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ASSISTANCE IN THE QUALITY AND IMPROVEMENT  
OF FURNITURE INDUSTRIES

SI/SAM/88/801

WESTERN SAMOA

Technical report: Development of the secondary wood  
processing industry\*

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

Based on the work of Horatio P. Brion,  
furniture production expert

Backstopping officer: Antoine V. Bassili,  
Industrial Management and Rehabilitation Branch

United Nations Industrial Development Organization  
Vienna

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\* This report has not been edited.

V.90 88333

EXPLANATORY NOTES

The Monetary unit of Western Samoa is the Tala or Western Samoan Dollar. The official rate of exchange for the Western Samoan Dollar at the time of this mission was WS\$2.2767 = US\$1.00.

The following acronyms are used in this Report:

- UNDP - United Nations Development Programme
- UNIDO - United Nations Industrial Development Organization

A hyphen between numbers (e.g., 1-15) indicates the full range involved, including the beginning and end points.

A full stop (.) is used to indicate decimals.

A comma (,) is used to indicate thousands, millions, billions.

The following symbols and/or abbreviations are used in this Report:

- " - inch
- ' - foot (or feet)
- % - "per centum", meaning 1/100
- BF - "Board Foot" (or "Board Feet"), measure of wood volume, 1-inch thick, 1 foot wide & 1 foot long
- cu. ft. - cubic foot (or cubic feet)
- cu. m. - cubic meter
- Ft. - foot (or feet)
- has. - hectares
- Ltd. - "Limited", referring to limited ownership of business firm
- S4S - Surfaced-four-Sides lumber boards

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Mention of company names and product brands does not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

TABLE OF CONTENTS

<u>Chapter/Section</u>	<u>Page</u>
I. INTRODUCTION -----	1
1.1 PROJECT BACKGROUND -----	1
II. THE SECONDARY WOOD PROCESSING INDUSTRY OF WESTERN SAMOA -----	3
2.1 CURRENT STATUS -----	3
2.2 INDUSTRY POTENTIALS -----	4
2.21 Timber Resources of the Country -----	4
2.22 Manpower Training Facilities -----	4
2.23 Non-traditional Materials for the Furniture and Joinery Industry -----	5
III. THE FIRST PHASE OF THE PROJECT -----	6
3.1 IMMEDIATE OBJECTIVES OF THE FIRST PHASE -----	6
3.2 INDUSTRY PARTICIPATION -----	6
3.3 MODE AND TECHNIQUE OF DELIVERY OF TECHNICAL ASSISTANCE SERVICES -----	7
3.4 PROBLEMS COMMON TO THE INDUSTRY -----	8
3.41 Raw Material Problems -----	8
3.42 Production Techniques -----	8
3.43 Other Shop Activities In Support of Production -----	9
3.44 Other Problems -----	9
IV. COURSE OF ACTION DURING SECOND PHASE OF THE PROJECT -----	9
4.1 MODE OF TECHNICAL ASSISTANCE SERVICES -----	9
4.2 TENTATIVE LIST OF TOPICS FOR DISCUSSION DURING THE SEMINAR-WORKSHOP ACTIVITIES -----	10
4.21 For the Entrepreneur/Manager Group -----	10
4.22 For the Key Shop Personnel Group -----	11

	<u>Chapter/Section</u>	<u>Page</u>
<u>ANNEXES</u>		
I	JOB DESCRIPTION -----	12
II	TECHNICAL ASSISTANCE TO LOSER INDUSTRIES, Ltd. -----	15
III	TECHNICAL ASSISTANCE TO S.F. YOUNG FURNITURE AND CONSTRUCTION -----	23
IV	TECHNICAL ASSISTANCE TO COCONUT WOOD PRODUCTS, Ltd. -----	31
V	TECHNICAL ASSISTANCE TO STRICKLAND BROTHERS, Ltd. -----	35
VI	TECHNICAL ASSISTANCE TO SILVA UPHOLSTERY -----	47
VII	TECHNICAL ASSISTANCE TO FUAYATU ATI -----	49
	B I B L I O G R A P H Y -----	51

# I. INTRODUCTION

## 1.1 PROJECT BACKGROUND

Western Samoa is covered with a significant amount of tropical hardwood timber forests, particularly in its forest areas in the island of Savai-i. A major portion of the timber produced in the forests of the country is currently exported as sawn-timber and veneer. Only a very small portion of the forest timber yield is converted into secondary wood products. The furniture and joinery products thus produced accounts for about 10% of the timber yield of the country. The remainder is used for construction purposes. The furniture or joinery products currently produced in the country are sold only in the domestic market, for the quality of the products are definitely far below the level acceptable in the foreign market.

A previous mission conducted under UNDP/FAO/UNIDO Project DP/RAS/86/075, indicated that two major pre-requisites for a desirable rate of development of the furniture and joinery industry in Western Samoa, to wit:

- i. The establishment of kiln-drying facilities in the country;  
and
- ii. The provision of technical assistance to the industry in order to improve product quality and increase the output of production operations to more desirable levels.

As a result of their appraisal, the Government, on 31 March 1988 requested UNIDO to assist the existing furniture industries in Western Samoa in applying principles and techniques involved in the serial production of furniture and other wood based items and in upgrading the quality of their products. A new project, providing for 3 months of expert assistance

SI/SAM/88/801 was approved. Horatio P. Brion, a furniture production expert, undertook a two phased mission, the first phase from 4 November 1989 to 3 December 1989 and the second phase from 26 March to 17 June 1990. His duties are given in Annex I.

It aims to assist the existing furniture industries in Western Samoa in applying principles and techniques involved in the serial production of furniture and other wood-based items, and in upgrading the quality of their products.

## II. THE SECONDARY WOOD PROCESSING INDUSTRY OF WESTERN SAMOA

### 2.1 CURRENT STATUS

Approximately 15 establishments comprise the secondary wood processing industry of Western Samoa. These woodworking shops range from cottage industry level enterprises to small scale semi-mechanized furniture and joinery product manufacturing operations. These woodworking firms are concentrated mainly in the town of Apia and its immediate environs. Two of the firms are also engaged in the manufacture of joinery products and a limited quantity in design of timbers woodworks. One firm, estimated to be the largest shop in the country, also produces components for housing and school buildings construction. In general, the products offered by the industry range from handicraft items, simple design wardrobes, household and office furniture items, joinery products such as door and door jambs, window and window frames, and other items such as coffins and planter boxes.

Furniture and joinery products, as a whole, have comparatively much lower quality than corresponding products manufactured in and sold by Southeast Asian developing countries. The predominant manufacturing systems are still highly artisanal in nature, so that both quality and output are low. The entire output of the industry is sold in the domestic market.

The industry has an estimated maximum labour compliment of around 160 workers during the peak season (that is, the Christmas and New Year season) and, on the average, 100 workers during the rest of the year.

There is hardly any improvement in both the quality of its products and output of the industry since the visit of this Consultant 15 months ago during a mission under UNDP/FAO/UNIDO Project DP/RAS/86/075.



## 2.2 INDUSTRY POTENTIALS

### 2.21 Timber Resources of the Country

Using the results of the 1977-78 forest inventory and the rate of depletion of the forest stand as a result of logging operations conducted by the Samoa Veneer Products, Ltd., Samoa Forest Products, Ltd. and other logging firms, together with the average annual conversion of forest lands into agricultural lands (estimated at 308 hectares annually) the forest resources of the country in 1968 was estimated at around 20,000 hectares, with a cutting potential of about 80.7 cubic meters of logs per hectare of natural commercial forest land. Considering that the government allows a total of roughly 100,000 cubic meters of saw logs to be cut annually, it appears that the existing forest resources of the country can support a good-sized secondary wood processing industry for the next 17 years with ample wood material supply for an estimated population of around 180,000 people.

### 2.22 Manpower Training Facilities

There are currently 2 institutions which provide training facilities for the carpentry and woodworks industry. The Western Samoa Technical Institute is primarily concerned with the training of young people for the crafts and trades. Graduates of the course in carpentry, still have to undergo at least 3 years of apprenticeship before they can be fully admitted as regular workers in the industry. However, it may take a longer time for the same graduates to be trained and to function effectively as workers in the furniture and joinery manufacturing industry, for their training and experience are principally geared to the needs of the construction industry.

Another training institute for the trades and crafts was more recently established by the Don Bosco Brothers (a religious organization), also in the capital town of Apia. Its course of

studies resemble closely that of the Western Samoa Technical Institute. However, it appears that there is more emphasis in training the student to prepare them for work in the manufacturing industry. There is no basis yet for evaluating the performance of the graduates of the institutions as only a few of the graduates have been working in the local furniture and joinery manufacturing industry.

It appears that the furniture and joinery industry has not given serious consideration to the potential benefits that might be derived by a more intensive support and cooperation with these training institutions. Lately, however, the leaders of the furniture and joinery manufacturing industry must have realized the need to review their relationship with the WSTI for a more positive cooperation geared to training manpower for the industry in view of the significant number of Samoan migrants to New Zealand and Australia, resulting in the depletion of the industry's skilled and highly skilled workers.

2.23 Non-traditional Materials Resources for the Furniture and Joinery Industry

In view of the remarkable growth, in the last few years, of the rattan and bamboo furniture industry in the Philippines, and the rattan industries of Thailand, Indonesia and Malaysia, interest in Western Samoa has been focused to the possible manufacture of furniture products using rattan poles and/or bamboo. Recent surveys indicated the availability of bamboo which is of the specie that can be used for the manufacture of bamboo furniture items. There were some reports that vines having the characteristics of rattan (Calamus family) are in existence on the western slopes of the mountain ranges in the island of Savai-i. Similar reports also point to the existence of rattan in the eastern forests of the island of Upolu, near the town of Aleipata. Efforts are now being made to ascertain the veracity of these reports.

There are, however, certain grass species, locally known as "LAFO" and "MANIUNIUI" which grow abundantly in many villages and fields of Western Samoa. Samples of Lafo were obtained and initial tests to produce woven lattice material from Lafo indicate a high potential for its use in furniture making. Similar tests are planned for the conversion of Maniuniui into components for the manufacture of furniture.

### III. THE FIRST PHASE OF THE PROJECT

#### 3.1 IMMEDIATE OBJECTIVES OF FIRST PHASE OF PROJECT

In consultation with the counterpart officer from the Department of Economic Development, Mr. Misiolo Sefe, the following were adopted as the immediate objectives of the first phase of the Project:

- i. To provide ad hoc technical assistance in the form of advice and recommendations to the participating firms on the most pressing problems in their day-to-day production activities;
- ii. To identify problems which are common to the industry and significant enough to be dealt with during workshop sessions planned for the second phase of the Project; and
- iii. To formulate a course of action for the second phase of the Project on the basis of observations and findings during the first phase.

#### 3.2 INDUSTRY PARTICIPATION

The following firms participated in the first phase of the Project:

1. Lober Industries, Ltd., manufacturers of wooden furniture and joinery products; which was visited on 5-7 and 25 September 1989,
2. S.F. Young Furniture and Construction, manufacturers of wooden furniture and joinery products, and builders' woodworks; which was visited on 11-13 and 26 September 1989,

3. Silva Upholstery, interior furnishers and manufacturers of upholstered furniture and furnishings, with plans to establish a woodworking shop to fabricate the wooden framework for their fully-upholstered furniture line; which was visited on 8-9 September 1989,
4. Western Samoa Coconut Wood Products, Ltd., manufacturers of coconut wood lumber and joinery products; which was visited on 14-15 and 22 September 1989,
5. Strickland Brothers, Ltd., manufacturers of rattan furniture and furnishings items; which was visited on 18-20 September 1989, and
6. Fuanatu Ati, wooden handicrafts and leather goods shop, operating at cottage industry level, which was visited on 21 September 1989.

### 3.3 MODE AND TECHNIQUE OF DELIVERY OF TECHNICAL ASSISTANCE SERVICES

The manufacturing shops of the participating firms were visited and their manufacturing techniques were observed. Wherever possible, ad-hoc advice was given on techniques and practices to improve the product quality and production output.

The observations and findings, together with the corresponding suggestions/recommendations are presented Annexes II to VII.

It is estimated that there are at least another 5 or 6 furniture shops, ranging from the handicraft to the semi-mechanized level of operations which could have been served but for lack of time. It is felt, however, that the six participants in the first phase of the mission represented a good cross-section of the industry, so that any plans for the second phase of the Project based on their operating characteristics stand a good chance of being effective and relevant to the needs of the other firms not reached during the first phase.

### 3.4 PROBLEMS COMMON TO THE INDUSTRY

#### 3.41 Raw Material Problems

- i. Inadequately dried sawn-timber is still the predominant cause for the undesirable low quality of the wooden furniture and joinery products.
- ii. In the case of rattan furniture products, the use of imported low grade rattan poles (principally Grade C with a few poles which could pass for Grade B), aggravated by crude production methods and the use of primitive tools, lead to low quality and high cost of the product.

#### 3.42 Production Techniques

- i. The benefits to be derived from "serial production" techniques are denied the industry due to low volume orders and the diversity of product designs.
- ii. Even the better mechanized shops use their machines more as tools rather than industrial equipment, so that machine set-ups are as frequent as the number of workpieces being produced.
- iii. Primarily due to the instability of the wood material (green or inadequately air-dried lumber) furniture component parts have to be reworked and fitted to the next component before they could be properly joined together at the assembling section.
- iv. Sanding with coarse sandpaper has become a conventional solution to the poor surface preparation resulting from lack of proper maintenance of the planer or jointer knives.
- v. The only industrial finishing material readily available in the country is a clear finish coating commercially known as "polyurethane varnish". This is a relatively long-drying finish coating. It is commonly applied by brushing.

- vi. The absence of quality standards in the country, both with respect to materials and finished furniture pieces, make it hard to institute quality control activities in the furniture shops.

#### 3.43 Other Shop Activities in Support of Production

- i. Inadequate or improper maintenance of production machinery still characterizes the furniture shops in the country. It is not uncommon to observe that at least 20% of the total machinery complement of the shop is either out-of-order or not in good operating condition.
- ii. The same undesirable situation also exists in the maintenance of cutting tools (knives, bits, etc.).
- iii. Although each shop disposes of its saw-dust and shavings residues, it appears that less attention is given to the disposition of lumber off-cuts. This practice results to the clogging of vital production areas which are used for storage of the off-cuts.
- iv. None of the shops visited showed any concern for fire hazards and machining accidents.

