in which case the two numbered graduations will coincide in the centre. If the inverted number will appear above the upright one. The reading on the micrometer drum is then taken. Direct reading to 1' (2'). The total reading, circle and micrometer, is the mean reading for the two diametrically opposite parts of the circle.

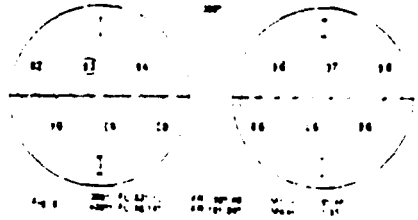
Fig. 4 Horizontal circle reading

6.2.3 The Vertical Circle (fig. 6)

Before reading the vertical circle, the index lever (12) must be centred by turning the setting drive screw (8). The field of view provides an image of the diametrically opposed parts of the circle. There is no micrometer however and consequently no coincidence setting is possible.

In the face left position, zenith angles are read and in face right nadir angles. In the upper image the numbering is upright and increases from left to right, whilst in the lower image it is inverted and increases from right to left. Each graduation image is marked with either 'FL' (face left) or face right). The upper number always represents the measured position.

To read the circle, the upright number on the upper image nearest to the middle and on the left side is taken as the number of degrees (grades). The interval between this number and the same but inverted number



In the lower image are counted each one interval in the opposite direction, i.e. an interval represents 10 (10'). As the coincidence setting has been passed there will normally be a portion of an interval to be estimated. This is done to a fraction of an interval (i.e. to 1' or 2'). FL and FR are the face left (L) and face right (R) readings, the vertical angle is obtained as follows:

$$\alpha = 90^{g} - FL + 200^{g} - FL$$
$$\alpha = FR - 300^{g} \text{ (FR} < 300^{g}\text{)}$$

or the mean of the two readings.

FR FL

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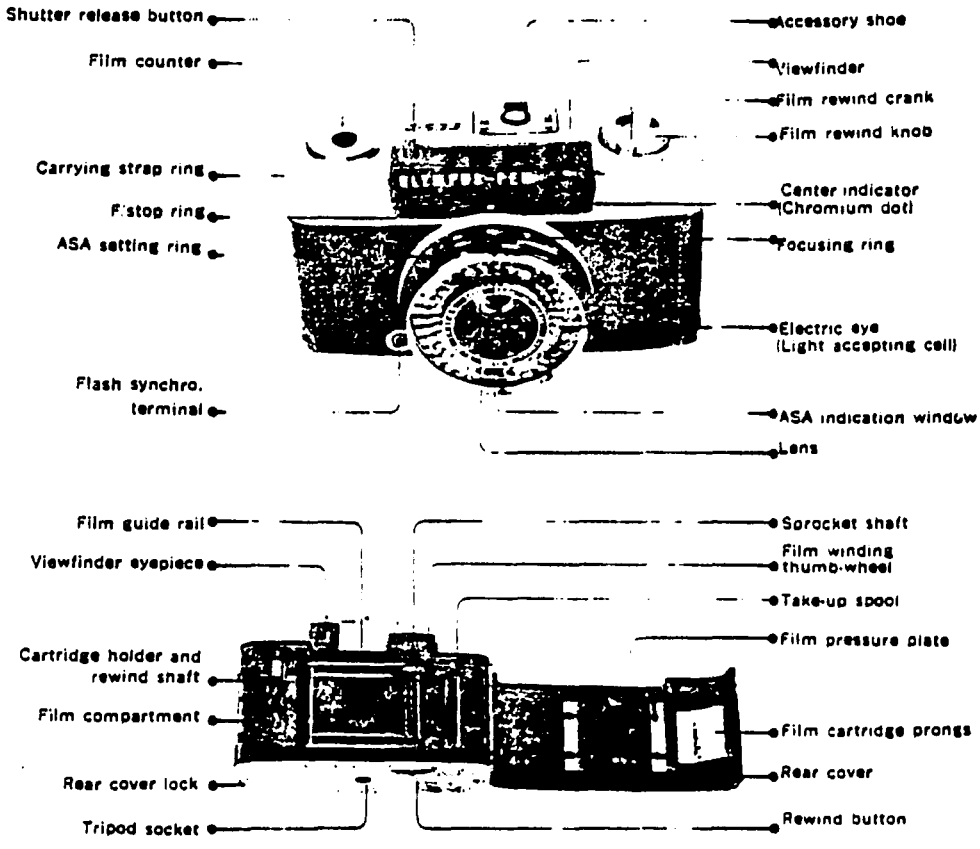
A N N E X

