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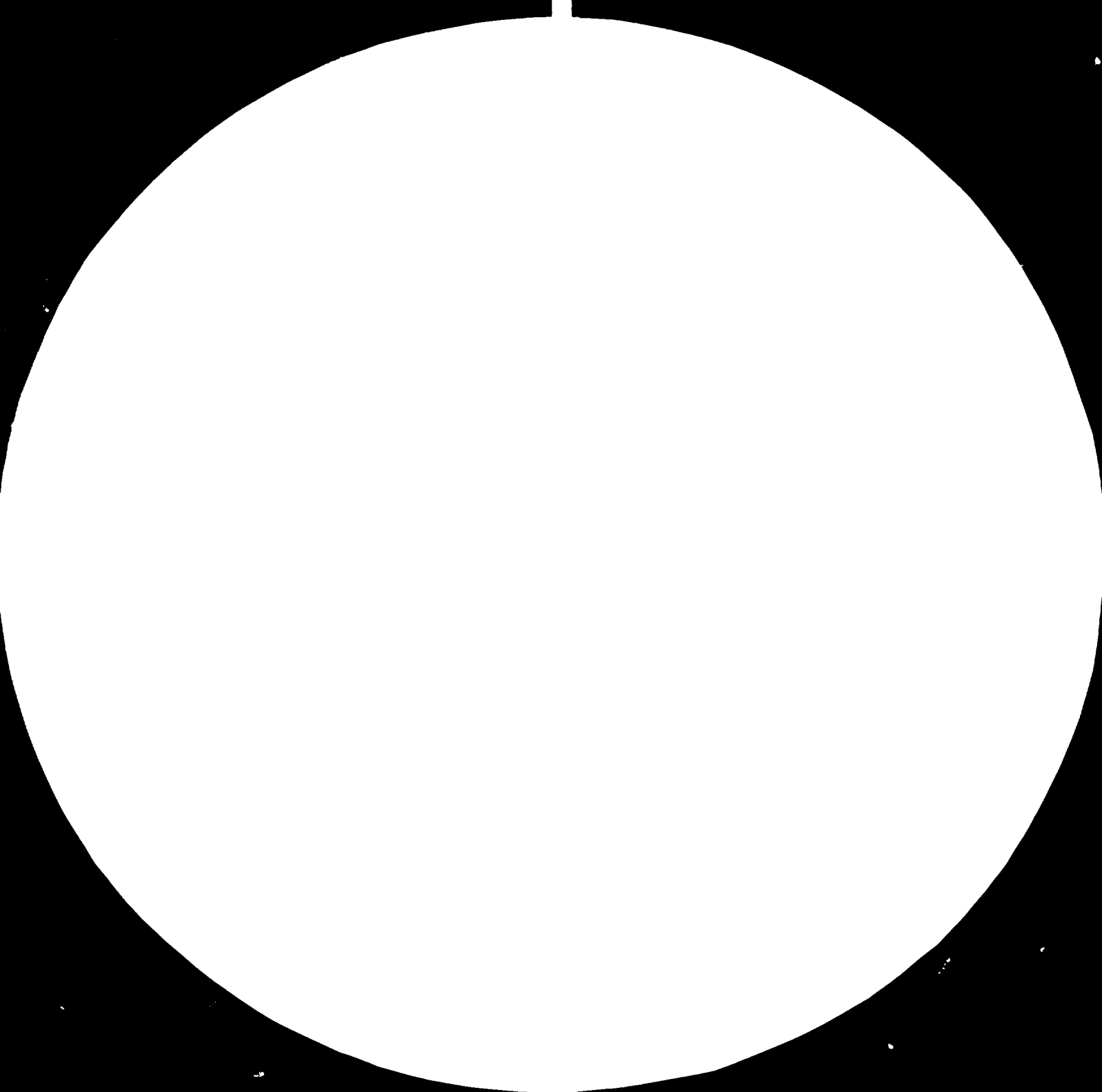
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ASSISTANCE TO RURAL DEVELOPMENT  
AND TRANSPORT  
DP/HON/81/002  
HONDURAS

Technical Report: Proposed Assistance to the Development of  
Prefabricated Modular Wooden Bridges \*

Prepared for the Government of Honduras  
by the United Nations Industrial Development Organization,  
acting as executing agency for the United Nations Development Programme

Based on the work of Robert M. Hallett  
Industrial Development Officer  
Agro Industries Branch  
Division of Industrial Operations

United Nations Industrial Development Organization  
Vienna

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## Introduction

The Government of the Republic of Honduras requested a preparatory technical assistance mission in the woodworking industry sector to prepare a project document for the development of a system for making prefabricated modular wooden bridges and to develop plans for assistance for the 1982 - 1986 planning period. It was intended that the first would form the basis for an extensive bridge-building programme whose aim would be to improve secondary and access roads for the benefit of rural development, and that the second would emphasize the use of wood in construction and the manufacture of wooden products.

These objectives were identified first by a planning mission to Vienna by Messrs. Lic Efraim Reconco, Executive Secretary of CONSUPLANE and Anton Kruidrink, UNDP Resident Representative, and elaborated by a UNIDO programming mission to Honduras in November/December 1980. In both cases, a film entitled "Short Cut Spans" which illustrates the wooden bridge concept from experience in Kenya played a key role.

As a result of this request, an Industrial Development Officer from UNIDO's Agro Industries Branch, Robert M. Hallett, undertook a mission to Tegucigalpa from 20 January to 4 February 1981. During his stay he had discussions with officials of CONSUPLANE (Consejo Superior de Planificaci6n Economica), SECOPT (Secretaria de Comunicaciones, Obras Publicas y Transporte), COHDEFOR (Corporaci6n Hondureña de Desarrollo Forestal) and ESNACIFOR (Escuela Nacional des Ciencias Forestales) and various representatives of the private sector.

Counterpart staff assigned by SECOPT to the mission were: Ing. Alex Bendeck, Supervisor from the Direccion General Obras Civiles and Ing. Michelangel Matuta Acosta, Chief, Department of Design and Structures.