#### 3.44 Other Problems

Numerous other operating problems exist. However, the problems enumerated above need to be addressed at the earliest possible time, if the industry is expected to develop in the desired direction.

### IV. COURSE OF ACTION DURING SECOND PHASE OF THE PROJECT

#### 4.1 MODE OF TECHNICAL ASSISTANCE SERVICES

The magnitude, diversity and scope of the industry's problems described above and the nature and work habits of the people involved in the

industry, indicate the advisability of the following programme of action: Transfer of know-how will be pursued at both the academic and practicum standpoints. Topics involving solutions to the enumerated problems, including such topics as may be suggested by the industry, will be presented and discussed in a Seminar-Workshop series, involving the participation of the entrepreneurs/managers themselves, on one side, and their key production personnel on the other. Production concepts will be presented during the Seminars, demonstrated/illustrated during the workshop sessions, and their application monitored by the Consultant during his scheduled visits to the participants' manufacturing shops. Immediate application of the newly introduced concepts/industrial practices will be stressed through "Group Work Assignments" to be worked out by participants in-between Seminar-Workshop sessions.

The immediate need for such a programme of action is an adequate venue for the Seminar-Workshop sessions, preferably one which has the basic machines for training woodworking personnel. Talks with the Principal, Education Department, Western Samoa Technical Institute (WSTI), and a subsequent inspection of their woodworking shop facilities, have convinced the Consultant that WSTI would be a very good venue for the proposed Seminar-Workshop Programme. The Principal of WSTI has agreed to host the Seminar-Workshop, in cooperation with the Department of Economic Development and the United Nations Development Programme (Apia, Western Samoa). He has also offered the services and participation of the UN volunteer assigned to the carpentry shop, and most possibly, the services and participation of some of the more advanced students in its carpentry course. It is suggested that the Department of Economic Development finalize the arrangements with the WSTI, based on the details of the programme which will be furnished by this Consultant sometime in April 1990.

4.2 TENTATIVE LIST OF TOPICS FOR DISCUSSION DURING THE SEMINAR-WORKSHOP ACTIVITIES

4.21 For the Entrepreneur/Manager Group:

- i. Product Costing
- ii. Plant/Machinery Lay-Out

- iii. Plant/Machinery/Cutting Tools Repair & Maintenance
- iv. Quality Control
- v. Production Control
- vi. Selection and Use of Proper Materials & Supplies
- vii. Wood Finishing Systems & Techniques
- viii. Personnel Management & Industrial Safety Programmes

4.22 For the Key Shop Personnel Group:

- i. Machine and Cutting Tools Repair & Maintenance
- ii. Proper Machine Operations/Use
- iii. Floor Level Supervision
- iv. Machine Scheduling and Manning
- v. Quality control Procedures and Techniques in Production  
Operations
- vi. Documentation and Information Systems, Factory Floor Level
- vii. Joinery Techniques
- viii. Safety in Woodworking Operations

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ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT FOR THE GOVERNMENT OF WESTERN SAMOA  
Assistance in the Quality and Improvement of Furniture Industries.

JOB DESCRIPTION

SI/SAM/88/801/11-01 J 12209

Post title: Furniture production expert

Duration: 3 months

Date required: As soon as possible

Duty station: Apia, with possible travel within the country

Purpose of the project: To assist the existing furniture industries in Western Samoa in applying principles and techniques involved in the serial production of furniture and other wood-based items and in up-grading the quality of their products.

Duties: The expert shall be assigned to the Economic Development Department. In collaboration with his counterpart from that Department the expert will provide ad-hoc assistance to existing furniture plants to enable them to apply principles and techniques involved in serial production of furniture and joinery and to up-grade the quality of their products. In particular he will be expected to provide advice in the following areas:

- Design, fabrication and installation of jigs and fixtures suitable for the serial production of furniture and joinery items;
- Proper utilization of adhesives and abrasives appropriate to furniture manufacturing;
- Finishing systems and proper application of finishing materials;

Applications and communications regarding this Job Description should be sent to  
Project Personnel Recruitment Branch, Department of Industrial Operations  
UNIDO, Vienna International Centre, P.O. Box 300, A-1400, Vienna, Austria

-Proper maintenance of production equipment including maintenance and repair of woodworking tools;

-Production and quality control on all aspects of furniture manufacture;

-Prototypes of furniture items produced as a result of the new methods introduced through this project.

He will also be expected to draft technical reports that will be prepared on an ad-hoc basis, covering some or all of the above topics, to serve for training and reference purposes. If appropriate he shall conduct short intensive courses for factory personnel.

He will also prepare technical reports, covering some or all of the above topics to serve as training and reference purposes. A terminal report will also be prepared. It will identify the problems of the joinery and furniture industries and make appropriate recommendations, addressed to the management of the plants, the government authorities, and if need be, international organizations.

**Qualifications**

Engineer or wood technologist with considerable experience in managing small furniture and joinery plants. Experience in developing countries highly desirable.

**Language**

English

**Background information:**

A good volume of timber produced from the forests of Western Samoa is exported as sawn timber and veneer. A very small portion of the forest timber yield is converted into secondary wood products. Whatever furniture or joinery products thus produced are sold only in the domestic market for the quality of the products are definitely far below the levels acceptable on the foreign market.

There also exists in Western Samoa sufficient coconut wood as the country has an on-going coconut replanting programme. Current levels of replanting activities make an estimated 18,860 MBF (round measure) of coconut stem available annually to the wood processing industry of the country.

Coconut wood is currently being processed by the Samoa Coconut Wood Products Ltd (CWPL) a sawmill which is jointly owned by the Western Samoa Trust

Estates Corporation (WSTEC) and the Development Bank of Western Samoa (DBWS). This sawmill also operates a pressure treatment plant for the production of fencing posts and electric power transmission and lighting poles. The company also has a modest moulding plant.

In spite of the availability of ample wood materials and relatively low levels of labour costs, the secondary wood processing industry of the country has not developed satisfactorily during the last few years. Difficulty is still experienced with regard to improving further the quality of locally produced furniture and in producing for export higher value added wood based items. Furthermore, the utilization of coconut wood for furniture and other similar items is not common in spite of the abundance and relatively lower price of this material as compared to traditional hardwood species.

25 September 1989

Dear Mr. LOBER:

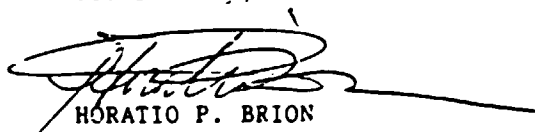
Please find attached a list of improvements that should be introduced in your woodworking operations in order to attain better quality products and, possibly, lower production costs.

Enclosed also please find the original tracing of the proposed factory lay-out under the expanded operations you plan to implement in the near future.

I shall be glad to discuss both of the above at your earliest convenience.

Please note that the above-described technical assistance services were provided your firm during the **FIRST PHASE** of **UNIDO Project No. SI/SAM/88/801**, through the **UNDP-APIA (WESTERN SAMOA)**. The **Second Phase** of the Project will be undertaken early next year, **March-April**, possibly. It is sincerely hoped that some positive results should have materialized by then, so that more benefits may be attained by your firm during the **transfer of technology** activities planned for the second phase of the Project.

Yours truly,



HORATIO P. BRION

UNIDO Furniture Production Expert

Mr. **JOE LOBER**  
Managing Director  
LOBER INDUSTRIES, Ltd.  
Apia, Western Samoa

UNIDO PROJECT No. SI/SAM/88/801

TECHNICAL ASSISTANCE TO LOBER INDUSTRIES, INC.

I- OBSERVATIONS AND FINDINGS

A. General Observations

1. Although there are indications that good efforts have been exerted to maintain an organized shop, "BETTER HOUSEKEEPING" practices can help improve the crowded floor situation in the shop.
2. Flow of materials-in-process is not well defined. Back-tracking was noted in a number of operations involving the planer-thicknesser, the jointer-surfacer and the table saw. This indicates that the existing lay-out does not suitably correspond to the sequence of operations for the product lines now being produced in the shop.
3. Proper use of machinery and equipment needs further attention on the part of the workers. "Nicks" on the planer and jointer knives indicate wooden work-pieces still **embadded with metal (nails, screws, etc.)** were run through the machines. The damaged machine-bed raising mechanism of the planer thicknesser is another indication of this shortcoming of the shop personnel.
4. Corrective machining is employed to even-out the defective surfacing jobs attained on either the planer or the jointer. This is a "wasteful" practice, for the corrective action becomes a repetitive and costly one, until the real source of the problem (knives need to be changed and sharpened!) is solved.

Note: Presumably there are other areas of the shop operations which need improvement. However, minimal shop operations during the period of the visit, prevented the Consultant from a wider coverage of the operations. Most of the shop personnel were re-assigned to assist field personnel in completing a certain contract job on time.

B. State of Machinery Repair and Maintenance Practices

1. Further improvement of maintenance techniques (in terms of frequency of maintenance checks and regular lubrication activities) is needed. Lubricating ports and fittings on all machines should be kept clean and unclogged.
2. Wooden machine fences ( as in the vertical spindle moulder) should be regularly checked for squareness with the machine table.

Lober Industries, Ltd.

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3. All the knives on both the planer-thicknesser and the jointer-surfacer have concave edges about the mid-length of the knives. This situation indicates the need for:
  - a) Re-training the machine operators to feed the workpieces evenly throughout the whole length of the knives; and
  - b) Re-training the maintenance personnel to conduct more frequent checks on the condition of the cutting tools installed on the machines in the shop, and replace them with sharpened tools **before** a more serious problem (like acute concaveness of the cutting edges) occurs.
4. The spring-loaded "hold-down" roller on the feed end of the lower slotting machine needs a new roller. A suitable size ball bearing may be used as replacement for the lost wheel.
5. In view of the additional machines which have been acquired to meet the increased machining needs of the planned expanded operations, it will become extremely necessary, within the shortest foreseeable future, **to formalize the creation of a maintenance section with over-all responsibility to keep the machines and the cutting tools in good operating condition.**

C. O t h e r    M a t t e r s

1. In order to help keep the machinery in good working condition at all times, it is suggested that a system be introduced whereby each piece of machinery is assigned under the responsibility of a worker who has been adequately trained on the proper use and maintenance of the machine. The system makes it mandatory for the responsible personnel to advise the Maintenance Section of the need to service his machine, and to allow only properly trained shop personnel to operate the machine. The responsible personnel will, of course, be given the ~~commensurate~~ authority to enable him to discharge his responsibilities properly.
2. A significant amount of glue is wasted during edge-gluing operations because the glue mix is too thick and a good amount of the glue is "squeezed-out" of the edge joint when pressure is applied on the joint. The proper consistency of the glue mix is such that it can be brushed on to the surfaces to be joined and the squeeze-out, if there is any, can be easily wiped off the surfaces with a moist piece of cotton cloth rag. This practice will also alleviate the heavy load placed on the planer or sanding machine when working on glued surfaces.

Lober Industries, Ltd.

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3. The bandsaw blade should **NOT** be kept under tension at the end of the working day. It should be loosened a little after working hours and re-tensioned before it is put in use again.
4. Similarly, sanding belts installed on machines, even portable sanders, should be loosened a little after the day's work is over. It should, of course, be re-tightened before the machine is used again.
5. The above are just examples of problems common to woodworking shops in developing countries. More of such problems will be dealt with during the second phase of the Project.

## II- OPERATIONS EXPANSION PLANS AND MACHINERY LAY-OUT

### A. Basic Assumptions and Considerations

The following target product lines are expected to be produced in the expanded operations programme:

#### 1. MOULDINGS

1,000 Bd. Ft./month, increasing gradually to 3,000 Bd. Ft./month, in a SPAN OF THREE YEARS, of any one or more of the following moulded products: baseboards, scorias, quarter rounds, railings/bannisters, etc. The longest piece is 18 ft., while the widest piece is 7 in. This Consultant was informed that the 4-side planer recently purchased in New Zealand is wide enough to handle the job.

#### 2. DOORS

Louvre Doors -----	30 pcs./mo.
Raised Panel Doors ----	20/mo.
Hollow-Core Doors ----	60/mo.
Solid Doors -----	20/mo.

#### 3. FURNITURE (All custom-made Office Furniture)

Desks (Solid Wood Construction)-----	5/mo.
Cabinets (Solid Wood Construction)---	2/mo.
Book Shelves (Solid Wood Const.)----	4/mo.
Tables (Solid Wood Construction)-----	4/mo.