Part V :

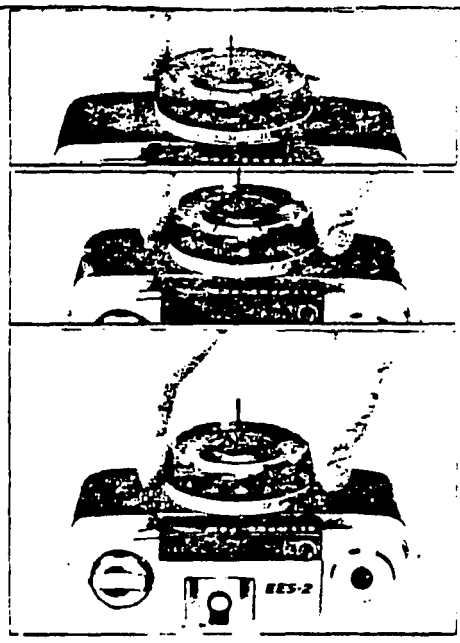
O P E R A T I O N O F T H E C A M E R A
O L Y M P U S P E N E E S - 2

V/1 Parts and Feature of the Olympus Pen EES - 2



■ Main Features

Film size: 24×18mm using regular 35mm cassette
Lens: D. Zuiko F 2.8, f=30mm (4 elements in 3 groups)
Shutter: Olympus programmed shutter
Automatic: 1/40 sec. or 1/200 sec
Manual: 1/40 sec., X synchro contact
Automatic: Shutter release button locking system for under exposure
Lens opening: Automatic. Diaphragm automatically moves from F 2.8 to F22
Manual: For flash photography from F 2.8 to F 22
Viewfinder: Luminous brightframe finder (Magnification 0.5) with parallax correction mark and red warning signal for under exposure
Film loading: Easy loading system
Film winding: Thumb winding at camera rear Self-cocking to prevent blank and double exposure
Film counter: Exposed counting, self-resetting type
Film rewinding: Crank type with self-holding rewind button
Focusing: Zone focusing lens system (4 distance symbols setting)
Exposure meter: Automatic exposure adjustment by built-in electric eye meter
Automatic exposure range: EV 9.32–EV 17.14 (ASA 100)
Film speed setting: ASA 25–ASA 400
Rear cover operation: Hinge type
Accessory shoe: Careless flash contact
Size & weight: 108(width)×66(height)×48(depth)mm, 4¼(width)×2⅝(height)×2(depth) inches, 370 gr., 13 oz.



5

Rotate the ASA setting ring until the ASA number of the film being used appears in the ASA indication window. Then turn the F.stop ring until the AUTO mark clicks and stops at the center indicator.

* Set ASA film speed to 40 for 32, when you use film with ASA rating 32.

ASA

6. **Set the distance**

The focusing ring has 4 distance symbols. Take an approximate distance between your camera and the subject, and set the appropriate distance symbol to the center indicator by rotating the focusing ring. For general picture-taking, set the group snap symbol to the center indicator, which gives you a good result.

6

Distance symbol				
Distance represented	3.3 ft 1m	5 ft 1.5m	10 ft 3m	∞
Subject	Close-up	Portrait	Group snap	Landscape

* Beyond close-up symbol ( ), the ring stops as 0.9m (3 ft) which is the closest distance setting.

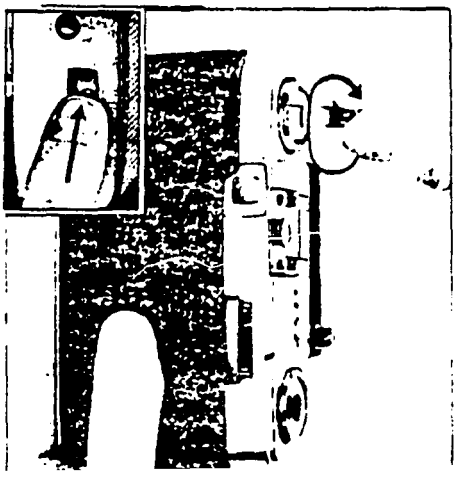
7. **Compose the picture and release the shutter**

Hold the camera firmly. Look through the viewfinder and place the subject in the center of the frame. Press the shutter release button with the flat part of the index finger, but NOT with the tip of the finger.