Because of the urgency and importance of rural development, the terms of reference of the mission were narrowed on the advice of the Resident Representative to concentrate on drafting a practical project document for the wooden bridges and doing as much pre-project work as possible to ensure the minimum delay once the project was approved and the first expert was in the field. The mission was extended by two days by the Resident Representative who

requested a final meeting on 4 February 1981 upon his return from a one-week absence.

The list of persons met with is given in Annex I. Some references are listed in Annex II and the draft project document comprises Annex III. Equipment, tools for the workshop comprise Annex IV.

#### Discussions with officials

Because of the central evaluating and co-ordinating role of CONSUPLANE, an early meeting was held with Mr. Lic Ulises Gómez, Technical Adviser, who stressed the importance of aiding the rural areas through better transport and communication and by providing employment in small workshops such as are envisaged by this system of bridges. The costs and benefits and details were discussed together with three other senior personnel: Sr. Guillermo Bustillo, Adviser to the Director General of Infrastructure, Sr. Avencio Ochoa, Chief Engineer, Energy Department and Sr. Carlos Panameño, Chief, Transport Department.

Chief among the questions asked were probable cost and lifetime of the bridges. The Kenyan experience was related as one-quarter to three-quarters the cost of an equivalent concrete bridge and a lifetime of a least 20 years was estimated for Pitch Pine (treated), the most likely species to be used for the prototype bridges.

The consensus was one of acceptance and enthusiasm for the project. A project summary was given to Sr. Bustillo with an estimate of probable costs (Lps 410 - 777/m span) for a paper he was preparing for an international meeting on intermediate technology in June 1981 in Stockholm. It was apparent that national transport plans were to be fully re-examined and re-costed with information deriving from this project.

Discussions with the counterpart agency SECOPT were brief since they had been prime supporters of the project since the programming mission in November/December of last year and because day-to-day contact would be maintained with the designated counterparts. Aside from these, latter co-ordination of SECOPT's input were through Sr. Hector Nufio, Civil Engineer, who took part in the first meeting to decide the programme of the mission, priorities and separation of activities.

It was agreed that Mr. Bendeck would be involved in the workshop, manufacturing, costing and erection aspects of the proposed project and Mr. Matuta would be responsible for road construction plan interpretation and analysis, identification of prototype bridge sites and probable demand for bridges during 1981-1986, and cost-benefit study.

COHDEFOR was formed in January 1974 to execute the national forestry policy and to promote large scale industry. Discussions with Mr. Manuel Hernandez, Co-ordinator of External Aid, revealed considerable interest in the project and co-operation was offered, depending upon formal approval and contact in due course. The Engineering Office in the Forest Department is responsible for road construction and forest camps and so would be the logical contact on a working level. Possible workshop sites were identified as the Forest Camp at Jutiapa (5 Km ssw of Salama), La Union (Carta Forest Camp) and Guaimaca Forest Camp near Talanga. The main road construction camp is Carta F.C. and would therefore be the likely first choice in the region. COHDEFOR should be approached formally for the supply of materials for a demonstration bridge within their plan. CORFINO (part of COHDEFOR) the large industrial forestry project in Olancho was mentioned as a potentially important user. The Forestry School at Siguatepeque was suggested for similar possibilities - a demonstration bridge, workshop site and training. It was suggested that FAO could also arrange a short course for demonstration workshop staff in basic wood technology - drying, storage, preservation. ESNACIFOR - the National School for Forestry Sciences, in Siguatepeque offers a fair range of basic courses to 300 students over three years. The Director, Sr. Froylan Casteñeda, would provide a short basic course to workshop staff as determined by expert but probably timber drying, handling, grading and preservation. He would welcome a demonstration bridge, a workshop located in or near school grounds as a teaching aid and offered all support possible to the project. The school is starting an Industrial Forestry Course aimed at practical commercial work and this could include more timber engineering than the current basic work.

#### Discussions with other Agencies

The project is intended to make rational use of Honduras' forest resources and discussions with FAO project officials were useful in appraising



timber supplies and sawmill capacities. Mr. Jan Troensegaard provided valuable information on the projects HON/75/004 and HON/78/005 plus plans for the third phase planned for 1981 onwards. The FAO project is restricted to Pines with emphasis on instituting sound management policies and productive plantations.

A four year plan for the Central Area - Plan Comayagua - funded by the Inter-American Development Bank is a prime example. Information on production estimates was provided from Technical Note BOS-17, April 1980 "Pautos Para Le Ordenacion Forestal en Honduras". Investment possibilities in the forest sector as seen by FAO were also indentified with several being in the secondary conversion, woodworking industry field - often as a part of an integrated complex. Examples are expansion of the CASISA Mill at Siguatepeque to make prefabricated housing components; an integrated plant for mouldings, toys and handles at Talanga; mouldings for export with market research in the United States with plans for small central plants to dry and process; wire-bound boxes and pallets. (See internal report dated 16 January 1981 "Investment Possibilities in the Forest Sector of Honduras"). Discussions should be held with UNIDO concerning the implementation.

The broad leaved species are the domain of CIDA who are concentrating on inventory work on the North Coastal area and the Northeast and on identifying industrial possibilities near Coracito Overall plans are to improve the roads from the Guayapa River area where large volumes of pine are available, through northern Olancho where hardwoods dominate, to the improved port of Puerto Castilla for export.

A fairly comprehensive study of hardwood species availability/occurrence and characteristics has been made and reported in "Properties and Utilization of Principal Species in Project Area" November 1978, Working Paper No. 3, Project No.: 448 - 00505, Programme Forestal CIDA/COHDEFOR, a copy of which was provided to the mission by Mr. John Roper, CIDA Adviser.

Sawmill capacity is normally 5 - 10,000 m<sup>3</sup>/year logs with only a few sawing hardwoods. Two large COHDEFOR mills exist at Siguatepeque and Fiafsa (Yoro District), both 100,000 m<sup>3</sup>/year. Another large mill is at Juticalpa with a similar capacity and also having a brand-mill system. Most others use circular saws. Only two mills have treatment facilities - one in Bufalo, near San Pedro Sula and the other near Talanga (Tegucigalpa area).

### Discussions with private sector

The sawmill nearest to Tegucigalpa with pressure impregnation facilities and dry kilns in Aserredero Lardizabal (31 Km from Tegucigalpa). Discussions with Mr. Fernando Lardizabal clarified that supply of treated Pitch Pine (Pinus elliottii and Pinus palustris) would be no problem in the sizes mentioned; delivery would be about 30 days up to the rainy season of May and the cost about Lemp. 0.60/bd. ft. or US\$ 135 - 140/m<sup>3</sup>. A 9 m - 2 truss bridge uses 6 m<sup>3</sup> and a 30 m - 8 truss bridge about 35 m<sup>3</sup> of timber i.e. from US\$ 840 to US\$ 4,900 per bridge.

One of the largest wood processing groups is PECAS which comprises four sawmills in Olancho, Maderas Preciosos in Tegucigalpa and Derinas (Derivados de Madera S.A.) about 20 Km. south of Tegucigalpa. They are owned by an American importer/assembler in New Orleans which is served by Ro-Ro Container Service every two to three weeks via Puerto Cortes. They saw/process Pitch Pine plus Laurel, Santa Maria, Guanacaste, Oak (Roble), San Juan, Barbe de Jolote and some others into profiles and furniture components. They could cut other constructional timbers to order if contracted. Oak would be Lps 0.85/bf or US\$ 425/mbf. Mr. Freddy Gothe is mill manager and Messrs. Dickmann and Berberich are in charge of sawmills via Maderas Preciosos in Tegucigalpa.

It was remarked that the main problem facing the smaller sawmills (hardwood) was COHDEFOR's policy of increasing stampage rates. This would apparently push six mills out of business this year if carried out. It was apparent too that a regular demand of several hundred cubic metres per year of constructional timbers would help the hardwood sawmill sector.

### Project Development

#### A. Scope

It became clear early on that the Government intended to make fullest possible use of these bridges once proved cost effective. Plans were set in motion during the mission to compile possible bridge sites for new bridges which had financing approved, for replacement of poor standard wooden bridges needing continual maintenance, for replacement of Bailey Bridges to free

them for their intended emergency role, and for COHDEFOR for their access road construction programme.

In order to prepare fully for an extended programme it was agreed that the first workshop should be in Tegucigalpa where facilities already existed for staffing, supervision, security of site and proximity to material sources. This was to be clearly distinguished from the planned rural workshops which would eventually take over the major production role leaving the central one for administration, co-ordination and promotion.

#### B. Workshop sites

In Tegucigalpa, discussions with the Maintenance Directorate of SECOPT revealed a most suitable site - adjacent to the airport within the grounds of the No. 1 District Maintenance Depot (the Chief is Sr. Marco Tulio Canales).

Two wooden, semi-walled sheds 6m x 25m already exist and could be improved and modified at minimum cost. The ground is flat and dry. The whole area is fenced and security staff are there full time. Workshop staff could easily be recruited or transferred within the SECOPT structure and commuting and transport is easy. Raw materials are within close range and bridge sites exist within the region.

With this organization, a firm base can be established for the network of rural workshops.

#### C. Materials

Contacts with Aserredero Lardizabal, the sawmill with kiln and treatment facilities near Talanga, determined that treated pine would be available with no particular problems. A provisional cutting list was drawn up during the mission so that as soon as the project document was signed, the counterparts could order the timber for at least 30m of bridge modules - 80 panels making 8 trusses of 10 each.

Steel availability was checked by Mr. Bendeck and with a few minor exceptions all is available. Some design modifications may be necessary to save labourious cutting from standard dimensioned steel plate i.e. double thickness - one-half width for chords.

D. Design and Specifications

It will be important to determine appropriate preservation methods so that as much work as possible may be done at the workshops rather than having to rely on outside sources for pressure treated timber. It may be that a shorter lifetime for a rural 2 - truss bridge for light loads is preferable if it means that a small local sawmill can supply sawn wood for treatment at that workshop. Density and therefore strength variations for pine must be checked carefully - possibly with assistance from a suitable laboratory.

Road standards are first, second, third and access - a copy of directions was given to the mission. Reference to bridges is only in the American loading designs. No problem would be encountered with these bridges for secondary and lower roads.

Another design modification or addition would be for one-metre infill panels so that lengths between the three-metre modules could be built, say 10, 11, 13 and 14 m since many existing bridges needing replacement are short and wider than 3.8 m. Two-lane bridges are also needed and the question of asphalt covering should be considered as well as post-tensioning, but these may not be able to be designed within the project scope and budget.

E. Costs

Information was obtained on the costs of alternative bridge constructions and comparisons with estimates prepared during the mission for the wooden system, show that the Kenyan experience is fully borne out - one quarter to one third the cost of concrete. The Director General of Maintenance estimates for two concrete bridges are the following:

	<u>Bridge 1</u>	<u>Bridge 2</u>
Span	7.0 m	8.35 m
Width	6.0 m	6.0 m
Concrete approx. L 350/m <sup>3</sup>	L 6,615	7,938
Reinforcing steel approx. L 2.5/Kg	6,050	8,413
Other materials	537	633
Total Cost	L 13,192	16,984
Cost per metre span	L 1,885/m	2,034/m

Estimates for the wooden bridges are from Lemp. 410 - 777/m and work out in the following way:

	<u>Bridge 1</u>	<u>Bridge 2</u>
Span	9.0 m	20.0 m
Width	3.8 m	3.8 m
Timber	L 1,555	9,000
Steel	750	9,000
Manufacture, erection consumables, depreciation	1,020	3,180
Sub Total	<u>3,325</u>	<u>21,180</u>
Overhead 10 per cent	375	2,120
Total	L 3,700	23,300
Cost per metre span	<u>410/m</u>	<u>777/m</u>

Bridge No. 1 represents the shortest practical span with only 2 trusses but still able to carry the full HS 20 load of 40 tons while bridge No. 2 is the largest normally erected - 8 trusses and 30 m span.

One possible bridge site has a budget approved of L 250,000 for a two-lane, 30 m span. Two one-lane wooden bridges could be erected for L 50,000 plus an estimated L 50,000 for abutments (which would be much lighter than for concrete) for a savings of L 150,000.

Final tenders were shown to the mission for a bridge to HS 15 standard two-lane, 8.0 m long. The equivalent cost, for the super-structure only was Lps 28,567 or Lps 3571/m. Additional costs were:

Excavations	Lps 2,340 - approx. L 15/m <sup>3</sup> of fill
Abutments	Lps 23,400 p - approx. L 150/m <sup>3</sup> of masonry

(Reinforcing steel contributed Lps 13,085 - approx. 2.45/kg to the super-structure cost).

#### Staffing of Workshop

The six or seven should be recruited from existing SECOPT employees and may include one or two from COHDEFOR. It would be useful in preparing for other workshops if all could be at the supervisory level so that, once

trained in all aspects of manufacture and erection, they could pass on their experience in the regional workshops.

#### Tools and Equipment for Workshop

Provisional lists and estimated costs are attached as Annex IV.

#### Role of the Film "Short Cut Span"

The film, which shows very clearly an old poor quality bridge, a modular bridge with a heavily loaded truck crossing and all aspects of manufacture, assembly and erection, played a major part in promoting this project. It was convincing at the Ministerial level and invaluable in affording fast, efficient communication of the concept at the working and planning level.

During the mission it was shown three times: 1) at SECOPT - Direccion Generale de Obras Civiles to Mr. Bendeck and 24 engineering students and graduates attached to this Ministry working on road design, structures and civil works 2) to CONSUPLANE - for those who had not seen it during the Bancroft Programming Mission and those who represented other Departments and foreign aid bodies. A total of 37 persons attended from the planning department, and finally 3) at CHODEFOR - through the office of the Co-ordinator of External Aid to 38 engineers, planners and representatives of aid programmes. It was informally agreed that CHODEFOR's engineering office would prepare a list of all bridges planned, help with selecting sites and consider replacing one with a wooden bridge as a demonstration. Their considerable staff and equipment would be available to help the project. A film could be made of Honduran project to aid training in the country, although this would be beyond the scope of the project.

#### Other Possible Assistance to the Wood Sector

Continuation of the bridge project HON/81/002 should be considered in the form of assistance in modifying still further the designs and extending applications of the basic system (see also Project Document) and in planning and co-ordinating the extensive use of these bridges. A subsection of the Division Gen. des Caminas will deal with this and could be strengthened in this way.

Assistance to extend the workshops to cater for making simple sheds and storage buildings with portal frames of constructional timbers, especially the lesser-known hardwoods would be a logical choice.

Several investment opportunities identified by FAO should be considered for implementation by UNIDO and the basic premises re-evaluated. The aims of the Government to promote rural development may not be realized to the fullest by erecting large complexes to the exclusion of aid to the private sector - namely small and medium workshops/factories for adding value to timber. Supply of appropriate species still seems to be a problem for the smaller plants.

ANNEX I.

List of Persons Encountered

CONSULPLANE	Lic Ulises Gomez, Technical Adviser Lic Norma de Sierra Ing. Guillerma Bustillo, Adviser to Dir. Gen. of Infrastructure Ing. Carlos Panameño, Chief, Transport Department Ing. Avencio Ochoa, Chief Engineer, Energy Department
SECOPT	Ing. Hector Nufio Sr. Ibrahim Molina, Chief, Department of Equipment and Maintenance Sr. Marco Tulio Canales, Chief, Manitenance District Number 1 * Sr. Miguel R. Barahona, Chief, Section of Plannifi- cacion y Programme * Ing. Waldo Ramirez, Chief, Department of Technical Studies *
COHDEFOR	Ing. Manuel Hernández Paz, Co-ordinator of External Aid Ing. Juan _____, Chief, Engineering Office
FAO	Mr. Jan Troensegaard Mr. Glenn Forrester
CIDA	Mr. John Roper, Adviser
CORFINO	Mr. Ben Gibson
<u>PRIVATE SECTOR</u>	
Aserradero Lardizabal	Mr. Ferdinand Lardizabal
Maderos Preciosos	Mr. Ramon Martinez
Derivados de Madera S.A.	Mr. Fred Gothe

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\* Indicates Dir. Gen de Mantenimiento de Caminas y Aeropuertos



ANNEX II.

REFERENCE DOCUMENTS

World Bank: Staff Appraisal Report Eighth Highway Project, Honduras, Report Number 2971 b - Ho. August 6, 1980.

CONSUPLANE: Plan Nacional de Transporte 1979-1983.

CONSUPLANE: Programme de Accion Immediate "Jose Cecilio del Valle" 1981-82, Tomo II Parte IV. Decemoer 1980.

Comisión de Política Agrícola: Propuesta Proyecto de Tecnologías Rurales, Presentado por El Grupo de Trabajo del Gobierno de Honduras. 7 June 1979.

CIDA/COHDEFOR: "Properties and Utilization of Principal Species in Project Area", Working Paper Number 3, Project Number 448 - 00505. November 1978  
Programma Forestal

ANNEX III.

UNITED NATIONS DEVELOPMENT PROGRAMME

PROJECT OF THE GOVERNMENT OF THE REPUBLIC OF HONDURAS

DRAFT PROJECT DOCUMENT

TITLE: DEVELOPMENT OF PREFABRICATED MODULAR WOODEN BRIDGES

REFERENCE NO.: HON/81/002/A/01/37

Duration: 7 months

Primary Function: Direct Support

Secondary Function:

Sector (Government class.)  
(UNDP)

Subsector (Government class.)  
(UNDP)

Government Implementing Agency: Ministry of Communications, Public Works  
and Transport Department

Executing Agency: UNIDO

Estimated Starting Date: April 1981

Government Inputs: (in kind)

UNDP Inputs: US\$ 60,000

Signed:

\_\_\_\_\_  
On behalf of the Government Date

\_\_\_\_\_  
On behalf of National Executing Agency Date

\_\_\_\_\_  
On behalf of International Execut. Agency Date

\_\_\_\_\_  
On behalf of the UNDP Date

PART I. LEGAL CONTEXT WITH TERMS OF REFERENCE

This Project Document shall be the instrument referred to in Article 1, paragraph 1, of the Assistance Agreement between the Government of Honduras and the United Nations Development Programme, signed by the Parties on

The Government Implementing Agency shall, for the purpose of the Standard Basic Agreement, refer to the Government Co-operating Agency described in that Agreement.

PART II. THE PROJECT

A. Development Objectives:

The long term objectives of the project are to:

- 1) Assist the Government in improving the national road network with emphasis on rural development and secondary, access roads, by developing a modular bridge system using locally available material (timber) and simple skills and equipment and producing bridges at far lower costs than heretofore.
- 2) Increase the employment opportunities at the local level through the setting up of workshops that will provide their respective hinterlands with the means for building wooden bridges.

B. Immediate Objectives:

The immediate objectives of the project are to:

- 1) Survey the requirements for bridges from 6m to 30m span within the design capabilities of the system and compile a listing for each District co-ordinated with the Plan Nacional de Transporte 1979 - 1983 and Programa de Acción Inmediata 1981 - 1982 and indicating in each case whether funds are likely to be available for execution. The plans of COHDEFOR and the road maintenance/replacement programme would also be considered.

- 2) Summarize briefly available forest inventory data to show general availability of species suitable for constructional use and group them into strength classes for bridges.
- 3) Check the bridge element design developed in Kenya for available Honduran species and adapt the loading and design parameters as required for Honduran conditions. Make additional or modified designs or specifications if necessary.
- 4) Determine a site or sites suitable for the construction of (a) demonstration, prototype bridge (s).
- 5) Identify and adapt or build a demonstration workshop in the Tegucigalpa area capable of manufacturing bridge components.
- 6) Erect (a) prototype bridge (s)  
This will include:
  - Assembling of modular elements
  - Testing of modular elements
  - Training of workshop staff in manufacturing and assembly quality control procedures and basic timber technologies
  - Training of staff in erection techniques including supervision of temporary, locally recruited site labour
- 7) Prepare a manual containing all information and instructions necessary for making and erecting such bridges in Honduras. This will detail the decision-making/design process; include a costing/planning worksheet to aid in deciding on using these bridges at other sites and an estimate of probably costs per lineal metre of span once regular production has been established.
- 8) Prepare a report summarizing the potential for such modular bridges in the country and recommending a suitable number of workshop locations for producing bridges at a rate that will meet the demand consistent with Government construction plans, but bearing in mind the rural self-help nature and potential of this system.

C. Special Considerations:

None

D. Background and Justification:

CONSUPLANE has noted in its Plan Nacional de Transporte 1979-1983 that the sectoral objectives of the 1974-1978 plane were:

- 1) Contribute to the growth of other sectors both economic and

social/services, including access roads for new zones capable of high agricultueal production;

- 2) Achieve an economic and efficient transport system at the national and international level;
- 3) Integrate the national territory into an economic, political and social unit.

The Highway Master Plan (December 1977) confirmed emphasis on small scale improvements, deferred maintenance and new low standard roads to serve agricultural areas. The National Plan 1979-1983 reflects this and points to a notable problem of the sector, inter alia, of the lack of a gradual strategy to substitute old technologies in the realization of works using a large proportion of imported materials and equipment with little employment generation.

An important component in the cost of road construction and improvement is for bridge building. Poor and frequently impassible bridges contribute to transport costs and economic isolation of rural areas. The capability of building cheaper bridges without incurring costly design inputs on a regional self-help basis would make a valuable contribution to the aims of the National Transport Plan. The use of local materials (primarily timber) would save foreign currency, especially if both manufacture and erection are accomplished using simple skills and equipment, and would provide an impetus to local production, sawmills and small workshops.

A prefabricated modular wooden bridge system (similar to the Bailey bridge concept) has been developed by UNDP/UNIDO in Kenya where, in the past few years many examples ahve been successfully erected. In Kenya these bridges have been found to be about  $\frac{1}{4}$  to  $\frac{1}{3}$  the cost of more traditional concrete bridges.

During a UNIDO programming mission to Honduras in November/December 1980, as a follow-up to the visit of the Minister of Planning and the UNDP Resident Representative to UNIDO/Vienna, consultations with CONSUPLANE and SECOPT officials identified this system as having great potential towards achieving the objectives mentioned

above, and the Government requested a preparatory technical assistance mission to prepare for an extensive wooden bridge construction programme to be initiated during 1981.

Since the objective is to prepare for an extensive programme throughout the country, a demonstration workshop to produce the first bridges was considered essential.

This first workshop would serve the function, not only of producing the first bridge elements but would also undertake central functions such as training, purchasing of materials and equipment, quality control of proof testing and administration until such time as the regional workshops are capable of acting independently. The final role of the first workshop would be as administrative focal point and promotional/liaison centre to ensure proper co-ordination of element production with construction programmes and central planning of works.

Its location should be Tegucigalpa, preferably as part of or adjacent to an existing 'SECOPT' workshop. Dried, preservative treated timber can be obtained from either of two sawmills - near Talanga and San Pedro Sula.

When the first demonstration workshop is established, it should be anticipated that other regional ones will be created to cater for bridge needs within their immediate areas using locally produced lumber and a minimum of bought-in steel components, (basically blanks for cutting and drilling the specification). The assistance of other organizations would then be required to extend the workshop system for training (INFOP) and for setting up workshops (CDI).

The question of local supply of properly treated lumber or of suitable treatment means (e.g. dip diffusion) at the workshops themselves would be clarified during the project. Some hardwoods are naturally very durable and may need only a simple treatment against termites while others would require pressure impregnation. The possibility of acquiring a mobile pressure treatment plant

should be investigated. Its cost is in the region of US\$ 75,000 and it could spend enough time in each region to treat the lumber required for local needs.

The training needs will be clarified during the project and recommendations made for rural workshop establishment will be made in consultation with CONSUPLANE and CDI.

A most important feature of the modular system is that quality control in the workshop permits a great reduction in design and site work for each bridge. The bridge manual provides all information necessary for erecting a bridge to the standards required up to 30 metres span and erection can then be done using workshop staff and local labour in only a few days. A lifetime of 20 years may be expected for the bridge structure if made of treated Pitch Pine and longer if some of the more durable hardwoods are used (one supplier guarantees 20 years for Tanalith treated Pine).

A further justification is that experience will be gained in making better use of Honduras' valuable forest resources and so should lead the way towards other structural uses in rural areas.

E.

Outputs:

The principal outputs of the project will be:

- 1) A survey of bridge sites suitable for this design.
- 2) An assessment of constructional timber species with a strength classification.
- 3) A manual specifically prepared for Honduran conditions, regulations and species for further training, manufacture and erection of bridges.
- 4) A demonstration workshop with tools and jigs capable of building prefabricated bridge elements.
- 5) Workshop staff (about 6) trained in timber selection, handling and treatment and in assembly of prefabricated modular bridge elements and their erection on site.
- 6) A demonstration, prototype bridge (or bridges if possible).
- 7) A realistic strategy for employment in regional workshops.

F. Activities:

(All are located in Tebucigalpa and a designated site or sites in the region).

	<u>Description</u>	<u>Starting Time</u>	<u>Duration</u>
	Purchase of secondary materials for bridge components and workshop (tools and wood for table, jigs, etc.) N.B. Primary materials - timber and steel - are to be provided by the Government	Feb./March 81	-
<u>1/</u>	5. Establish the workshops, plan layout, make assembly table, jigs and templates	April 1981	1 month
	1. Compile information on bridge sites	May 1981	1 month
	2. Evaluate Honduran Species for construction use and group into strength classes	April 1981	1 month
	3. Check and adapt bridge designs and procedures as required for Honduran standards.	May 1981	1 month
	4. Check bridge sites and verify suitability and accuracy of abutments	April/ August 1981	$1/2$ month
	6. Arrival of primary and secondary materials (Pitch Pine and Steel)	April 1981	$1 \frac{1}{2}$ months
	6. Manufacture of bridge elements	May 1981	5 months
	6. Test panels	May 1981	6 months
	6. Assemble erection tripods on site (s) and prepare for erection	August 1981	2 months
	6. Erect bridge (s)	Sept. 1981	2 months
	6. Train staff in basic timber seasoning, storage, grading and preservation techniques	June or July 1981	$1/2$ month
	7. Prepare manual	April 1981	2 months
	8. Prepare a report	Sept. 1981	2 months

1/ Numbers refer to the corresponding number of the Immediate Objectives (See II.B above).



G. Inputs:

Government Inputs

The Government of the Republic of Honduras will contribute to the project in the following way:

1. Pre-project requirements:

- 1.1 Information on national bridge-building plans sufficient for substitution indications (CONSUPLANE).
- 1.2 Information on forest resources and production capacity, species characteristics (COHDEFOR).
- 1.3 Assignment of a site for a workshop (approximately 800 m<sup>2</sup>).
- 1.4 Agreement to use the prefabricated modular wooden bridges on at least two sites during the project and a commitment in principle to incorporate them into the National Highway Plan if cost effectiveness is proved.
- 1.5 Authorization to spend for the agreed budget amount.

2. Assignment of National Personnel

2.1 Counterpart personnel

- |                                   |                  |          |
|-----------------------------------|------------------|----------|
| a) Civil engineer                 | Tegucigalpa and  | 9 months |
| b) Design and structures engineer | designated sites | 6 months |

2.2 Other

- |  |                  |          |
|--|------------------|----------|
| a) Workshop staff (6 or 7) <sup>1/</sup> | Tegucigalpa      | 7 months |
| b) Driver                                | Teg. and regions | 7 months |
| c) Occasional labour as required         | Bridge site(s)   | -        |
| d) Secretarial, draughting facilities    | Tegucigalpa      | -        |

3. Buildings, equipment and supplies<sup>2/</sup>

- 3.1 Workshop (shed approximately 160 m<sup>2</sup>), covered store, office.
- 3.2 Vehicle suitable for staff travel and light loads, fuel, lubricants, maintenance and insurance.

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<sup>1/</sup> Or as decided by expert

<sup>2/</sup> To cover expenses beyond those provided for in UNDP Budget line 40/49

- 3.3 Office equipment and supplies (typewriter, paper, etc.), electricity, telephone at workshop.
- 3.4 Timber, mild steel plates, bolts, nails, welding rods, oxy-acetylene.
- 3.5 Bridge abutments at designated site(s).
- 3.6 Vehicles for transporting incoming material and bridge components and occasional labour.
- 3.7 Site facilities for erection gang (lodging, camp) as required.
- 3.8 Draughting and Bilingual Secretarial services in Tegucigalpa as required.

UNDP/UNIDO Inputs

1. Experts

The internationally recruited experts will overlap during the first month of the project since, owing to the unique nature of the project, it is unlikely that the current main proponent of the system could be released from his present UNDP posting for long enough to implement it entirely and a newcomer to the system, however experienced, would be at a disadvantage. The longer posting will be split for about 1 1/2 months leaving 3 months for the final stages. (See also Proposed Work Plan, Annex One). The number in parentheses refer to various Immediate Objectives.

11-01	Timber engineer (wooden bridges)	(2, 4, 5)	1 m/m
11-02	Timber engineer (constructions)	(1,2,3,4,5,6,7,8)	5 m/m

2. Training of National Personnel

It is proposed that two or more workshop staff be sent to a short course (1 or 2 weeks) in basic timber technology either at the Forestry School, Siguatepeque or the Department of Forestry at La Ceiba unless suitably qualified staff can be found. The cost, if any, is estimated at US\$ 1,000.

3. Equipment

The workshop will need to be built or rented and equipped with a range of simple hand and power tools, including:

- Radial (De Walt) saw
- Drill press and bits for mild steel
- Portable power drill and bits for wood
- Portable power cross-cut saw
- Portable welding equipment, mask
- Hammers, hand saws, wrenches, tapes, etc.
- Cable, pulley block and winch for erection
- Hydraulic cylinder and gauge for proof testing of panels plus miscellaneous materials as required.

TOTAL            US\$    20,600

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This amount can also contribute to reduce Government inputs for 1) premises, 2) raw materials, 3) vehicle or 4) other equipment, but consideration should be given first to equipping a second workshop with essential tools.

H. Work Plan

A tentative work plan is shown under Section F (Activities) of this document. A proposed detailed work plan (bar chart) is included as Annex I but the final detailed implementation will be prepared by the first expert and verified with the second during the overlap period. (if only one expert is recruited for the entire project, he will be solely responsible).

The detailed work plan will be annexed to this document after its approval by all three parties concerned and will be considered an integral part of it.

I. Framework for Effective Participation of National and International Staff in the Project

The activities necessary to achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to it. The Ministry of Communications,

Public Works and Transport will provide all facilities and prerequisites with counterpart assistance through the Dirección General de Caminos. The Consejo Superior de Planificación Económica (CONSUPLANE), through the Secretaría Técnica will act as a co-ordinating body between the Government and the UNDP.

The respective roles of the national and international staff shall be in accordance with the established concept and specific purposes of technical co-operation. Collaboration with the Centro de Desarrollo Industrial (CDI) should be anticipated if further workshops in rural areas are to be established.

J. Development Support Communication

Not applicable.

K. Institutional Framework

Please note linkage between SECOPT with leading role and CONSUPLANE and COHDEFOR.

L. Prior Obligations and Prerequisites

None, other than prerequisites listed in G.1.

M. Future UNDP/UNIDO Assistance

The Government intends to establish a series of regional workshops possibly 5 or 6 to supply bridges in their areas. Assistance in setting these up and in co-ordinating bridge building planning should be foreseen.

Also, a logical extension of each workshop would be for the manufacture of standard portal frames and trusses for storage sheds, farm buildings and light industrial buildings as well as wooden silos. This would use the same basic wood technology and timber engineering principles and would provide further employment and rural development opportunities. A contract with an organization experienced in timber engineering applications to develop these designs could be anticipated.

PART III. SCHEDULES OF MONITORING, EVALUATION AND REPORTS

A. Tripartite Review Meetings

A tripartite review meeting should be held during the 5th month of the project to check progress and plan the extent of rural workshops and bridge building activity deemed appropriate.

B. Evaluation

The project will be evaluated by the Government, UNIDO, and UNDP and a decision on follow-up action will be taken after this evaluation is completed.

C. Reports

An interim progress report will be submitted within two weeks of the end of the first phase (month 3) which will present design information, species groups, a bridge site compilation by District and a report on the status of bridge element construction and the selected sites and their preparatory work.

The final report will consist of the manual and a report briefly describing the project's implementation recommending a regional strategy and appending the interim reports. These should be submitted for review by UNIDO at least two weeks before the end of the project and submitted formally on completion.

PART IV. BUDGETS

A. UNDP Budget

HONDURAS	HON/81/002/A/01/37	31.7.A
<u>Development of Prefabricated Modular Wooden Bridges</u>		
	<u>TOTAL</u>	<u>1 9 8 1</u>
	m/m US\$	m/m US\$
10. <u>Project Personnel</u>		
11. <u>Experts</u>		
11-01 Timber Engineer (Wooden Bridges)	1 5,800	1 5,800
11-02 Timber Engineer (Constructions)	5 29,000	5 29,000
	<hr/>	<hr/>
11-99 Sub-Total	6 34,800	6 34,800
15. Experts travel at 150/month	900	900
	<hr/>	<hr/>
19. Total Personnel Component	35,700	35,700
30. <u>Training</u>		
33. In Service Training	1/2 1,000	1/2 1,000
	<hr/>	<hr/>
39. Total Training Component	1/2 1,000	1/2 1,000
40. <u>Equipment</u>		
49. Total Equipment Component	20,600	20,600
50. <u>Miscellaneous</u>		
52. Reports (Manual)	2,200	2,200
53. Sundries	500	500
	<hr/>	<hr/>
59. Total Miscellaneous Component	2,700	2,700
	<hr/>	<hr/>
99. GRAND TOTAL	60,000	60,000
	<hr/> <hr/>	<hr/> <hr/>

B. Government Budget

Project Budget covering the Government's Contribution in Kind  
(Lempiras)

Country: Republic of Honduras  
 Number: HON/81/002/A/01/37  
 Title: Development of Prefabricated Modular  
 Wooden Bridges

Personnel	TOTAL		1 9 8 1.	
	m/m	L.	m/m	L.
1 Civil Engineer	9		9	
1 Structures Engineer	6		6	
1 Workshop Supervisor	7		7	
1 Site/Erection Supervisor	3		3	
2 Skilled Operators - Carpenters	7		7	
1 Welder - Machinist	7		7	
2 Semi-Skilled Assistants	7		7	
1 Driver	7		7	
- Secretarial, Draughting Staff	-		-	
<u>Equipment and Supplies <sup>1/</sup></u>				
Raw materials for prototypes	25,000		25,000	
Operation and Maintenance of equipment and vehicles	p.m.		p.m.	
Land for workshop site	p.m.		p.m.	
Workshop building(s)	p.m.		p.m.	
<hr/>				
TOTAL				

1/ Beyond that covered by the UNDP input.

Activity	1981	Feb.	Mar.	April	May	June	July	August	Sept.	October	Nov.	Dec.
Expert 11-01				_____								
Expert 11-02				_____				_____				
Counterpart 1		_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Counterpart 2		_____		_____	_____	_____	_____	_____		_____		

1. Compile bridge site info. \_\_\_\_\_
2. Evaluate/group hardwoods \_\_\_\_\_
3. Adapt designs \_\_\_\_\_
4. Check sites/abutments \_\_\_\_\_
5. Build workshop jigs, etc. \_\_\_\_\_
6. Receive raw materials \_\_\_\_\_
6. Make bridge elements \_\_\_\_\_
6. Test elements \_\_\_\_\_
6. Make erection tripods and prepare sites \_\_\_\_\_
6. Erect bridges \_\_\_\_\_
7. Prepare manual \_\_\_\_\_
8. Prepare report \_\_\_\_\_

ANNEX I.: PROPOSED WORK PLAN



DRAFT JOB DESCRIPTION

HON/81/002/11-01

Post Title: Timber Engineer (Wooden Bridges)

Duration: 1 month

Date Required: 1 April 1981

Duty Station: Tegucigalpa

Purpose of Project: To assist the Government in improving the national road network by developing the capability of making and erecting prefabricated, modular wooden bridges.

Duties: The expert will work with counterpart personnel of the Ministerio de Comunicaciones, Obras Públicas y Transporte to establish a workshop and produce modular elements for the erection of a prototype bridge(s). In particular he will:

- (1) Supervise the creation of a workshop, purchase of tools and equipment and the making of jigs and templates.
- (2) Check and adapt the designs developed in Kenya to suit Honduran conditions and Pitch Pine including such preservative treatment as necessary.
- (3) Verify the ordering of primary raw materials done as a pre-project activity and modify or make-up as required.
- (4) Select sites for bridge erection and ensure that abutments construction is adequate.
- (5) Evaluate available hardwood species for suitability for bridge construction.

Duties 4 and 5 are expected to be carried out in co-operation with the timber expert.

Language Requirements: Spanish or English

Qualifications: Civil or structural engineer with experience in timber bridge building.

Background Information: (see project document)

DRAFT JOB DESCRIPTION

HON/81/002/11-02

Post Title: Timber Engineer (Constructions)

Duration: 5 months (split)

Date Required: 15 April 1981

Duty Station: Tegucigalpa

Purpose of Project: To assist the Government in improving the national road network by developing the capability of making and erecting prefabricated, modular wooden bridges.

Duties: The expert will work with counterpart personnel of the Ministerio de Comunicaciones, Obras Públicas y Transporte to establish the capability in Honduras of making prefabricated modular wooden bridges. In particular he will:

- (1) Assist the first expert in creating a workshop and make jigs and templates.
- (2) Evaluate available hardwood species for their suitability for such bridge construction and group them into strength classes.
- (3) Supervise the production of bridge components and train national staff in all aspects of their manufacture.
- (4) Erect a bridge (or more if possible) on selected sites ensuring sufficient preliminary work on abutments has been carried out by the Government.
- (5) Prepare a manual detailing all information necessary for making bridge modules and erecting bridges in Honduras.
- (6) Prepare a report showing the extent to which these bridges might be used in Honduras and recommending further workshop sites to fit into this demand pattern as well as training requirements and structural assistance needed for establishing viable small enterprises.

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\* This would include a compilation of potential bridge sites and a species appraisal.

- (7) Carry out any other work possible to assist in the speedy incorporation of this bridge system into Honduras' national plans.

**Language**

**Requirements:**

Working knowledge of Spanish essential

**Qualifications:**

Civil or structural engineer with experience in timber bridge building. Knowledge of strength classification of timber species essential.

**Background**

**Information:**

(see project document)

ANNEX IV.

a) Tools Required for Workshop - (Lemp's)

	<u>Unit Costs</u>	<u>Estimated Costs (L)</u>
1. Drill Press for steel and bits	1,800 + 200	2,000
2. Oxy-acetylene torch and cylinders		500
3. Welding equipment with rods and mask		1,500
4. Files		40
5. (4) 3m Tapes, (2) 30m, (2) steel rules, (2) scribes	40 + 60 + 10 + 10	120
6. 2 Sets of wrenches ( <sup>2"</sup> $\frac{1}{2}$ " - 1" bolts)	50	100
7. Template steel - 24 gauge	-	10
8. Portable drill (power) for wood and bits	600 + 40	640
9. Portable power X-cut saw + 3 blades	365 + 55	420
10. Hammers (6)	10	60
11. (2) Anger drills and bits	40 + 40	160
12. Hand saw, X- cut (2)	30	60
13. Heavy duty vice (5")	160	160
14. 3 Shovels	10	30
15. Hydraulic load cylinder and gauge		2,000 (est.)
		<hr/>
		7,800
		<hr/>
Other tables, cabinets, storage space		300
Total of Table etc.		200
		<hr/>
		500
		<hr/>
Total Workshop		8,300
		<hr/> <hr/>

b) Timber Required for Assembly Fig/Table

<u>Item</u>	<u>L</u>	<u>W</u>	<u>Th</u>	<u>No.</u>
1. Posts/legs	800	x 150	x 100	4
2. Long sides	3,000	x 250	x 50	4
3. Short sides	1,750	x 150	x 100	4
4. Top pieces	3,000	x 250	x 50	2
5. Long brace	3,000	x 250	x 50	1
6. Diagonals	2,300	x 150	x 50	2
7. Guide	1,500	x 250	x 50	1

8. Bolts, hardware, etc.

(P.69) c) Wet Crossing Equipment

1. Tirfor winch 3t
2. Double sheaved blocks 3t
3. Single sheaved block 3t
4. Bow shackles 2t
5. Anchor wires 5m
6. Suspension wire 50m
7. Haul wires 15m
8. Harnesses 3m
9. Shear legs

IV. Continued

<u>x Vol/pce</u>	= <u>Vol(m<sup>3</sup>)</u>	<u>Bdft.</u>	<u>Cost approx. 1.6/bf</u>
.0120	.048	20.6	12.4
.0375	.150	64.5	38.7
.0263	.105	45.2	27.1
.0375	.075	32.2	19.4
.0375	.038	16.1	9.7
.0173	.035	14.9	8.9
.0188	.019	8.1	4.9
	<hr/>	<hr/>	<hr/>
	.470	201.6	121.1
			78.9
			<hr/>
			200.0

1  
8  
1

<u>No.</u>	<u>Unit Cost</u>	<u>Cost</u>
4		
2		
1		
8		
2		
1		
2		
2		
-		

(P.69) c) Wet Crossing Equipment Cont.

No.

10. Cap with "U"
11. Chemicals for soil poisoning
12. Epoxy for grouting anchor bolts
13. Extra bearers and guides

1



Unit Cost

Cost

---

Lps 3,000 est.