#### 4. KITCHEN CABINETS

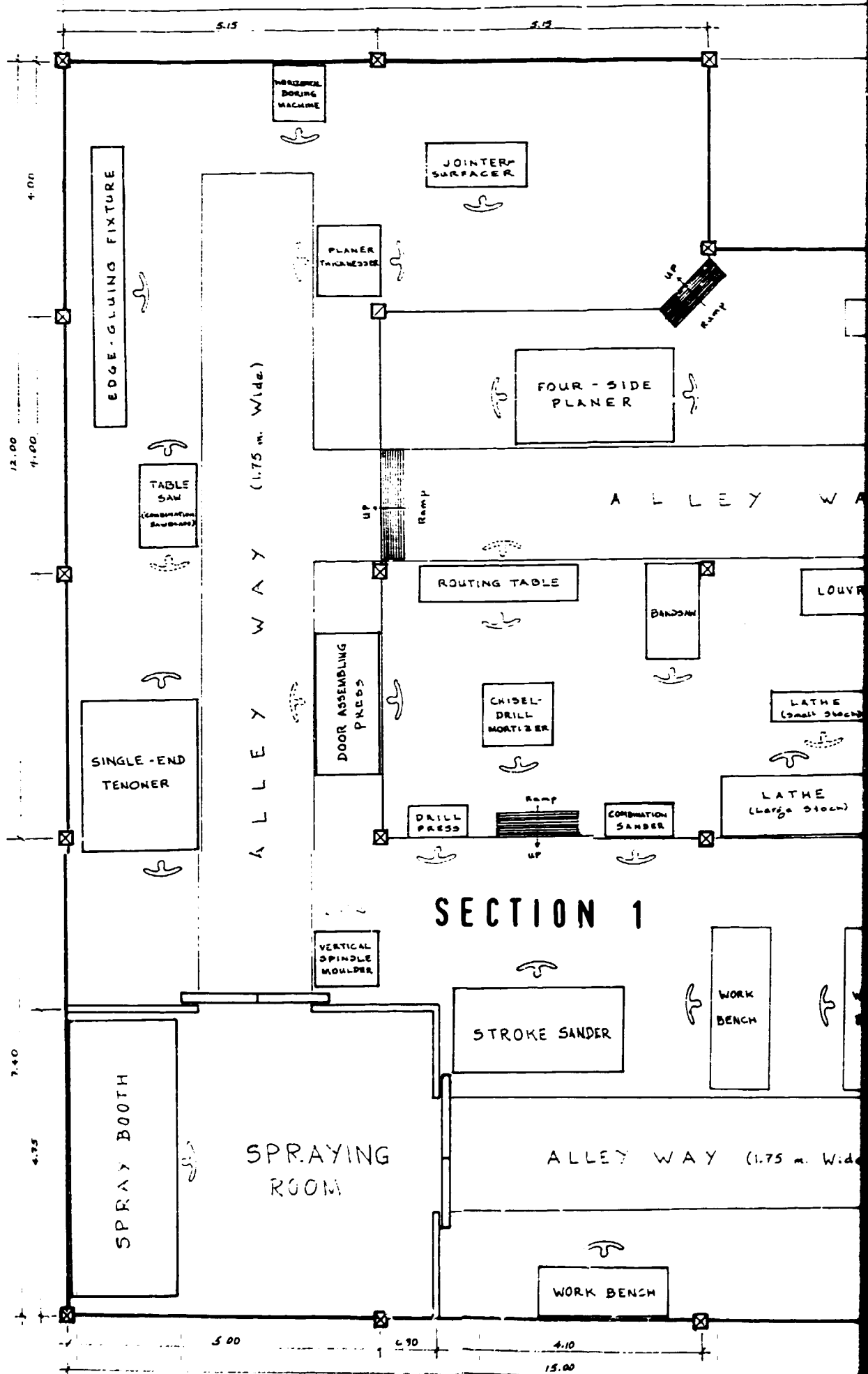
Solid Wood Framings, with Particle Board faced with Formica sheets-----	1 set/mo.
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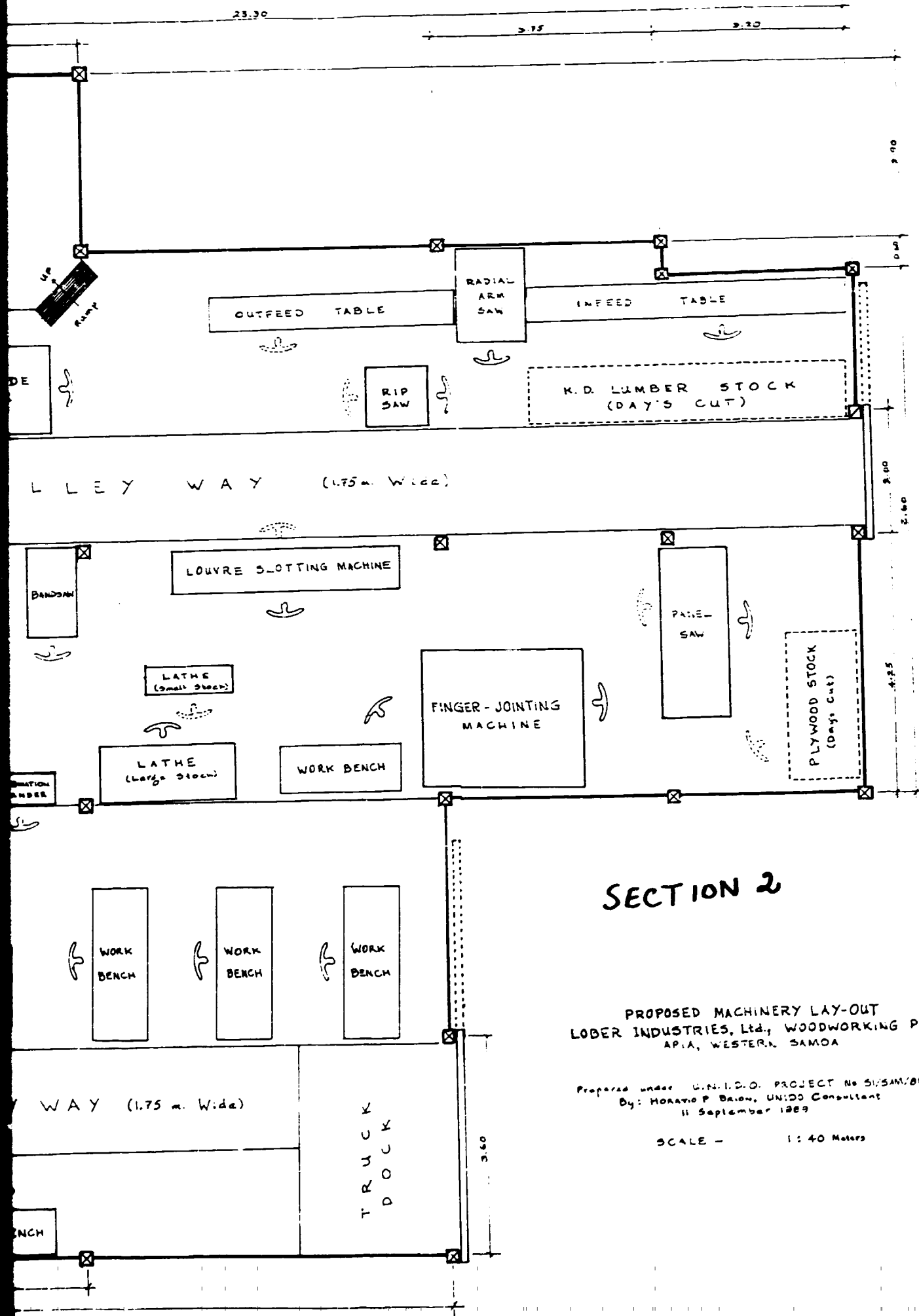
NOTE: All furniture items will be coated with clear or painted finishes.

B. Notes On and Limitations of Proposed Machinery Lay-out

1. The covered area of the shop will be increased by constructing a roof over a 4.75 x 15.00 m. area between the existing shop and the present office building.
2. A dry type of spray booth will be fabricated locally to fit the needs of the finishing operations. The spray dust will be exhausted into a still water through where the spray dust is expected to be caught on the water.
3. Transport of materials-in-process will be done with the use of production trucks, dollies, etc. These will be designed to be pushed through the 1.75m. wide alley ways identified on the lay-out plan.
4. A suitable industrial woodwaste extraction system will be designed, fabricated and installed to help dispose of the sawdust, sanding dust, shavings, etc. The centrifugal fan, silos and air-dust separators may be erected in the area just behind the cutfeed table (outside the present shop building).
5. The main constraint of the proposed lay-out is the relatively small area made available to the production of a widely diversified product line composed of furniture, joinery and builder's woodworks products. Thus, certain operations cannot be efficiently performed simultaneously (such as cutting to length on the radial arm saw and ripping for moulded products, among others). It is hoped that eventually a more compressed product line will be identified to allow more efficient production operations. Another alternative would be to separate the production line for furniture and joinery items from that for builder's woodworks (mouldings, doors, windows, etc.).
6. The allotted area for temporary storage is small. Hence, deliveries of finished goods to customers should be made within the shortest possible time from completion of the product.
7. Production operations should be based on the fabrication of a series of component parts of the end product, so that the number and frequency of machine set-ups will be kept to a minimum. This immediate objective may further be attained by the use of production jigs and fixtures designed and fabricated to be sturdy enough to last a desired number of production runs. In short, the concept of "SERIAL PRODUCTION" Technique will be applied to shop production operations.







# SECTION 2

PROPOSED MACHINERY LAY-OUT  
LOBER INDUSTRIES, Ltd., WOODWORKING PLANT  
A.P.A., WESTERN SAMOA

Prepared under U.N.I.D.O. PROJECT No SI/SAM/88/801  
By: HORATIO P. DAION, UNIDO Consultant  
11 September 1989

SCALE - 1 : 40 Meters

26 September 1989

Dear Mr. YOUNG,

Please find attached a list of some observations and suggested remedial actions which this Expert noted during the short visit to your woodworking factory last 11-13 September. It is sincerely believed that the indicated problems in your manufacturing facilities and operations be addressed immediately so that your firm may attain better quality products, and possibly, lower production costs.

Enclosed also please find the original tracings of the proposed factory lay-out for the expanded operations you plan to implement in the near future.

I shall be glad to discuss both of the above at your earliest convenience.

Please note that the above-described technical assistance services were provided your firm during the FIRST PHASE of UNIDO Project No. SI/SAM/88/801, through the UNDP-APIA (WESTERN SAMOA). The Second Phase of the Project will be undertaken early next year, March-April, possibly. It is sincerely hoped that some positive results should have materialized by then, so that more benefits may be attained by your firm during the transfer of technology activities planned for the second phase of the Project.

Yours truly,



HORATIO P. BRION

UNIDO Furniture Production Expert

Mr. STEPHEN F. YOUNG  
Managing Director  
S.F. Young Furniture and Construction  
Apia, Western Samoa

UNIDO PROJECT NO. SI/SAM/88/801

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TECHNICAL ASSISTANCE TO S.F. YOUNG FURNITURE AND CONSTRUCTION

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I- OBSERVATIONS AND FINDINGS

A. PRODUCTION OPERATIONS

There was minimal production activities at the factory during the three-day assignment to the firm. Only four workers were assigned to the shop, to complete some contracts for kitchen cabinet and wooden crutches. The rest of the shop personnel were assigned to assist the field carpenters in completing a RUSH construction job at a school run by a religious order.

Nevertheless, the production techniques observed were still typical of those encountered in woodworking shops in many developing countries. The machines were being used as tools rather than as industrial machines.

"Cupping" problems were encountered when edge-glued boards (with a total width of about 18 inches) were surfaced on one face. This Consultant suggested that both faces of each board should be surfaced on the planer-thicknesser before another board is fed into the machine. This technique proved successful in preventing the occurrence of "cupping", and was followed when surfacing the remainder of the batch of edge-glued boards.

"Heeling" was also noted at the end of the few boards planed when the Consultant arrived at the shop. Two units of improvised work-horses were fabricated out of wooden off-cut pieces. One work-horse was placed before the planer, while the other was placed at the outfeed end of the machine. These helped eliminate the problem of "heeling".

It can be presumed that similar instances in the firm's production activities could be improved by the introduction of production jigs and fixtures, or by simply applying basic woodworking concepts (such as the need for balanced evaporation of moisture from both faces of wide wooden boards, especially when they are machined in green condition).

B. GENERAL PLANT CONDITIONS

1. The extensive practice of storing off-cuts in any place within the shop indicates the need for better and more strict "HOUSEKEEPING PRACTICES". Aside from being veritable fire hazards the piles of off-cut timber occupy valuable floor space which could be put to better productive use.

## S.F. Young Furniture & Construction

2. The flow of "materials-in-process" is not clearly defined or traceable in the existing machinery lay-out. In fact, the kitchen cabinet was assembled and varnished in the machining area. This indicates that the existing machinery lay-out does not fit any more the product mix of the factory.
3. A number of machines were noted to be out of order and have been stored on the sides of the shop, without adequate cover. It is suggested that a little money be invested in cleaning these machines, cover them properly to prevent dust and other undesirable elements from settling on the precision parts of the machines. The best way to handle the situation, of course, is to repair the machines as soon as possible and put them back in the production line.
4. The stroke sander is in urgent need of repair and reconditioning works. The machine has degenerated into an ordinary hand sander, when with simple repair activities the machine can be made to work as it was designed for. This is another occurrence which indicates the need for a stronger floor level supervision.
5. The upholstery section has been confined to a very small and cramped area. It is believed that this operation merits more attention from management, merely for the reason that upholstery materials are all imported and expensive.

Note: Other areas for possible improvement will be identified and dealt with correspondingly during the second phase of this Project.

## II- OPERATIONS EXPANSION PLANS AND MACHINERY LAY-OUT

### A. BASIC ASSUMPTIONS AND CONSIDERATIONS

The principal objective of the expansion plans is to attain production outputs which are three times current output levels, in two years time from the grant of incentives by the government.

The expansion plans call for the establishment of production facilities for builder's woodworks and pre-fabricated housing components, distinct and separate from the furniture and joinery products manufacturing shop. Each division, from the financial point of view, will be **treated as separate profit centers.**

S.F. Young Furniture and Construction

An extension of the existing shop building will be built to provide a floor area equal to the current floor area of the furniture and joinery manufacturing shop. The furniture and joinery production operations will be moved into the new extension building, while the pre-fabricated housing components division will be installed in the area to be vacated by the furniture and joinery division. Facilities common to both divisions, such as K.D. or A.D. Lumber storage area, maintenance and repair shop, production office, workers' dressing and comfort rooms, etc. will be shared. Although production control and quality control activities will be separate for the two divisions, material management will be common unit to both.

B. EXPANDED PRODUCT LINES

At full operations level, two years from the time government incentives are approved, the expanded production facilities will produce the following product lines:

1. FURNITURE AND JOINERY PRODUCTS

<u>Item</u>	<u>Current Outputs</u>	<u>Proposed Outputs</u>
Lounge Sets (composed of 1 settee, 2 end chairs, 1 coffee table & 2 end tables).....	5 sets/mo.	15 sets/mo.
Dining Sets (1 table and 6,8 or 10 chairs).....	5 "	20 "
Bedroom Suite (1 double bed, 2 chests of drawers, 2 night tables, 1 dressing table w/mirror, dresser stool and 1 easy chair).....	4 "	12 "
Office Furniture:		
Desks.....	8 units/mo.	20 units/mo.
Executive Chair.....	8 "	24 "
Guest Chair.....	80 "	200 "
Doors (various types)....	16 "	40 "

2. PRE-FAB HOUSING COMPONENTS

(Based on the wooden requirements of a 2-room school building, 30 x 35 ft. floor area, with 35 x 60 ft. total ceiling area made of hardboard panels.)

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<u>Item</u>	<u>Current Outputs</u>	<u>Proposed Outputs</u>
Structural Components : (trusses, beams, purlins, ceiling joists, floor joists, etc.).....	7,171 B.F. per year	42,026 B.F. per year
Interior/Exterior Sub- assemblies: (Doors & door jambs, windows & window jambs, parti- tions, sidings, etc.)....	551 B.F. per year	3,306 B.F. per year
Moulded Components : (base- boards, T & G Flooring, Stone-cut/ V-cut boards, railings/bannisters, etc.).....	655 B.F. per year	3,930 B.F. per year

C. OPERATING CONDITIONS AND LIMITATIONS

In view of the large volume of sawn timber that will be processed by the two manufacturing divisions, it is deemed necessary to maintain the following conditions and observe the listed limitations in order to maximize the utilization of the manufacturing facilities and attain the stated production targets, both as to quality and quantity:

1. Jobs requiring highly skilled personnel will have to be filled with foreign recruits, in the anticipated lack of qualified personnel from local sources
2. Floor level supervision will be strengthened and middle level management will be created in the firm's table of organization.
3. The repair and maintenance section will be formalized as a supporting unit to production operations and adequately trained personnel will be chosen to man the section.
4. Product and production standards will be developed and eventually used as the basis for the installation of effective quality and production control systems for both divisions of the firm.
5. Materials-in-process will be transported from one work station to the next using production carts, dollies, trolleys, etc. specifically designed for the purpose.

**S.F. Young Furniture and Construction**

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6. Unless a warehouse is erected for finished goods produced by the two divisions of the firm, the relatively small space allocated for intermediate storage of finished goods require that delivery of finished goods to customers be made as frequently as possible in order to avoid congestion of the storage areas.
7. Two separate dust/shavings/chips extraction systems will be designed, fabricated and installed, one in each of the manufacturing divisions. The dust air separators, silos, centrifugal fans, etc. however, will be installed in a common area outside the shop building as indicated in the lay-out prints.
8. A second floor will be constructed over the existing office area. Fabrication of upholstered furniture components will be located in the second floor of the remodeled building. Any upholstered component which require assembling to the woodworks component of the furniture product will be attached to the wooden component in the area indicated in the lay-out prints.
9. Extensive use of production jigs and fixtures will be the key to attaining the desired output and quality levels of the finished products. Standardization of product design will help keep the quantity of such jigs and fixtures to a desirable level. Standard jigs (and some fixtures) will be stored in the stockroom and will be issued to production personnel in the same manner as production tools.



19.65

LUMBER AIR-DRYING AREA

CONCRETE ALLEY WAY (1.8

ALLEY WAY (1.8 Meters Wide, Indoors)

ASSEMBLING BENCH  
(6 Units, 0.914 x 2.44)

VERTICAL SPINDLE MOULDER

TILTING TABLE SAW

PLANER THICKNESSER

CHISEL-DRILL MORTIZER

DRILL PRESS

FOUR-SIDE PLANER

SINGLE-END TENONER

ALLEY WAY (1.8 Meters Wide)

# SECTION 1

TABLE SAW (RIP)

JOINTER SURFACER

OUTBED TABLE

5.00  
3.20

1.80

← TO MAIN GATE

3.05

4.93

1.90

ALLEY WAY (1.8 Meters Wide)

OFFICE

MAIN

10.90  
9.26

3.05

3.05

3.05

3.05

30.50

1.80

6.00

4.00

AREA

AREA FOR INSTALLATION OF SILOS, AIR/DUST SEPARATORS & CENTRIFUGAL FANS OF WOODWASTE EXTRACTION SYSTEM

A Y (1.8 Meters Wide, Outdoors)

MAINTENANCE SHOP and TOOL GRINDING ROOM

FINISHED GOODS INTERMEDIATE

ING BENCHES

0.914 x 2.44m

CABINET & SHELVINGS

WORK BENCH (2.4 x 1.83m)

POWER HACKSAW

STRAIGHT-KNIFE GRINDERS

CIRCULAR & BANDSAW BLADE GRINDING MACHINE

DRILL PRESS

AIR-COMPRESSOR

Guiding patch doors

ALLEY WAY (1.8 Meters Wide)

DRILL PRESS

HORIZONTAL PANEL-SAW with Sliding Table Attachment

PANEL BOARD STOCK (Day's Cut)

LOUVER SLOTTING MACHINE

SECTION 2

K.D. & A.D. LUMBER MAIN STORAGE AREA

ALLEY WAY (1.8 Meters Wide)

Meters Wide)

A.D. (or K.D.) LUMBER STOCK (Day's Cut)

WORKERS' DRESSING & COMFORT ROOMS

PERSONNEL PASSAGE-WAY

PERSONNEL PASSAGE-WAY

FEED TABLE RADIAL ARM SAW INFEED TABLE

3.05

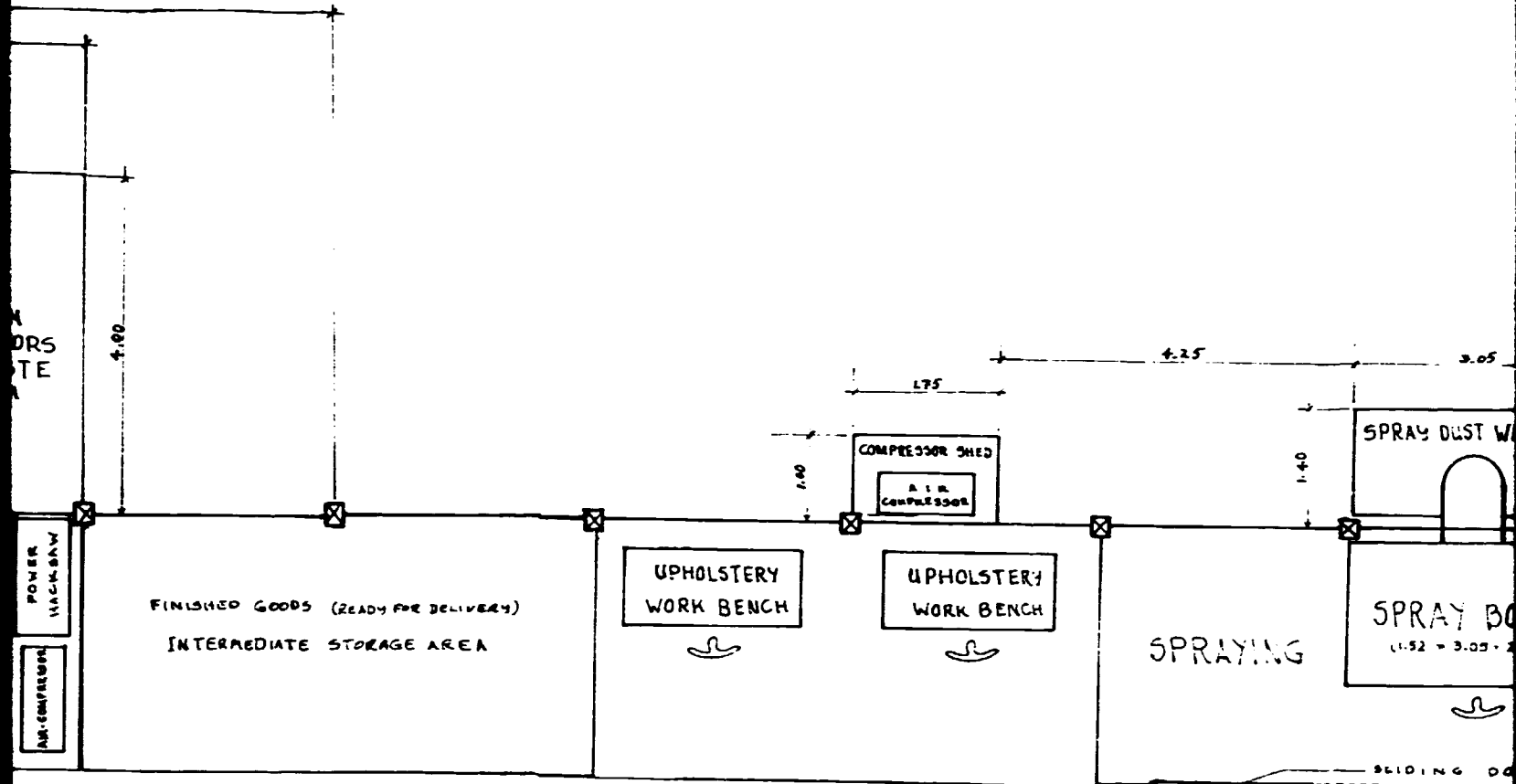
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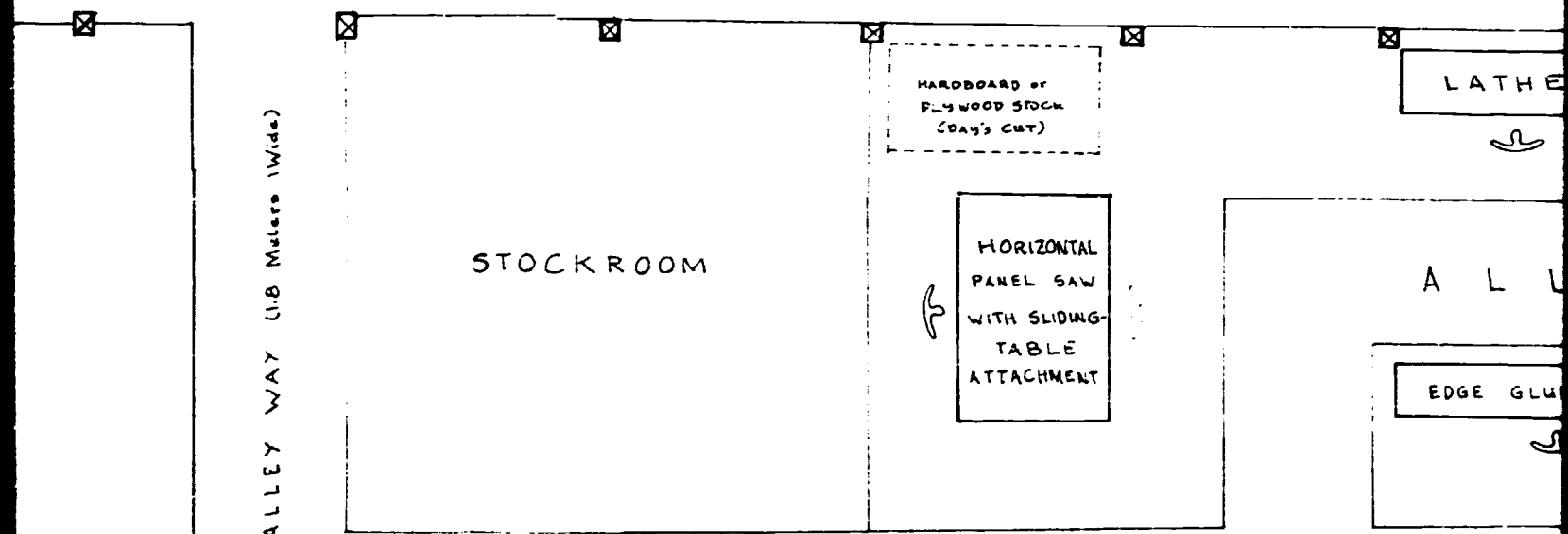
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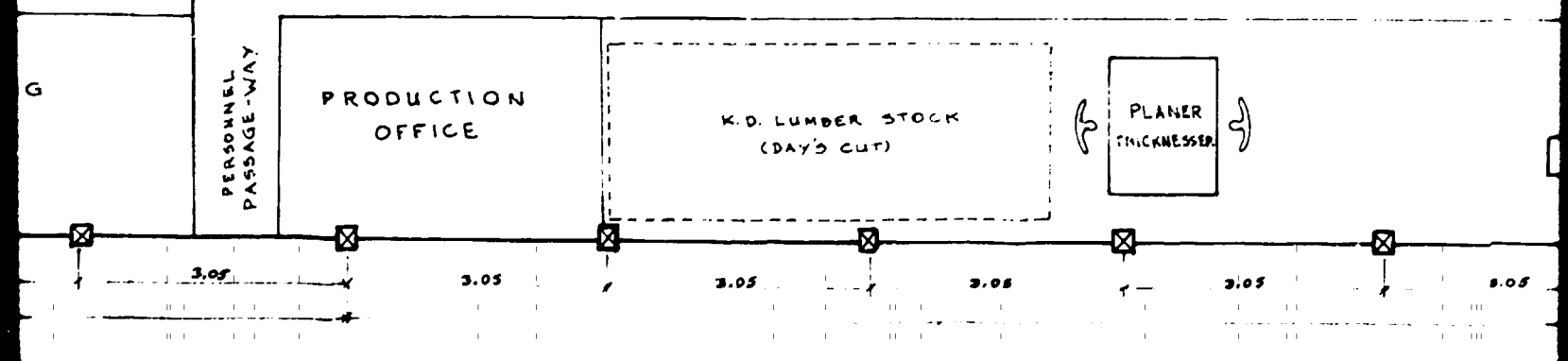


A L L E Y



**SECTION 3**

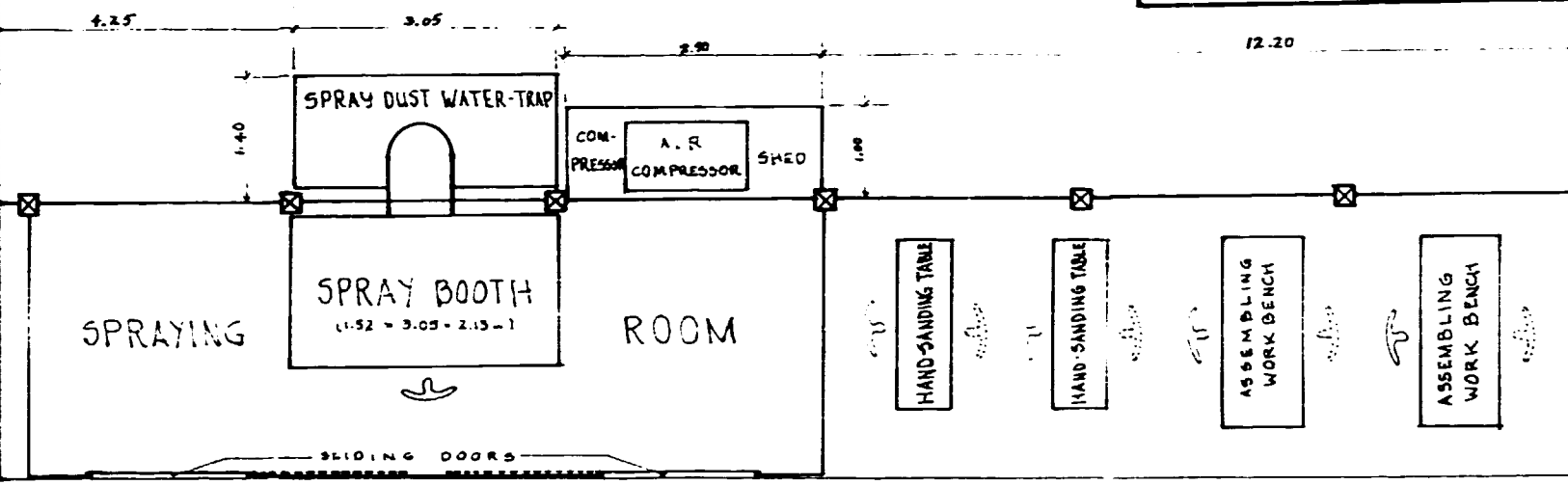
A L L E Y



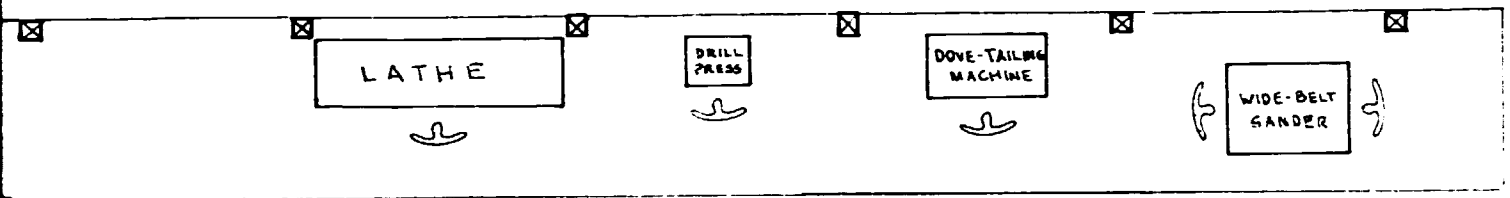
PROPOSED WOODWORKING FACTORY  
 S. F. YOUNG FURNITURE and CONST  
 FAATOLA VILLAGE, MATAUTU-UTA, A.P.A. NES

Prepared under U.N. E.D.O. PROJECT No. 1  
 By: HORATIO P. BRION, UNIDO Co  
 16 September 1989

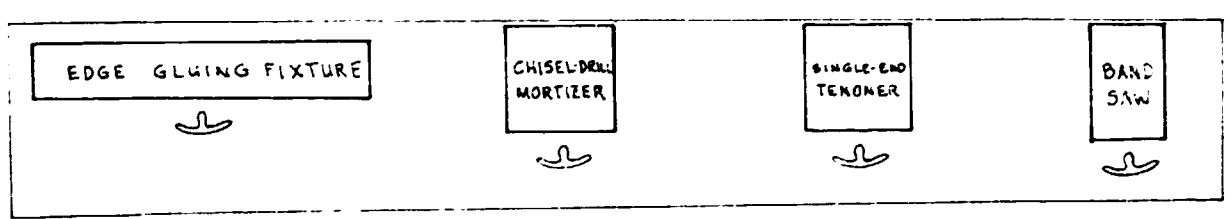
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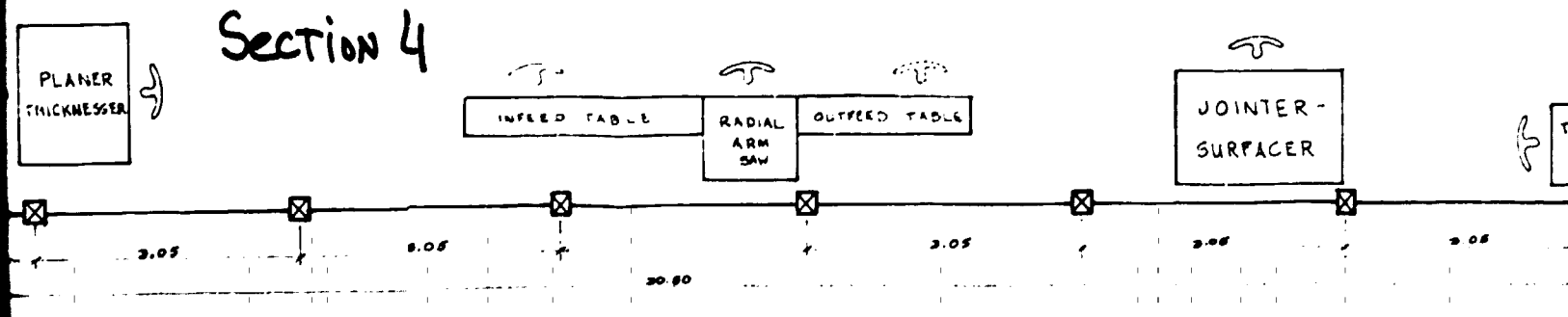


A L L E Y W A Y (1.8 Meters Wide)



E Y W A Y (1.8 Meters Wide)

Section 4

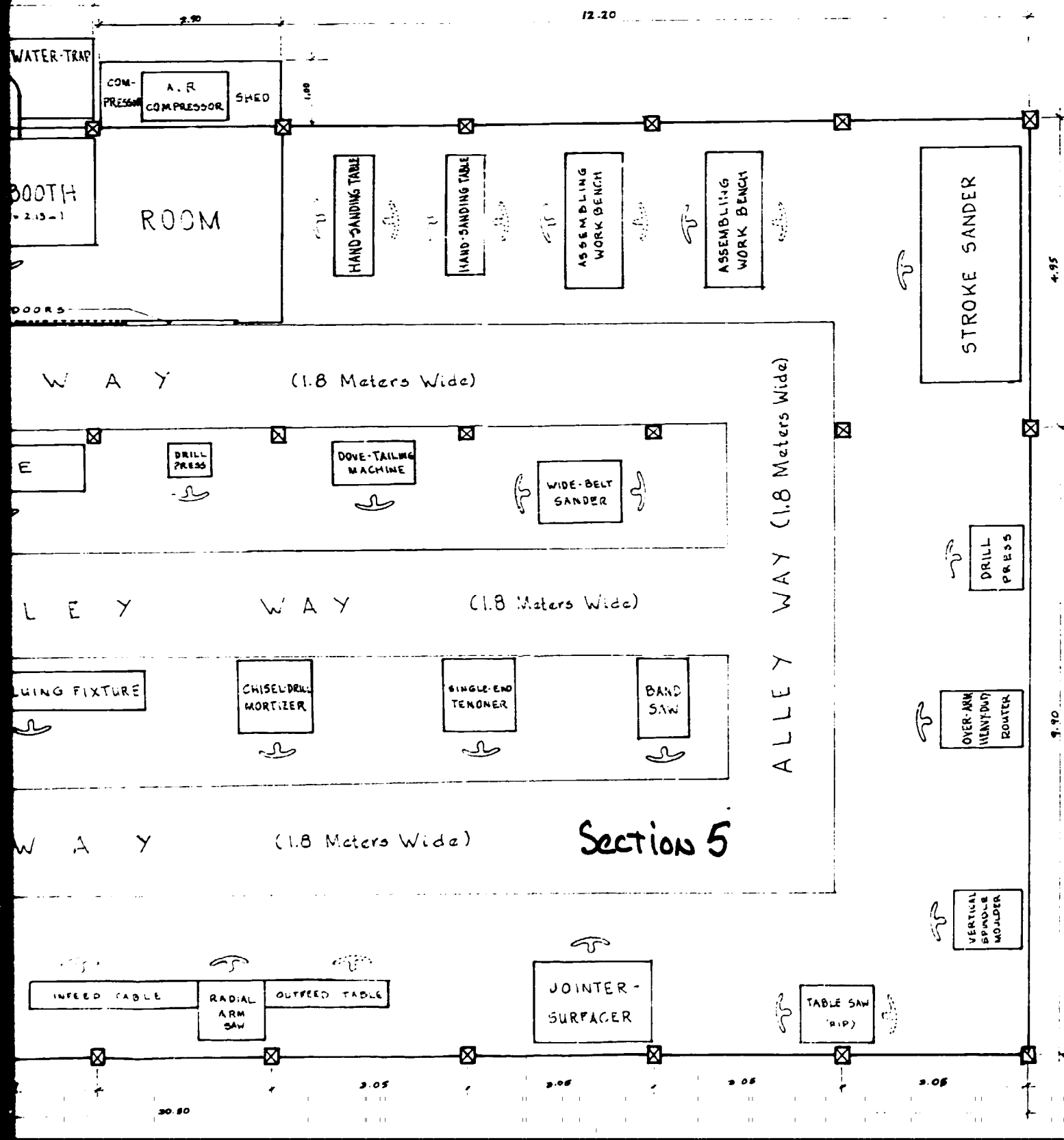


ALLEY WAY (1.8 Meters Wide)

PROPOSED WOODWORKING FACTORY LAY-OUT  
 S. F. YOUNG FURNITURE and CONSTRUCTION  
 FAATOIA VILLAGE, MAFAATU-UTA, APA, WESTERN SAMOA

Prepared under U.N.I.C.E.D. PROJECT No. 91/SAR/88/801,  
 By: HORATIO P. BRIGON, UNIDO Consultant  
 16 September 1989

Scale - 1:40 Meters



Section 5

27 September 1989

Dear Mr. LIU,

Please find enclosed the original tracing of the proposed RE-LAY-OUT of your machinery and equipment which you and I have agreed to be urgently necessary to the new product lines which have developed encouraging market demands recently, and which the original machinery lay-out of your woodworking shop is not capable of producing efficiently.

I have also listed (on the attached sheet) some findings during my short visit to your sawmilling shop 14-15 September in the hope that they may be of use in improving your sawmilling operations.

I shall be glad to discuss both of the above at your earliest convenience.

Please note that the above-described technical assistance services were provided your firm during the FIRST PHASE of UNIDO Project No. SI/SAM/88/801, through the UNDP-APIA (Western Samoa). The Second Phase of the Project will be undertaken early next year, March-April, possibly. It is sincerely hoped that some positive results should have materialized by then, so that more benefits may be attained by your firm during the transfer of technology activities planned for the second phase of the Project.

Yours truly,



HORATIO P. BRION  
UNIDO Furniture Production Expert

Mr. PATI LIU  
Manager and Secretary  
Coconut Wood Products, Ltd.  
Vaitele, Apia, Western Samoa

UNIDO PROJECT NO. SI/SAM/88/801

TECHNICAL ASSISTANCE TO COCONUT WOOD PRODUCTS, LTD.

I- OBSERVATIONS AND FINDINGS

Among the three operating units, only the sawmill was in operation during the 14-15 September visit to the firm's wood processing plant in Vaitele. The volume of work at the sawmill appeared to be much less than what it was when this Consultant visited the mill in January, 1988.

A. Sawmilling Operations

Fencing materials were being cut on the main saw and then re-sawn on the second circular saw to remove the soft portion of the coconut wood slab. The coconut stems being milled were of small diameters (approximately 150mm to 250 mm. diameters).

Both circular saws were noticed to "wobble" slightly when the coconut slabs were pushed against them. A brief check was conducted and showed that both saw blades were not uniformly leveled and/or tensioned. This situation was called to the attention of the Plant Manager, with the advice that the use of inadequately serviced sawblades could be one of the major reasons why the milling operations extract more power than it should normally do from the power take-off unit of the tractor engine driving the saws.

It was further suggested that a re-layout of the two circular saws to make them installed "in tandem" rather than abreast, as they are now, may help facilitate a more efficient sawmilling run.

B. Woodworking Operations

In view of the near possibility that kiln-drying facilities might be erected in the compound at Vaitele, the Plant Management was asked what sort of product lines it intended to produce at the woodworking plant. The following product mix, together with their corresponding target volumes, was furnished the Consultant, with the request that the existing machinery lay-out be reviewed and revised, if necessary, to allow the smooth production of the listed products:

<u>Products</u>	<u>Monthly Target Output</u>
Ship-lap boards (1" x6"x10").....	650 pcs.
S 4 S boards (1"x6"x12").....	400
Flooring boards (1"x6"x10").....	400 pcs.
Shingles (3/8"+3/4"x4"x18").....	1,000 pcs.

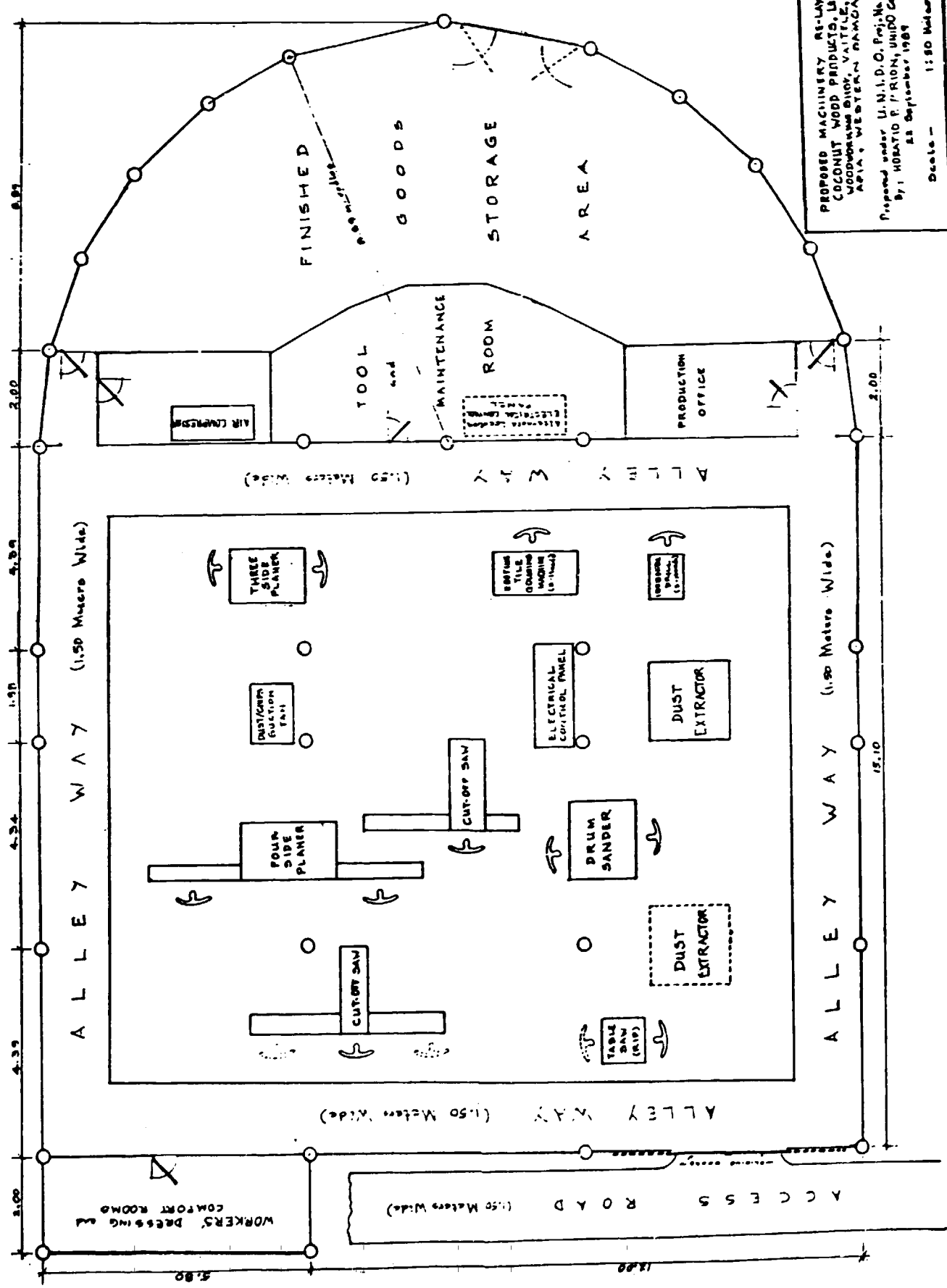
It appears that the existing machinery lay-out correspond primarily to the production of roofing tiles (with two parallel gouged canals in the center), with the four side planer installed in its present location without any bearing at all to the rest of the machinery on the shop floor. The accompanying lay-out prints is suggested to allow the production of the listed product mix and target output volumes, above.

1. The Proposed Machinery Lay-out

The table saw (with a rip saw blade) and the cut-off saw are located to rip to width and desired length all rough stock intended to be run through the 4-side planer (to produce moulded items) and the 3-side planer (to produce roofing shingles and tiles).

2. Fabrication of **box-planing** jigs will allow the use of the 3-side planer to obtain the desired taper on the wide surfaces of the shingles. Sketches of the "box-planing" jig were prepared and furnished the Plant Manager of Coconut Wood Products, Ltd.
3. Should the demand for Roofing Shingles increase to levels above the capacity of the 3-side planer to produce, it is also possible to do so with the use of the drum sander. This operation will require the use of 100 Grit sanding belt, and the same "box-planing" jigs, as mentioned above. It is recommended that three units of "box-planing" jigs be fabricated for each of the two machines to be used to obtain the desired taper on the shingles.
4. As in any precise woodworks machining operations, the extraction of saw/sanding dust and shavings from the operating machines is vital to the attainment of the desired level of precision. The dust extractor for the drum sander is self-containing. However, a proper disposal system for the 4-side and 3-side planers is necessary. The centrifugal fan unit for the system is already available. Corresponding air/dust separator units (cyclones), ductings and silos should be designed, fabricated and installed to extract the wooden residues of the two units of multi-sided planer.
5. A 1.50 meter alley way has been provided for the transport of materials-in-process from one work-station to the next. Thus, the design, fabrication and use of appropriate transport carriages becomes necessary. Such transport vehicles may be in the form of production carts, dollies, trolleys, etc.





PROPOSED MACHINERY RE-LAY-OUT  
 COCONUT WOOD PRODUCTS, LTD.  
 WOODWORKING DIV., VAITALE,  
 APPIA WESTERN SAMOA.  
 Prepared under U.N.I.D.O. Proj. No. 514/514/514/514  
 By: ROBERTO P. PERON, UNIDO Consultant  
 28 September 1969  
 Scale - 1:50 Meters

22 September 1989

Dear Mr. STRICKLAND,

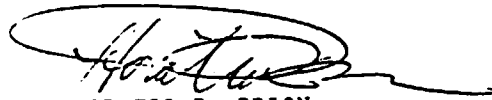
Please find attached a list of suggestions on your facilities and operations, which I deem worth addressing at this early stage in your production operations.

Enclosed also please find the original tracing of the proposed factory lay-out in connection with your plans to transfer your rattan furniture manufacturing operations to a larger tract of land located across the main road from your present location.

I shall be glad to discuss both of the above at your earliest convenience.

Please note that the above-described technical assistance services were provided your firm during the FIRST PHASE of UNIDO Project No. SI/SAM/88/801, through the UNDP-APIA (WESTERN SAMOA). The Second Phase of the Project will be undertaken early next year, March-April, possibly. It is sincerely hoped that some positive results should have materialized by then, so that more benefits may be attained by your firm during the transfer of technology activities planned for the second phase of the Project.

Yours truly,



HORATIO P. BRION  
UNIDO Furniture Production Expert

Mr. JOE STRICKLAND  
Managing Director  
Strickland Brothers, Ltd.  
Apia, Western Samoa

UNIDO PROJECT NO. SI/SAM/88/801

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TECHNICAL ASSISTANCE TO STRICKLAND BROTHERS, LTD.

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I- **OBSERVATIONS AND FINDINGS**

The firm is engaged in the manufacture of rattan (cane) furniture products, on a cottage industry level of operations. All raw materials are imported. Large diameter rattan poles (12 ft. long) are imported at the rate of 300 poles every two months. Other rattan materials (binding strips, decorative cane, etc.) are imported at the rate of 75 kgs. every two months. The firm employs three regular workers and is provided technical support by a brother of the Managing Director who operates a car repair shop.

1. **Production Operations**

The end products show the highly manual method of fabricating rattan furniture components. Rail ends in T-joints are cut straight, instead of being gouged to make a coping. Small diameter rattan sticks are split into half-round slats to provide material for seats and back rests of chairs. The fibrous core of the half-round pieces are later smoothed by burning off the loose fibers with the use of a manual burner fueled by bottled liquified petroleum gas (LPG). Bindings are completed and tucked under the binds without any effort at hiding the free end of the binding material, which is then held fast to the rattan rail with the aid of a stapling machine. Bending and shaping long rattan poles into desired shapes is done with the aid of the LPG burner. Thus, sharp curves on chair designs are not possible without the tendency of the cane to collapse on the inner side of the curve. The end result are creases on the inner faces of the curved furniture component. Finish coating is invariably clear varnish which does not do anything at all to help hide the natural defects characteristic of low grade rattan poles.

Production is carried on a "Job Order" basis. Thus, wastage of the raw material is forced upon the manufacturer as he is denied of the economies of scale which is found in "serial production". This is aggravated by the fact that only one length of rattan poles is available to the worker.

This situation was discussed with the Managing Director, who agreed with the Consultant that the following moves may help improve the quality of his product and increase the production output:

- i- The design, fabrication and use of an appropriate type and size of boiler generator and steaming chamber which will help make the rattan poles more pliable;

- ii- The use of metal components in the fabrication of bending jigs for furniture parts which are repetitively used in many furniture designs;
- iii- Tucking and stapling of binding ends in locations on the joints which are not easily visible to the eye;
- iv- The acquisition of chisel gouges to cut a coping on the end of components of T- or L- joints. The coping will strengthen the joint and make it more pleasing to look at; and
- v- The use of the UNIDO Manual on Rattan Furniture Production (ID/299) for basic designs of rattan furniture pieces. (The Managing Director has a copy of the Manual, courtesy of UNIDO, which was distributed among the participants in a recent seminar-workshop on rattan furniture production held in Jakarta, Indonesia.)

## 2. Materials Sourcing

Importation of the principal rattan materials present a big barrier to the production of furniture at reasonably lower costs. The apparent solution to this basic problem is to look for, and use, locally available substitutes for the imported materials. Inquiries from knowledgeable Samoans indicated the potential usefulness of local plants, such as **LAFO** and **MANIUNIUI**, in the manufacture of rattan furniture.

A small quantity of **LAFO** was procured and converted into 1/4 inch wide strips. Half of the quantity of strips thus produced were woven into simple matting, criss-cross weave to make 3/4 inch squares in alternating directions. The remainder of the strips were air-dried for five days and then woven in the same manner as the "green" strips. At the time of this writing, the matting woven from "green" **LAFO** strips showed acceptable appearance after it has also dried up in the woven form. Gaps between the dried strips as a result of the drying process, if there were any, were not readily visible to the eye. It was agreed between the Consultant and the Managing Director of the firm that the next step would be to test the painting/varnishing properties of the material. Similar tests using **MANIUNIUI**, are planned to be conducted during the next few weeks, as soon as the material is made available from the neighboring island of **SAVAI**.

Further reports on the sighting of vines which look like rattan, **CALAMUS** family, on the western ridges of the mountain ranges of **Savaï**, and in the forests on the eastern tip of the main island of **Upolu**, in the vicinity of **Aleipata**, have been received recently. It is planned to check this information in the next two weeks.

Strickland Brothers, Ltd.

3. Steam Generator and Steaming Chamber

A set of steam generator (boiler/furnace) and steaming chamber was designed, using locally available used materials, like 10-gal lon drums and mild steel pipes, The design and corresponding Bill of Materials are attached. (Note: Completion of the furnace design awaits the size of the fire bricks which were still unavailable at the time of writing.

II- OPERATIONS EXPANSION PLANS

On the basis of increasing local demand for rattan furniture, and in the hope that the shop may eventually produce rattan furniture for export, the Managing Director requested assistance in the development of a lay-out of the production facilities needed for the following target output:

i-	Lounge Suites (composed of 1 twin Settee, 2 single Chairs and 1 glass-topped Coffee Table).....	60%	of	Total	Output
ii-	Coffee Tables (singles).....	25%	"	"	"
iii-	Dining Sets (Sets for 4).....	15%	"	"	"
iv-	Shelvings (various designs).....	10%	"	"	"

It is hoped to increase output levels at about 3 times the current volume, within the next three years; and double them during the following five years.

The new factory will be located in the family lot across the main road.

The attached lay-out is recommended to meet the production targets set by the firm. Final choice of machine and equipment await the results of the test on local materials, and the outcome of the search for rattan in Western Samoa. The process flow corresponding to the proposed lay-out has been explained to the Managing Director.

STRICKLAND BROTHERS, LTD.

-----  
**BILL OF MATERIALS --- BOILER & STEAMING CHAMBER**  
 -----

I. STEAM GENERATOR SYSTEM

A. FURNACE (Wood-Fired)

	<u>Qty.</u>	
1. Ordinary Fire Bricks, ___ x ___ x ___	-----	pcs.
2. Mortar Powder Mix, _____ lbs/bag	-----	bags
3. Cement, _____ lbs./bag	-----	bags
4. Sand	-----	cu. ft.
5. Gravel	-----	cu. ft.
6. Grating, 1/2" dia. Round Bar, 20ft.	-----	pcs.
7. Fire Door/Ash Pit Door:		
a) 1" Angle Iron, 20 ft. long	-----	pcs.
b) 3/16" Mild Steel Plate, 4' x 8'	1	pc.
c) Hinge, improvised (see design)	2	sets

B. BOILER TANK

1. Body, 14" dia. mild steel pipe	4	ft.
2. End Plates, top & bottom		(Use part of I-A-7t)
3. Pressure Gauge, Max. Rdg. 250 psi	1	ea.
4. Steam Exhaust Valve (gate), 1"	1	ea.
5. Safety Valve, 60 psi read directly on gauge, maximum setting possible at 100 psi, maximum reading above 200 psi, graduated at 2 psi (if available)	1	ea.
6. Steam Exhaust Coupling, 1"	1	ea.
7. Steam Exhaust Nipple, 1" dia. x 3"	1	ea.
8. Water Inlet Valve, 1/2"	1	ea.
9. Water Inlet Coupling, 1/2"	1	ea.
10. Water Inlet Nipple, 1/2" dia. x 3"	1	ea.
11. Mounting Fins, 4 pcs.		(Use part of I-A-7)

II. STEAMING CHAMBER

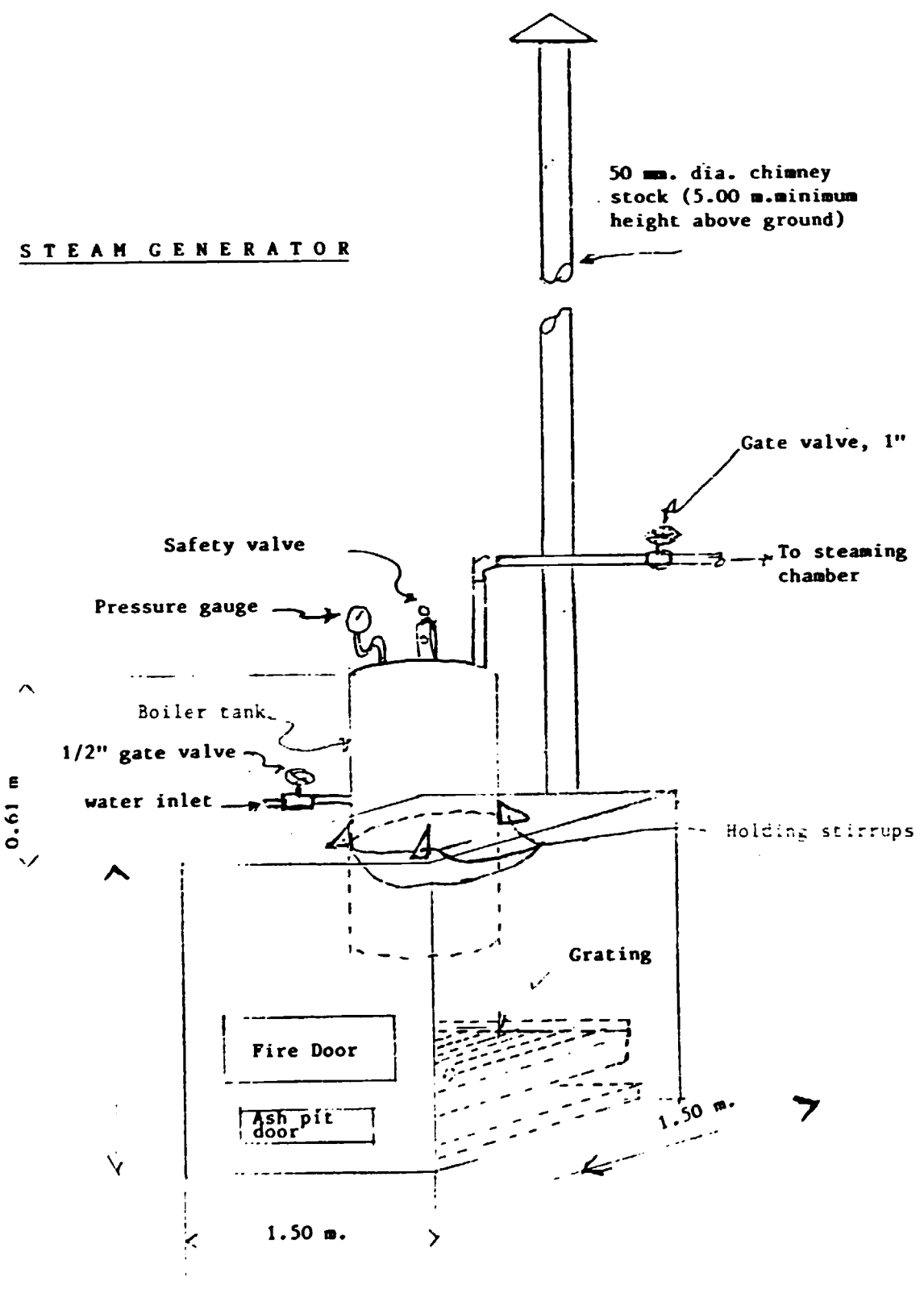
A. Chamber Tank, end-to-end welded 15" dia. x 24"H drums	6	pcs.
B. End Plate, 3/16" T x 24" dia.	1	pc.
		(Use part of I-A-7t)

Bill of Materials, page 2

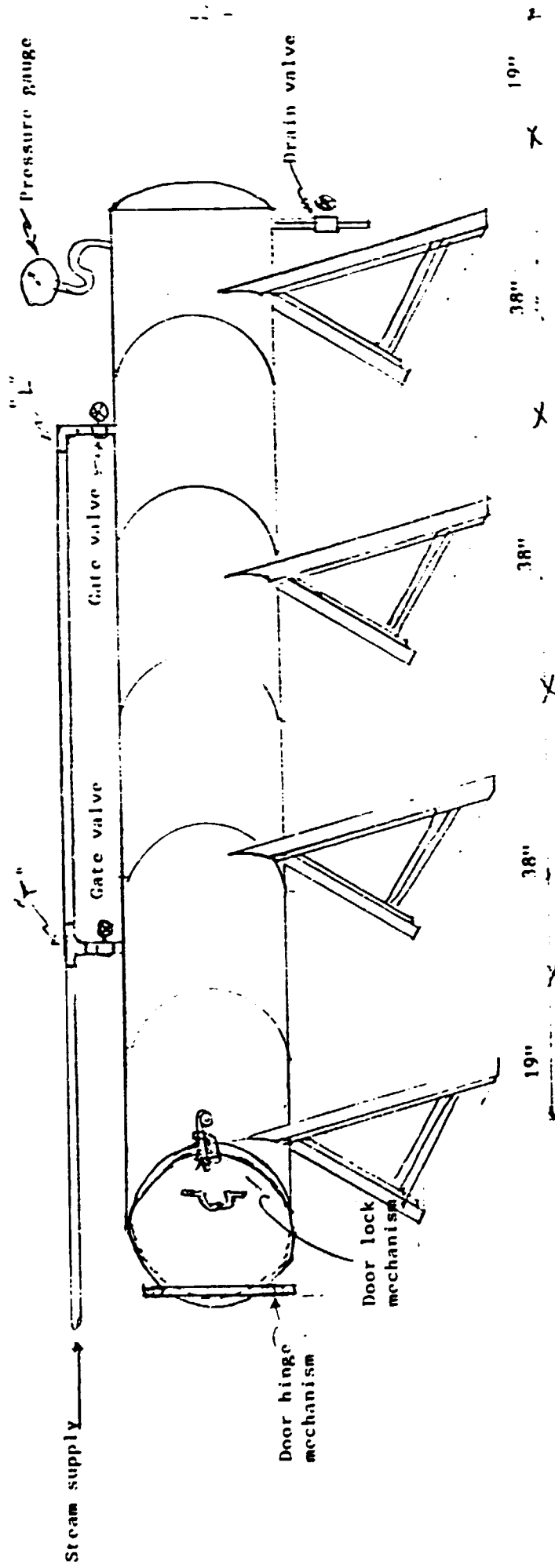
	<u>Qty</u>	
<u>C. Front Door Assembly</u>		
1. Door Plate, 3/16" x 26" x 26"	1	pc.
2. 1" Angle Iron Frame/Plate Lip, 2 sets, made from 20 ft. bars	1	pc.
3. Hinge, improvised (see Design)	1	set
4. Door Locking Device, improvised (see Design)	1	set
<u>D. Legs</u>		
1. Uprights (8 pcs.) made from 2" . angle iron bars, approximately 4 ft. each pc. at 30 deg. slant	2	lengths
2. Cross-rails, 4 pcs., length to fit straddle of legs		(use portion of II-D-1)
E. Pressure Gauge (as in I-B-3)	1	ea.
F. Steam Inlet Valve (gate), 1"	2	ea.
G. Steam Inlet Coupling, 1"	2	ea.
H. Steam Inlet Nipple, 1" dia. x 3"	2	ea.
I. Steam Inlet "T", 1"	1	ea.
J. Steam Inlet, "L", 1"	1	ea.
K. Steam Delivery Pipe, 20Ft. x 1" dia	2	pcs.
L. UNION Fitting, 1" dia., Steam Delivery Line	1	pc.

NOTE: If pcs of 3/16" plate are still available, cut 8 pcs.  
4" x 4" plates to be welded as bearing plates at the  
ends of the legs.

Note: All drawings are not to scale.

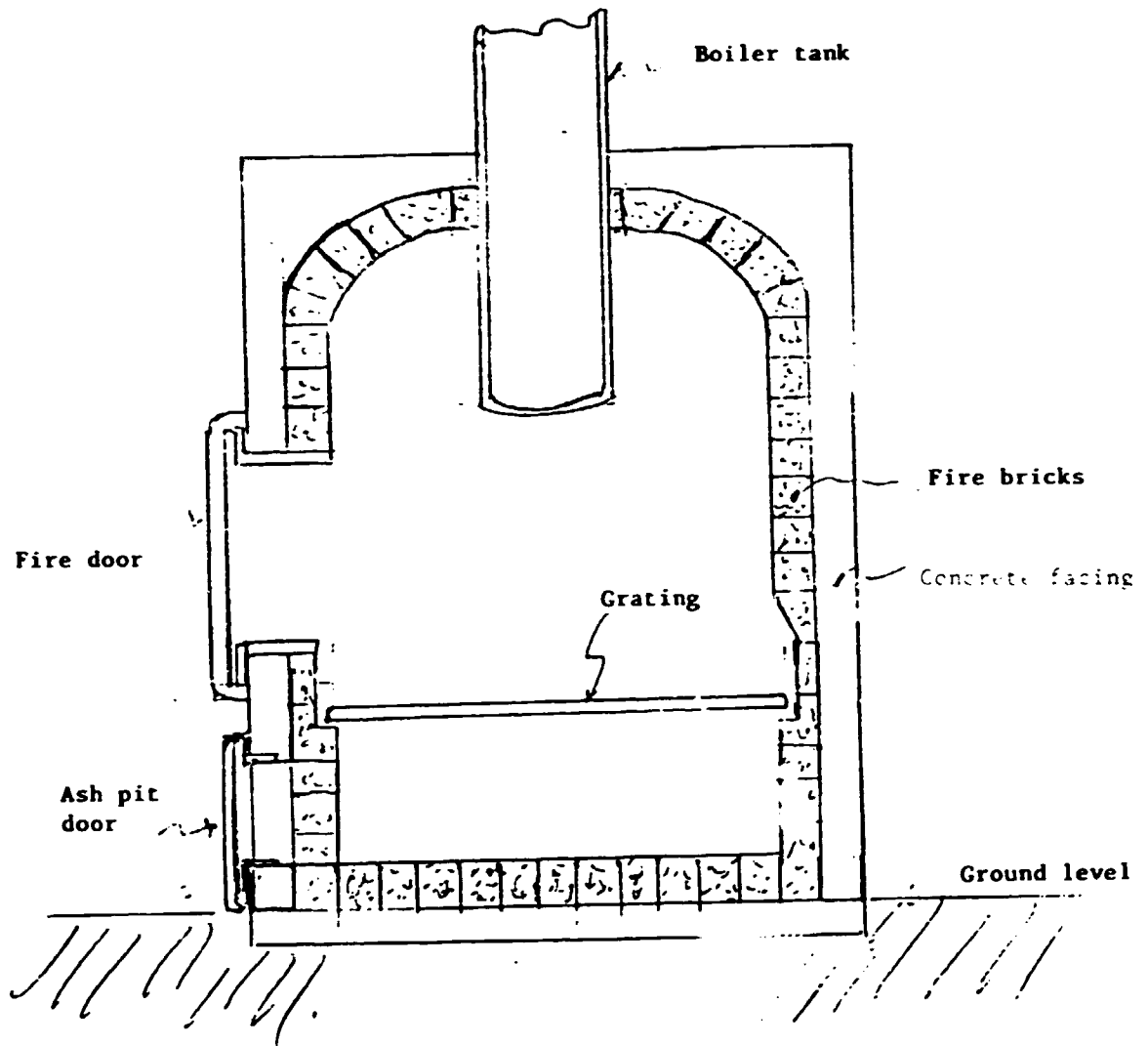






STEAMING CHAMBER

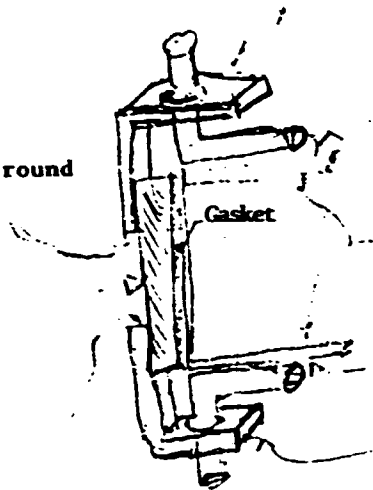
15" dia. x 166" L



SKETCH OF FURNACE  
CROSS SECTION

1 1/2" Flat bar drilled to take  
3/4" dia. round bar.

Lull Weld all around



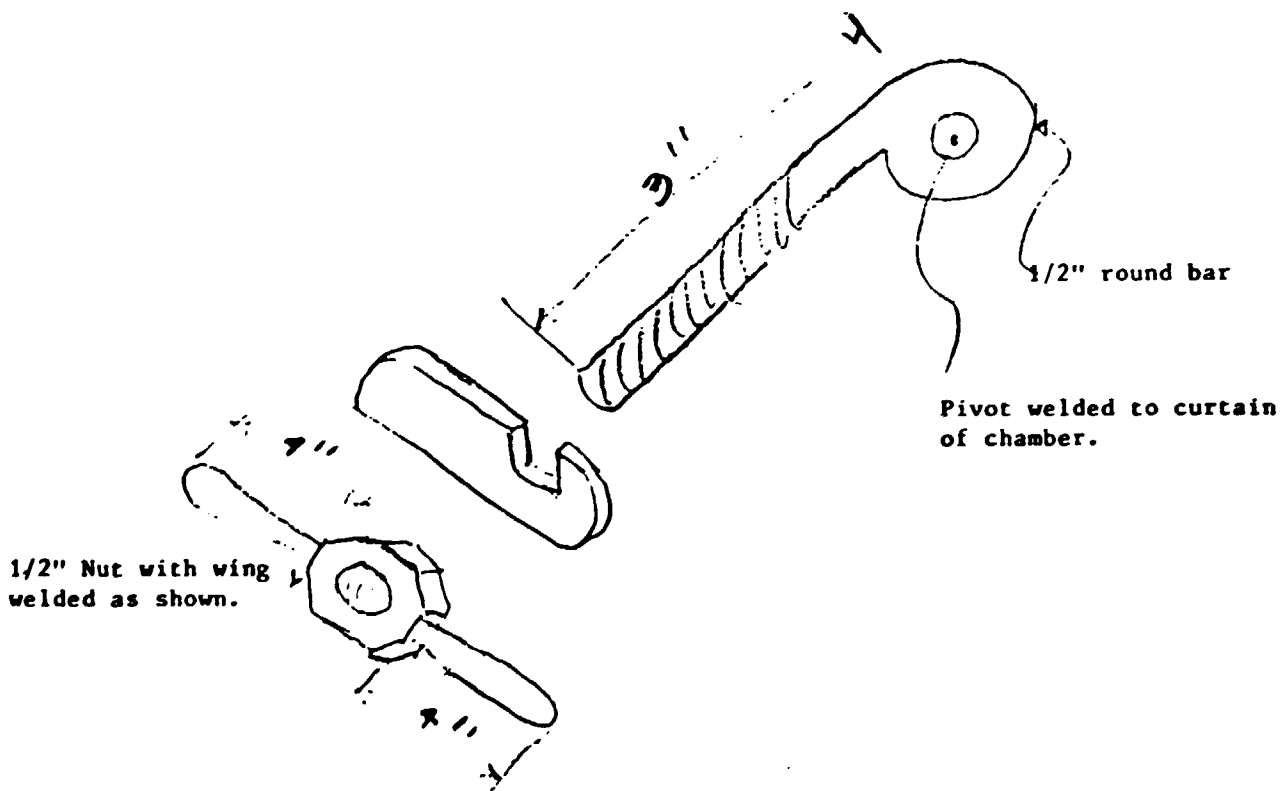
Full weld all around.

Steaming chamber wall.

Full weld all around

1 1/2" Flat iron bar drilled to take  
3/4" dia. round bar.

DETAILED SKETCH OF DOOR HINGE, STEAMING CHAMBER

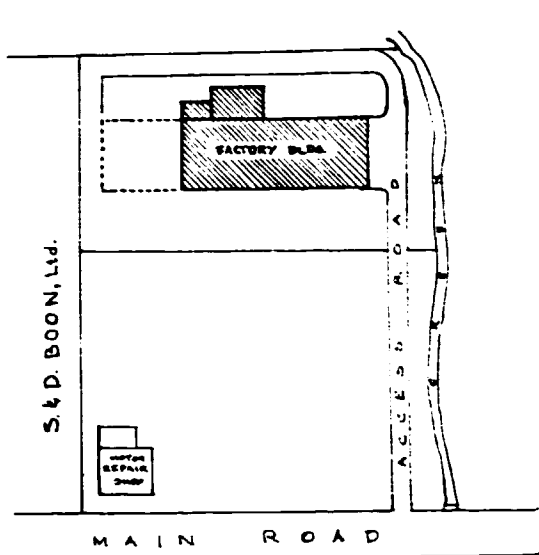


1/2" round bar

Pivot welded to curtain  
of chamber.

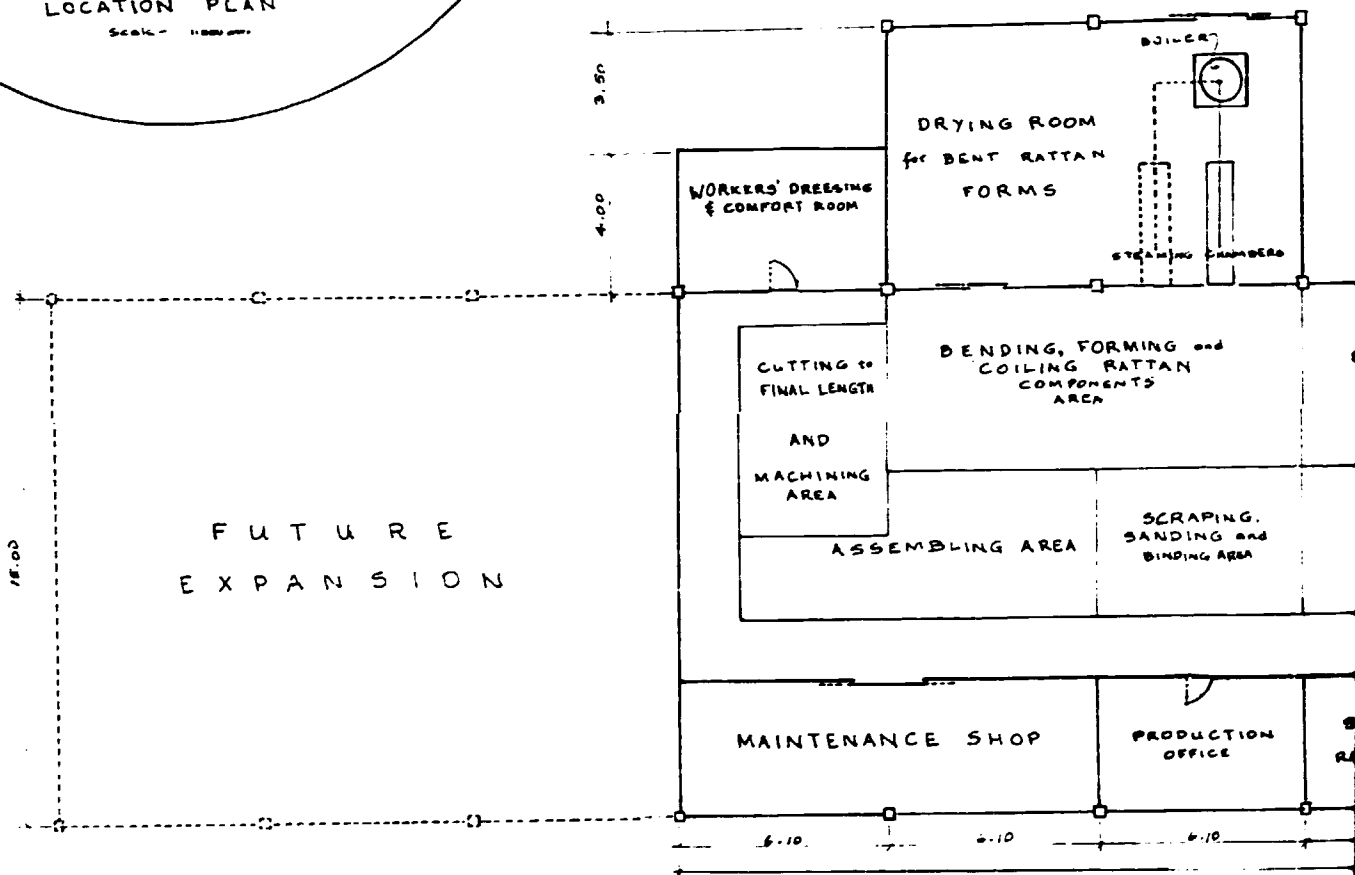
1/2" Nut with wing  
welded as shown.

DETAILED SKETCH OF DOOR LOCK, STEAMING CHAMBER



LOCATION PLAN  
Scale - 1:1000

S E R V I C E



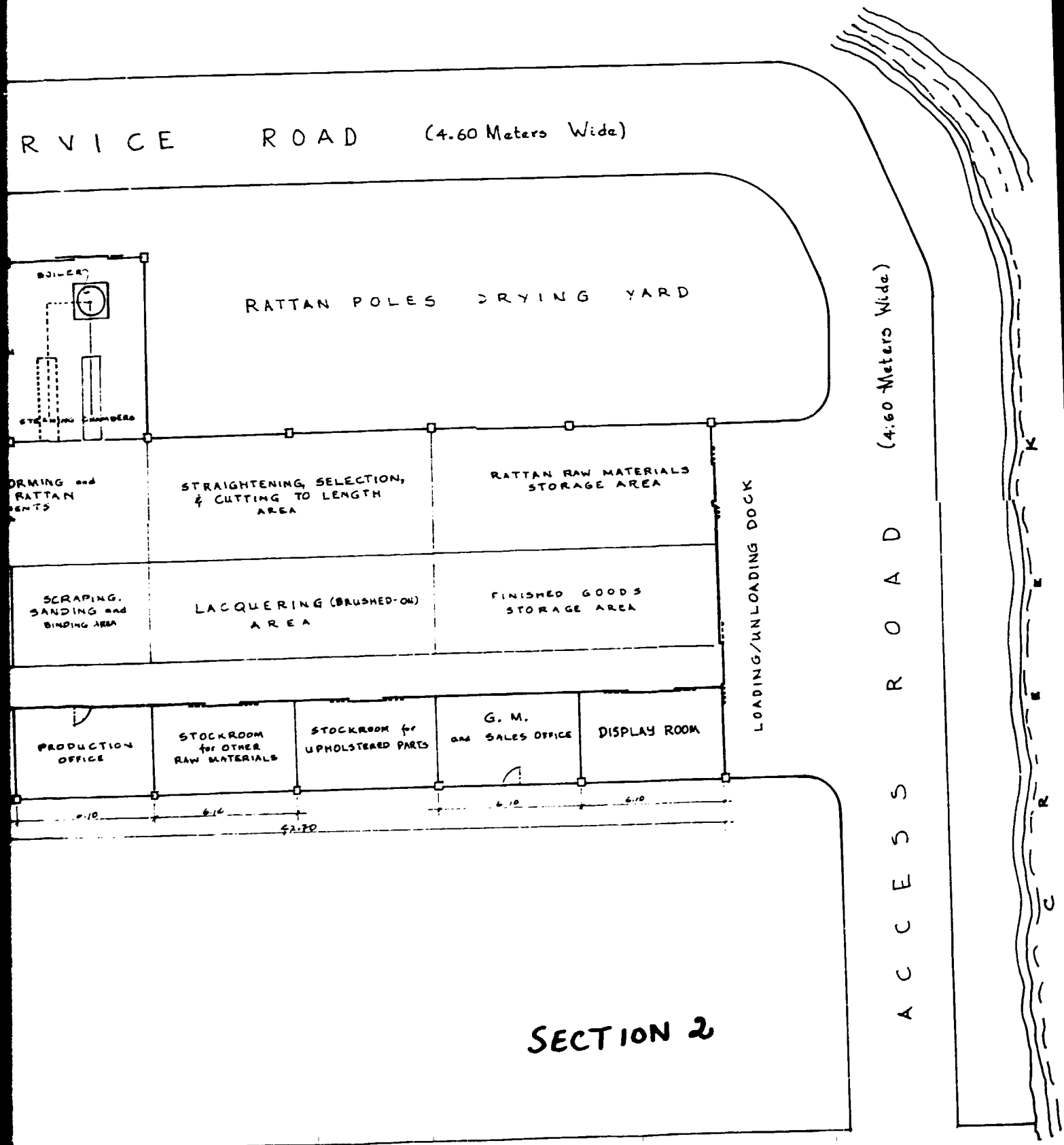
FUTURE EXPANSION

SECTION 1

PROPOSED FACTORY LAY-OUT  
STRICKLAND BROTHERS, Ltd.,  
RATTAN FURNITURE FACTORY, APIA, WESTERN SAMOA

Prepared under U.N.I.D.O PROJECT No. SI/JAM/69/801.  
By: HORATIO P. ELLIOTT, UNIDO Consultant  
21 September 1969

Scale - 1:100 Meters



SECTION 2

c/o UNDP-Apia  
Private Mail Bag  
Apia, Western Samoa

28 September 1989

Dear Mr. PARKER,

This is with reference to your request for technical assistance (through the Department of Economic Development, Government of Western Samoa), under UNIDO Project No. SI/SAM/88/801, as arranged by UNDP-Apia (Western Samoa).

During my short visit at your shop, we agreed that certain data are urgently needed to facilitate the development of a factory lay-out for your FULLY UPHOLSTERED FURNITURE production line. Among other things, the following are immediately needed to allow me to start the development of the required short study for the realization of a suitable lay-out for your intended expanded operations:

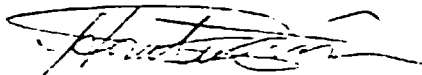
- A. Sketch of the land area where you intend to build the shop, indicating the major dimensions of the lot; existing buildings and structures (indicating their dimensions); existing access roads and such local constraints which will affect the erection of the shop;
- B. Rough sketches of the wooden frames you intend to produce, showing dimensions, if possible; and the timber species which you intend to use for the fabrication of the product; and
- C. The existing equipment in your upholstery shop, indicating their respective quantities and floor areas they occupy (indicate dimensions).

Should you still be interested in seeking our technical assistance please furnish us the above-listed information (through the Dept. of Economic Development and UNDP-Apia), so that this may be relayed to me soonest. In this manner, I would be able to provide you with the lay-out upon my return to Apia in early 1990 for the Second Phase of the Project.

SILVA UPHOLSTERY  
Attn.: Mr. RODNEY PARKER  
Apia, Western Samoa

It was a pleasure having the opportunity to work with you.

Yours truly,



HORATIO P. BRION  
UNIDO Furniture Production Expert

cc: Mr. MISIOLC SOFE  
Dept. of Economic Development  
Apia, Western Samoa

UNIDO PROJECT No. SI/SAM/88/801

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TECHNICAL ASSISTANCE TO FUAMATU ATI, Woodworks and Leather Goods  
Manufacturing Shop, Fagalii Uta, Apia, Western Samoa.

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Mr. Fuamatu Ati, is basically an artisan who produces the following products at his own workshops beneath and adjacent to his residence:

- i. Leather slippers, with rubber soles;
- ii. Novelties (wooden handicraft items);
- iii. Billiard tables and cues;
- iv. Leather belts; and
- v. Chairs and living room furniture items

With a view to helping him improve his working capability and quality of his products, the following were discussed with Mr. Ati during the visit to his shop on 21 September:

1. Sanding Belt Splicing

Mr. Ati wanted to know how he could splice paper-backed belts.

- a. A simple sanding belt skiving machine was designed for Mr. Ati.
- b. Using sketches, the technique of splicing paper-backed sanding belts, starting from skiving the edges to be jointed, the whole process was illustrated and described by this Consultant.
- c. The method of gluing the skived-ends of the sanding belts, together with the desirable type of glue, was also discussed with Mr. Ati.

2. Mr. Ati requested information on how a six-inch-wide sanding belt could be used on a flat bed sanding machine.

The design of the improvised flat bed sanding machine, using materials available in his workshop, was developed for and furnished Mr. Ati.

3. Mr. Ati wished to know where he could get spring materials to support seat cushions and also what type of spring materials he should use in the production of chairs and settees that he manufactures from time to time.

Mr. Ati was informed of the design and use of "NO-SAG-SPRINGS" and the more recently developed tension type of spiral or coil spring. He was also referred to Messrs. Joe Lober and Steve Young to find out about the sources of these spring materials.



Fuamatu Ati, Woodworks and Leather Goods Manufacturing Shop  
Page 2

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Simple sketches of how these materials are mounted on the wooden seat frames were given to Mr. Ati.

4. Billiard Table Tops

Mr. Ati asked how he can improve the construction of the billiard table top in order to obtain a more stable and lasting piece of Table.

Mr. Ati was informed that a construction method for very stable billiard table tops has been developed in the Philippines, using S4S 2" x 4" boards. The surfaced boards were glued face-to-face on the 4 inch faces and bolted together to form a rectangular laminated type of thick (4") board. It was recommended to Mr. Ati that he use Urea formaldehyde type of glue (commercially known as "Weld Wood"). He was informed that this type of glue is available in Apia.

5. Billiard Cues

Mr. Ati asked how to fabricate billiard cues more uniformly and with better quality than what he was presently making.

A sequence of operations was formulated for Mr. Ati. The sequence involved the use of the flat bed sanding machine described in No. 2 above, to obtain the desired taper, starting from a square cross section wooden rod.

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