7

When making close-ups (close-up symbol or closer), frame the subject in the area under 2 small indices which are the parallax correction marks.

When the subject is too dim, the shutter can not be released, and a red warning signal comes up in the viewfinder. In this case, move the subject to an area that has more light, or use a flashgun.

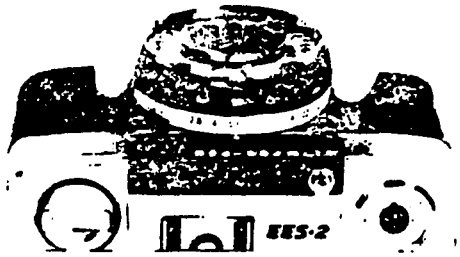


8. **Rewinding the film**

When a roll of film is completely exposed, rewind the film. DO NOT attempt to advance the film. The film is completely exposed when the red triangle of the film counter points the number 72, 40 or 24 depending upon the length of film used. Press the rewind button on the bottom of the camera body. Lift the rewind crank and turn it in the direction of arrow. The crank is tight while the film is being rewound, but when the end of the film leaves the take-up spool, the crank will become loose. Open the rear cover and pull out the film rewind knob. Then remove the film, keeping it away from direct sunlight.

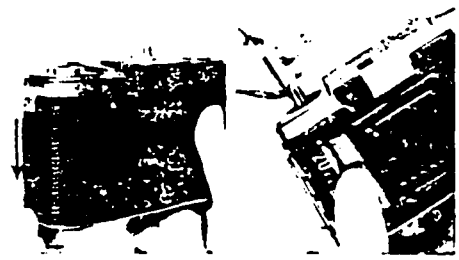
8

V/2 Camera Operation



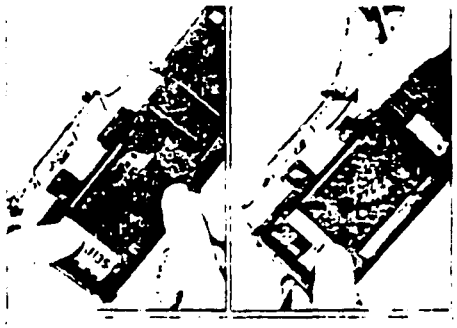
1

1. **Set the camera to manual system**
Turn the F/stop ring to move the "AUTO" mark off the center indicator. The Auto system is switched to manual system. Set any one of the F numbers to the indicator. The shutter can be released freely regardless of light condition.



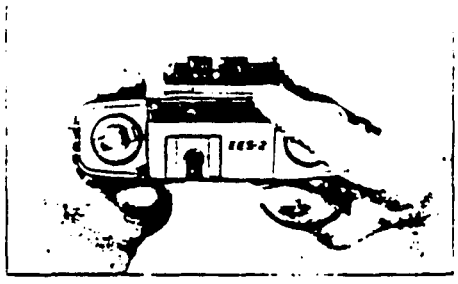
2

2. **Open the rear cover and load the camera with film**
Pull out the rear cover lock. The cover will open automatically. Then pull up the rewinding knob. Put the film cassette into the film compartment. Push the rewinding knob in. If the knob cannot be pushed in completely, turn it slightly clockwise or counterclockwise, while maintaining pressure.



3

3. **Engage the film with the take-up spool**
Hold the camera with your left hand. With the right hand, pull out the film end to such extent that it reaches the take-up spool. Insert the film end into any of the six slots on the take-up spool, keeping it away from direct sunlight. Be sure that the gear teeth on the sprocket spool engage the perforations of both sides of the film, winding the film on to the take-up spool. Close the rear cover.



4

4. **Check the film counter**
Wind the film and release the shutter button. Repeat this motion two or three more times until the red triangle of the film counter points to "1". From this point, start taking pictures. Whenever you wind the film be sure you wind it all the way. If the rewind knob turns during the repeated motion, this shows that the film is being advanced properly.

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A N N E X

Part VI :

C O N T E N T S O F T H E S U R V E Y
B O X

VI Contents of the survey b

1 Drawing board 52 x 42 cm
1 T - quare 52 cm
1 Small drawing board
1 Folder with :
  1 Manual "Bridge Survey Guidelines"
  Printed forms :
  - Survey check list
  - Triangulation
  - Tacheometric survey
  - Tacheometric survey with Kern K1 - RA
  - Soil investigation

1 knife
2 pencils
1 eraser
2 triangles
2 protractors (360° and 400 g)
2 drawing curves
1 compass
2 rolls of plastic tape
1 scale
Drawing paper for drawing board

1 Camera Olympus Pen EES - 2
2 Films
1 Geological Compass
1 Hammer
1 Chisel
15 Iron pegs Ø 13 mm, 30 cm long
1 Small trowel

1 steel tape 30 m
1 steel tape 2 or 3 m
1 spirit level for staff
1 spirit level
2 Plummets with string

1 tin with colour
1 brush
2kg of cement in plastic tin

20 plastic bags for soil samples
20 labels
1 roll of cord

1 American pig
1 box with nails
1 piece of canvas 150 x 100 cm

A N N E X

Part VII :

U N I F I E D S O I L C L A S S I F I C A T I O N C H A R T

ENGINEERING USE CHART FOR SOILS CLASSIFIED BY UNIFIED SOIL CLASSIFICATION SYSTEM *

Description		Important properties			
Typical names of soil groups	Group symbols	Permeability when compacted	Shearing strength when compacted and saturated	Compressibility when compacted and saturated	Workability as a construction material
Well-graded gravels, gravel-sand mixtures, little or no fines	GW	Pervious	Excellent	Negligible	Excellent
Poorly graded gravels, gravel-sand mixtures, little or no fines	GP	Very pervious	Good	Negligible	Good
Silty gravels, poorly graded gravel-sand-silt mixtures	GM	Semipervious to impervious	Good	Negligible	Good
Clayey gravels, poorly graded gravel-sand-clay mixtures	GC	Impervious	Good to fair	Very low	Good
Well-graded sands, gravelly sands, little or no fines	SW	Pervious	Excellent	Negligible	Excellent
Poorly graded sands, gravelly sands, little or no fines	SP	Pervious	Good	Very low	Fair
Silty sands, poorly graded sand-silt mixtures	SM	Semipervious to impervious	Good	Low	Fair
Clayey sands, poorly graded sand-clay mixtures	SC	Impervious	Good to fair	Low	Good
Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	ML	Semipervious to impervious	Fair	Medium	Fair
Inorganic clays of low to medium plasticity: gravelly, sandy, silty, and lean clays	CL	Impervious	Fair	Medium	Good to fair
Organic silts and organic silt-clays of low plasticity	OL	Semipervious to impervious	Poor	Medium	Fair
Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	Semipervious to impervious	Fair to poor	High	Poor
Inorganic clays of high plasticity, fat clays	CH	Impervious	Poor	High	Poor
Organic clays of medium to high plasticity	OH	Impervious	Poor	High	Poor
Peat and other highly organic soils	Pt				

* Bureau of Reclamation, 1953.

UNIFIED SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)						GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. (The No. 200 sieve is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4" size may be used as equivalent to the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.			GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS WITH (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below)			GC	Clayey gravels; poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size (For visual classification, the 1/4" size may be used as equivalent to the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			SW	Well graded sands, gravelly sands; little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	Poorly graded sands, gravelly sands; little or no fines
		SANDS WITH (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below)			SC	Clayey sands, poorly graded sand-clay mixtures
FINE GRAINED SOILS More than half of materials smaller than No. 200 sieve size. (The No. 200 sieve is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE		DRY STRENGHT (Crushing characteristics)	DILATANCY (Reaction to shaking)	TOUGHNESS (Consistency near plastic limit)		
	SILTS AND CLAYS Liquid limit less than 50		None to slight	Quick to slow	None	ML	Inorganic silts and very fine sand, rock flour, silty or clayey fine sands with slight plasticity
			Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays
			Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils.