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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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An agro-industrial pre-feasibility study .

Prepared by a consultant for the Office of the
Board of Investment, Government of Thailand

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INTRODUCTION

In a determined effort to promote and diversify investment in the agro-industrial sector, the Government of Thailand has undertaken a series of studies relating to prime agricultural commodities being currently produced in the country, from which a number of selected products have been examined in some detail and presented as investment opportunities to encourage the interest of potential foreign and domestic investors.

This report provides a source of information concerning the availability, suitability and cost of raw materials to produce a specific product, the cost of operating in Thailand and a market analysis for the product either for local consumption, import substitution and/or export. Investigations were carried out to assess the economic viability of the project, it's impact on the economy of the country and the possibilities it offers for the creation of employment opportunities.

Consideration has been given to the requirements of this particular project for investment incentives in order to show a sizeable net return on invested capital.

Information has been provided about Thailand and it's economy with a summary of the current Five Year Plan, the investment climate and related laws, and other basic information to assist a potential investor.

As an annex to this pre-feasibility study, there is a Product Area Report that identifies a wide range of possible processed and semi-processed products, and in general, evaluates the domestic and foreign markets for them.

In selecting the product to be given priority for study as an investment opportunity, the socio-economic effects, technical feasibility, availability of labor supply, availability of

or plans to provide, the required infrastructure, together with restraints on pollution of the environment, were taken into consideration.

This pre-feasibility and product area study is only intended to bring this potential opportunity to the attention of an investor, who it is anticipated would use it as a base to launch a more detailed feasibility study that would be required before making a decision to establish or expand this product industry in Thailand.

These studies have been funded in part by a loan from the United States Agency for International Development, (USAID), and the Board of Investment under whose direction they are being carried out. The BOI is being assisted by Chemonics International Consulting Division of Early California Industries Incorporated in association with Checchi and Company, both of Washington D.C. The Board of Investment would like to take this opportunity to thank the team of Consultants and USAID for their assistance in carrying out these studies.

This pre-feasibility study and annexed product area study, was prepared by Frederick J. Poats, (Leather Products Specialist), Clyde L. Rasmussen (Feasibility Analyst), Alfred A. Strauss (Financial Analyst) and Peter M. Amcotts (Project Manager).

Grateful acknowledgement is made of the assistance given by many Thai Government officials, United Nations and U.S. offices and libraries, and by industrialists and others in the private sector.

SUMMARY

LEATHER PRE-FEASIBILITY STUDY AND AREA STUDY

Modern technology, equipment, and leather finishing materials are not available to Thailand's tanneries at Bang Pu. Inadequate supplies of good quality leather and lack of modern leather finishes prevent Thailand's domestic shoe and leather goods industries from meeting current domestic and export demands for their products.

The proposed custom tannery and leather finishing facility will meet both of these needs by (1) providing tannery service for a fee to local Thai tanneries and (2) offering custom leather finishes for imported crust leathers for shoe and leather goods manufacturers. The new enterprise will provide a substantial increase (25 million square feet per year) to Thailand's present leather goods raw material supply base.

Utilization of a major share of the increased supply of leather will require new leather goods factories whose output will be exported. By doing so, Thailand follows other Asian nations (Japan, Korea and Taiwan) in the importation of raw materials to which a high value is added by processing, thereby benefiting both domestic industry and the labor force.

The principal function of the custom tannery and finishing enterprise is to make available to shoe and other leather goods manufacturers an "on demand" capability of finishing leather to their specifications in quick response to changes in the domestic and export markets for their products.

The estimated increase in revenues for Thailand's agricultural industry are mainly from added employment, (estimated 6,000 people), and value-added to leather and other raw

materials from shoemaking, (estimated at US$ 3.50/pair for 14 million pairs a year for a total of US$ 49 million a year). The estimated aggregate value of new investments to produce these revenues are; (1) tannery and leather finishing project (US$ 12 million) and (2) new shoe factories needed to use its output (US$ 35 million).

I. GENERAL PROJECT DESCRIPTION. LEATHER TANNING AND FINISHING PLANT.

A. Introduction.

As established in the Product Area Study, Thailand has a very limited livestock base to provide raw materials for a labor-intensive export-oriented leather products industry. At the same time, it was found that labor, the principal resource to be used by the industry, is plentiful, low in cost, productive, and superior in innate skills to many other shoe and leather goods exporting nations.

For these reasons, and because of environmental pollution problems inherent during early stages in leather tannage from salted hide to blue-chrome and crust leather, the most feasible choice for imported raw material is crust leather.[1/] This selection would put Thailand on a par with many other leather-goods manufacturing nations of the world. It can import raw materials competitively and, applying its favorable labor resource condition, can manufacture leather products with a major benefit to Thai industry and economy from the value-added to crust leather, by finishing it and making leather goods for export from Thailand.

1/ Crust leather, as discussed in this study, is a fully tanned and dyed piece of leather, lacking only the steps necessary to apply a finish texture and color to the grain-side surface.

B. General Project Description.

The proposed project is a custom service leather tanning and finishing operation. Its design plan includes a 1,500 hide-per-day tannery to process blue, chrome-tanned leather to crust leather, and a modern leather finishing division with four 1,000-hide per day finishing lines, each of which provides a different process and kind of finish to leather.

The project design, and its functions described and analyzed in this study report, is directed to several goals and specific purposes:

1. Providing present Thai tanneries at Bang Pu with leather retannage and finishing capabilities that will improve quality of tannage, dyeing, fat liquoring, pasting and finishing of cowhide and buffalo leathers. The tannery part of the plant facilities will include equipment to perform these processing steps for present tanneries on a fee-per-side basis.

2. Providing machinery for splitting leather in blue chrome-tanned and crust states.[1/] This leather splitting capability is not now available and the small size of tanneries, and the volumes they produce individually, do not permit such an investment. The inclusion of it in the finishing plant operations plan is for two reasons: (a) larger scale more automatic equipment can perform the splitting at the same price now paid to a few tanneries with splitting machines suited only to side-splitting in the washed and lime-dehaired state, and (b) the improvement in processing domestic tannage products with modern equipment and technology is an obligation imposed on the finishing plant investor.

1/ Blue Chrome-tanned leather is full-thickness or pre-split grain leather with chrome tannage. It will be further processed through retannage and preparation for finish application (to crust state) in the tannery in Bang Pu. It will be processed from crust to finished leather in the same systems as imported crust leathers.

3. Providing rough leather retannage and finishing for leathers of calf, goat, sheep, and cabretta that are typical leathers exported from India, Pakistan, and Middle-Eastern and African countries to the E.E.C. tanneries and leather goods industries. These skin leathers, when tanned and finished, will diversify and complement the bovine leather side-upper supply of Thailand. They will also be the raw materials for leather goods industry diversification to include garments, dress gloves, women's boots, as well as other higher-value leather goods to be exported.

4. Providing leather finishing lines for (a) sueded, (b) patent, (c) water- and (d) solvent-dispersed single and multicoated air-spray film coatings and (e) seasoning and padded coatings for leather. The finish plant will produce both full-grain and corrected-grain shoe side-upper leathers in a full-range of colors and coating finishes. It will have equipment for plating, embossing, buffing, photoelectric area-measurement and highly skilled personnel for grading of both domestic and imported leathers.

5. Providing split leather retannage, dyeing, fat-liquoring, drying, staking, and area measurement for splits from imported crust or rough leathers, as well as for improved tensile strength of present Thai-made splits from cattle and buffalo hide leathers.

6. Providing all the services including tannage and finishing materials described in (1) through (5) on a fee-only basis for local tanneries and for the leather goods trading company operation in Bangkok.

7. Provide receiving and storing facilities and services for imported leathers and chemicals for finishing for the leather goods trading company. This latter entity is owned and managed separately from the leather finishing plant enterprise. The trading company is the sole agency for importing leathers finished at the finishing plant and for tanning

and finishing chemicals used by that plant.

These seven provisions for the "nature of business" of the leather finishing plant clearly show its role as a technical services supplier to the domestic leather tanning industry, and to new leather goods manufacturing industries, who order supplies of imported leather raw materials with specified finishes from the leather goods trading company. As will be seen, these limitations of market activity by the leather finishing plant are essential to avoid the destructive monopoly power it would have if it owned and determined prices of raw materials and products through buying and selling actions.

A companion activity, the "Trading Company in Bangkok", is not included in this pre-feasibility analysis. Its functions and operations are described in the following area study. Its services are non-technical, trading and product promotional in nature. The specific details of its management, ownership and operations are a separate entity to be established before the proposed leather tannery and finishing facilities can begin operations.

As a separate project in ownership and management from the activities of the trading company, potential investors in the leather finishing plant will be those who have had previous experience in contractual or service-fee type tanning and finishing plant operations in other countries.

The economic/engineering method of analysis, using standardized factors for investment ratios in various tannage and finishing steps or departments is used. By this method of analysis, the potential investor can access the potential cost and revenue centers of the multi-purpose facility, without analysis of specific sizes and types of equipment which a detailed design and feasibility study would provide later.

The analysis is based upon a preliminary survey of tanneries, raw materials, processes and products in Thailand, plus earlier experiences in model tannery cost analysis[1/], as well as tannery design and cost analyses by The Roit Corporation, Westwood, Mass., United States,[2/] and J.A. Villa, Buenos Aires, Argentina[3/].

II. RAW MATERIALS, VOLUMES AND POTENTIALS.

A. Description and Technical Discussion.

The tannery and leather finishing plant, as described earlier, is a provider of services for a fee to leather tanneries in Thailand and to the trading company which imports leathers, contracts for their processing and finishing at the finishing plant, in accordance with its customers' specifications. As a service provider, the plant will charge, under a schedule of fees, for each process or sequence of processes applied to a customer's products. As a part of its functions, it will operate and rent storage facilities for leather imported by the trading company in Bangkok, and for chemicals or other materials used in processing that are bought through the trading company's importing operations.

The revenue for the investment project in the finishing plant is a combination of piece-rate fees for services multiplied by the number of leather pieces (sides) it can pass through its doors. To be cost-efficient, it must be a large volume operation 1,500 hides per day (8 hr.) in the tannery, 4,000 hides per day in finishing. It must be flexible in operation, such

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1/ Moede, Herbert H. and Poats, F.J., Tannery Costs, MRR 1032 Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 1974.

2/ The Roit Corporation, Tannery Location Study-Oklahoma, prepared for Off. of Comm. Affairs and Planning, State of Oklahoma, U.S.A. 1975.

3/ Villa, J.A. The Interrelationship between Parameters of the Leather Industry, ID/99 (ID/WG 79/6/Rev.1), UNIDO, United Nations, New York, 1973.

that one or another finish type may dominate the output without delaying delivery schedules unduly on orders. Variations in output volume by one or two types of finish mean that one or two lines can run two or three shifts per day, while others may be slack or idled. As the "on-demand" suppliers of finished leathers, such extremes in operations may occur frequently.

The volume of leather pieces finished per year is dependent on the number and rate of additions to leather goods manufacturing units and volumes that are developed in Thailand as a result of the new leather supply availability. This in turn depends on the investment climate of Thailand for these future leather goods factories and on how well they grow and perform during a period of years, with exports of shoes and leather goods as their principal outlet market.

B. Domestic Tanning Industry Needs.

The domestic tanning industry needs modern processes to improve its leathers but is not large enough in total to sustain the tannery functions and finishing plant investment it needs to modernize. As an estimate, about 40 percent (6.8 million ft^2) of the output by the private industry segment would use one or more of the tannery and finishing plant's services. Most of the leather, presently finished by such simple processes as being nailed to a wooden panel and being sprayed by a hand-operated paint spray gun, will continue to be acceptable to some buyers, according to Tannery Association estimates. The annual volume of bovine leathers coming to the future tannery finishing plant for its complete services is estimated by the Tanners Association to be about equivalent to 7.2 million square feet. The projected minimum annual capacity of the tannery division is 1,500 hides (44 ft^2) per day or 19.8 million square feet per year. An imported supply of blue chrome-tanned leather (13 million square feet)

to be tanned and finished is essential for the tannery division to operate efficiently.

C. Potential Changes in Thailand Leather Industries Situation.

The Government of Thailand has initiated a foreign investment and export incentives program (see General Appendix herein). Industries, such as leather goods manufacturing for export, are desired because they are labor intensive. Thai labor is already recognized as the resource of primary input to this project. By providing for investor incentives in the leather industry, Thailand will follow the earlier lead of other Asian countries, mainly Korea, Taiwan and Japan, whose domestic livestock industries are sufficient for only a small part of present leather usage for shoes and leather goods produced and exported.

In this context, the leather tannery finishing plant stands as a vital connecting link between imported raw materials and a greatly expanded industry to make shoes and other leather goods for domestic and export markets. It also provides the means for the domestic tanning industry, presently unable to afford modernization of certain tanning and finishing operations, not to be by-passed or economically disadvantaged by the change.

D. Conclusions.

A number of alternatives to meet the goals of leather goods industry expansion have been explored. Among them are imports of salted hides and blue chrome-tanned leather, as well as imports of finished leather. In a consideration of salted hides importation, disadvantages outweigh advantages. It was determined that imported crust and blue-chrome leathers could be competitive in cost to domestic tanning and that other problems, such as environmental pollution, would be minimized by using them as the primary raw materials imported into Thailand. Furthermore, the availability of such imported leathers would largely solve the problems concerning quality and versatility of finishes, an often-mentioned importers' complaint about leather

and leather products from Thailand in the past.

III. MARKET STUDY.

A. Domestic Market.

Thailand's recent history and trends in production and marketing of hides, leather and leather goods are reviewed in detail in the accompanying Area Study.)

B. Foreign Markets.

1. Target Markets: The study of foreign market opportunities is based upon assessments of the U.S. import markets in volume, value/prices, past trends and projections As a market strategy for Thailand's future exports of shoes and leather goods, the U.S. market situation is the dominant factor, and the market of large volume imports that appears to offer the basis for a large share of Thailand's industrial leather goods development.

In world production and consumption of leather footwear, the U.S.S.R. is the largest. It is also the second largest importer of leather footwear, which is preferred over rubber, synthetic and fabric-upper footwear. The United States is second in world consumer demand. Asian and EEC country totals for production less consumption class them as net exporters.1/ Therefore, the U.S. import market for shoes and footwear has to be Thailand's primary future market outlet.

As shown in Table 1, recent imports of leather footwear by the United States increased about 40 percent from 1971 through 1976. The annual value of imports in the same years increased 107 percent. The value per pair imported also is of special interest. Asian exporters to the United States have tended to hold values down, reaching cheaper-shoe consumer

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1/ The World Hides, Skins, Leather, and Footwear Economy, Commodity Bulletin 48, FAO, United Nations, New York, 1970

demand and increasing market volume (total number of pairs). Northern European and Canadian exporters to the United States, however, have let volumes continue about the same with import prices per pair rising steeply during the period. Thailand's market strategy could very well be to produce and market high-quality cattle hide side-upper shoes, with price targets between the two extremes.

2. Distribution System: The market system for Thai leather goods and shoes begins with the export promotion and sales activities of the trading company in Bangkok (see Area Study, project P-4, for a discussion on marketing functions for shoes and leather goods). The trading company will provide marketing and distribution of imported leathers in Thailand to domestic shoe and leather goods manufacturers, and export marketing activities for foreign buyers, (importers, multi-national trading companies and foreign government representatives), who will need this service-agency activity of the trading company to identify and help expedite orders, shipping schedules, and adjust or negotiate contracts between overseas buyers and Thai industry suppliers.

Transport systems for products will be ocean-shipping and air-freight systems for high "time-value" leather goods shipments. For inbound raw materials, (blue chrome-tanned and crust leathers and chemicals destined to the leather finishing plant), ocean transport in cargo containers will be the preferred transport method because of handling costs and ocean freight charges from countries of origin (primarily from U.S. West-Coast ports). Upon arrival, bulk shipment containers will be unloaded and trucked to Bang Pu for unpacking, cargo survey (quantitative and qualitative assessments of the shipment in relation to purchase contract and bill-of-lading documents such as Tates and Far East Superintendents provide for shippers and receivers in Bangkok), storage in inventory until sold or used by the leather finishing plant. These import receiving and storage services at the finishing plant will be costed and billed to the trading company.

C. Conclusions and Recommendations on Markets.

The world market situation on shoes and leather goods is both stable and dynamic. Its stability arises from well-known relationships between population growth and demand, conditioned, however, by a factor of the level of consumer incomes in each country. As the level of disposable income rises, the number and variety of footwear demanded rise faster than population growth. The United States, for example, is considered a "mature market", with consumption of four pairs of footwear per capita per year. In Japan, in the past two decades, rising incomes have greatly expanded shoe sales from a base of under one pair of shoes (all types) per year to more than two pairs per capita at the present time. A major share of Japan's total import of hides from the United States has stayed at home to meet this burgeoning domestic demand. Similar events have occurred, or are occurring, in each country where these factors of demand have been analyzed. An interesting facet of the Japanese market has been the shift in demand by type of raw material used in shoes. Initially, only a small part of shoe production used leather uppers, linings and soles. The industry put large investments into non-leather raw material development and footwear use. However, footwear of leather became both a status symbol and the practical outcome of changing consumer demand, hence the very sharp upward movement in hide imports from the United States, beginning in the mid-1960's.

Important factors in leather goods markets are styling, use of high quality raw materials, quality control, and ability to lead and meet quickly the demands of market styles and volume trends from season to season in foreign markets. The experiences of Bata Shoe Company in Thailand are strongly indicative of the superior quality of Thai people to be the labor resource necessary to meet these dynamic marketing challenges. In competition with 95 other Bata Shoe factories of the world,

the Thai factory won first place (the silver cup) for styling, artistry, techniques and materials in a contest conducted in 1973. A large number of first and second place ribbons for individual department achievements in the preceding year were also won by the Thai factory at the same time.[1/]

The foregoing discussion and observations on the growth patterns in world shoe demand suggest that there is an excellent opportunity for development of a greatly expanded leather industry in Thailand.

IV. OPTIMUM PROJECT SIZE.

A. Economies of Scale.

The optimum conditions for economies of scale are the basis for projecting the capacities of tannery and finishing divisions for the enterprise. The tannery proposed is a 1,500 hide per day capacity facility, with each of the four finishing systems being a 1,000 hide per day capacity facility. Equipment sizes, operating efficiency and flexibility among process routes for various kinds and qualities of leather and finishes dictate that the finishing division be provided with a larger capacity than the tannery division. These first approximations of size and flow schemes will be adjusted by the potential investor's marketing and engineering design decisions based on a more detailed feasibility study.

B. Market Considerations.

The estimated output capacity of the finishing plant is (a) much larger than present Thai industry demand, but (b) much smaller than the potential market for such services envisioned for the future Thai industry for shoe manufacturing and leather goods production for export.

1/ As reported by Mr. V.M. Dvorak, Managing Director, Bata Shoe Co. of Thailand, Ltd., Aug. 19, and Sept. 12, 1977.

V. THE PROJECT.

A. Raw Materials and Processes.

Figure 1 depicts the flow of raw material to finished leather in a modern tannery. The tannery and finishing plant will include processing steps to improve the quality of present Thai leathers. It will provide a full spectrum of modern finishes for leathers used in shoes and other leather goods to be made from domestic and imported blue chrome-tanned and crust leathers. See Technical Annex A for detailed explanation of steps in tanning and finishing. See Technical Annex C for a glossary of terms and definitions associated with modern tanning and finishing of leathers.

B. Processing.

1. Production Facilities.

The economic engineering cost model method is used to estimate the costs of facilities, equipment, and operations for this pre-feasibility analysis. It is based on similar models for tanneries in the United States and in Argentina (see footnotes page 8). Costs for building, land, labor costs, management and overhead expenses are based on studies of these factors in Thailand.

Raw materials, their storage costs, raw materials in process and finished goods in inventory are not charged to the factory operations. They are owned by (a) the trading company or by (b) local tanneries in Bang Pu, or by (c) leather goods manufacturers who contract for services with the finishing plant.

Figure 2 also shows the general space-allocation for the factory interior. Figure 3 shows the tannery and finishing plant as related to its supportive components on the site. Figure 4 indicates the proposed space-allocation for second-floor supportive facilities of the factory. Offices and administrative functions could be located in a separate building for a modest increase in construction costs.

2. Technical Processes.

The step-by-step sequence of processing operations is shown in Figure 1 and described in Technical Annex A. The layout, processes and sequences are shown in Figure 2.

Tannery division and support, facilities have some unique features. They are:

Figure 2: (9, 9a) A local tannery services receipt and delivery operation is provided for about one-third of the tannery division's operating capacity. The remainder is from the imports side Fig. 2 (1 & 2) of facility.

Figure 3: (10) Power plant. A single-source independent electric power and hot-water supply system for the whole facility.

Figure 4: (3) Large, central exhaust system through the second floor level open space to the roof of the plant.

(4) Partial water-storage capacity, for constant water-head pressure to tannery and finishing plant flow-matering operations.

(5) For storage of partially spent or premixed liquid chemicals used in tannery and finishing, again to provide constant head-pressure metering capability with process water from (4).

(6) Reserved space for future use, such as solar heating systems or other advanced technology which may develop, for evaporation and recycling of tannery and finishing chemical solutions.

C. Costs and Revenues.

1. Capital Costs.

Estimation of capital equipment costs and depreciation for modern tannery facilities, is based on department-by-department capital budget accounting practices. Three basic sources of information were used in estimation of fixed capital requirements for the following elements of the tanning and leather finishing plant. They are:

(a) United States. U.S. Department of Agriculture (See Footnote 1, page 8).

(b) The Roit Corporation (tannery facility design engineers--See Footnote 2, page 8). Atlantic Engine and Power, Inc., Baltimore, Maryland.
(Package power plants for electricity and hot-water generation systems)

(c) Argentina. J.A.Villa, for UNIDO, United Nations (See Footnote 3, page 8).

Table 2 lists the equipment required for the leather tannery and leather finishing plant and estimated costs, salvage values and annual depreciation expenses by major operating departments. Most equipment is depreciated over a 10-year period using the straight-line method of depreciation. However, the forklift truck is depreciated over a six-year period, wood pallets and both high and low wooden horses over three years.

Total equipment cost, based on the use of all new equipment in the proposed plant, is estimated at U.S.$ 2.9 million. All equipment costs include delivery and installation as of mid-1977. On a project of this size, competitive bidding by equipment suppliers would undoubtedly provide somewhat different equipment cost figures for a specific department. However, these figures are based on equipment suppliers's catalog list prices and include no quantity discounts.

The total investment of U.S.$ 11.9 million is indicated for land, plant and equipment. Factory equipment is detailed in Table 2, supportive facilities in Table 3 and land and building in Table 4. A summary of all these costs is as follows:-

Summary of Capital Costs

	US$ (000)
Factory equipment	2,890
Supportive facilities	1,472
Buildings	6,980
Land	563
Total	11,905

Working capital requirements are estimated at US$ 650,000 when plant is operating at full capacity. This is based upon operating costs for 100 work days, less depreciation, (2,062,000-480,000 x $\frac{100}{242}$). In the first year, with only a 60% operating rate, the working capital needs would be about US$ 620,000. (1,977,000-480,000 x $\frac{100}{242}$).

The amount of actual working capital needed is, of course, subject to adjustment depending upon negotiated financing charges, payments and collections for services that are different from those assumed herein.

Pre-operational costs for the tannery and finishing plant in the first year are estimated as follows:

Labor cost (1/2 month)	US$ 22,760
- direct	2,498
- indirect	4,928
Fuel costs (1/2 month)	
Total	30,186

This cost is charged off as an expense in the first year of operation.

2. Operating Costs.

(a) Level of Operation.

The quantities of hides and leather processed at rated capacity is 1,500 hides per day (726,000 sides per year) in the tannery and 4,000 hides per day (1,936,000 sides per year) in the finishing plant. This assumes one eight-hour shift per day, 242 days per year and two sides per hide (44 square feet of leather). Therefore, on a square foot basis the annual output is 15,972,000 sq.ft from the tannery and 42,592,000 sq.ft from the finishing plant.

When the combined plant is operating below capacity, or if it is operated with more than one shift a day, the mix between tannery and finishing plant will not necessarily be in the same proportion as indicated above. The ratio will depend upon product demand and hide and leather supply. However, in the following cost calculations pertaining to less than capacity operation, it is assumed the stated ratio will apply.

Full capacity of the system, on a per-shift basis, is determined by the operating step that is the critical element. In the tannery, this is the capacity of the 2 lines of the 250 plate dryers. In the finishing system, the rate of throughput for the dryer ovens in tandem with each coating applicator governs the capacity. All of the other components in each system are flexible enough in their loading and throughput rates to permit "over-capacity" utilization for special work without causing disorder in daily production schedules.

Splits derived from imported blue chrome-tanned leather can be processed through retan, dye, fat-liquor, vacuum dry, buff and stake and dry-mill operations. However, no provision has been made in these cost and revenue calculations for processing the splits.

(b) Annual Operating Costs.

Annual operating costs are calculated at three levels, as shown in Table 7. Included are labor, maintenance, fuel, depreciation, miscellaneous factory overhead and interest. Raw material costs (hides, leather, and chemicals) are not included because their ownership is in the hands of the Trading Company or other interests who bring hides and leather to the proposed facility for processing.

Operating costs are adjusted for differences in operating levels. The only cost differences of any significance are direct wage-rated labor, fuel and water. Labor costs are outlined in Table 5. The total labor requirement at full capacity is 212 employees on a one-shift basis.

The cost for utilities is essentially a fuel cost since electricity is produced and water is heated to 100°C by the plants own oil-fueled generator and water is pumped from a well. An annual cost of US$ 108,000 is shown for full capacity.

Maintenance costs of US$ 50,000 a year are a combination of periodic major diesel engine overhauls, and miscellaneous services and supplies. The labor staffing includes allowance for maintenance labor and engineering.

The calculation of depreciation is shown in Table 6. The annual charge is US$ 480,000. Allowances are made for salvage values.

An annual charge of US$ 25,000 is indicated for the many miscellaneous overhead items not already covered.

Interest cost shown in Table 7 is the average annual cost based upon the mid-life value, plus salvage value for equipment and building, divided by two. Annual interest rate allowed is 10%.[1/]

1/ This estimated rate of the carrying cost of the assets is low. Usually a compound percentage of from 18 to 25% a year is used to include interest, taxes and insurance.

Operating costs shown in Table 7 include both tanning and finishing costs at the capacities indicated. They cannot be related to the fees scheduled in Table 8 which shows fees separately for the tannery and finishing plant.

Calculation of interest is as follows:

	US$ Cost	US$ Salvage Value
Land	563,000	563,000
Buildings	6,980,000	698,000
Support	1,472,000	147,200
Factory equipment	2,890,000	508,000
	11,905,000	1,916,200
Add salvage	1,916,200	
	13,821,200	
Divide by two	6,910,600	
10% annual interest (rounded)	700,000	

2. Revenues.

(a) Primary Processing Revenue

Table 8 shows plant revenues based on fees for services of tanning and finishing leather. These fees are derived from two sources, (1) fees presently charged by larger tanneries at Bang Pu for service to smaller tanneries without such equipment capability and (2) costs per side (22 square feet of leather) in tannery operations of this size in the U.S.A. Added costs for chemicals consumed are a separate part of the fee schedule, which will be paid to the Trading Company for its materials.

Smaller sides that are tanned and finished will not be assessed a lesser fee, because the cost of operations, apart from chemicals consumed, is based on number

of pieces to be handled, not the area measure per piece. For this reason, charges per square foot are based on 22 square foot side pieces; side pieces of lesser area will have higher costs per square foot of leather. Consumption of chemicals, and charges for them, will be based on area in square feet of each lot processed.

The fee schedule for tanning and finishing operations in Table 8 is only partly indicative of the actual fee per side. Not all the events would occur for a side in the blue, chrome-tan state taken through finishing, nor would fees be charged for unnecessary steps. For example, tannery steps for brush, stake, measure and mark would be skipped or partially used if the piece went through corrected-grain finishing and embossing. Similarly, some leathers sold as full grain would have much less chemical finish cost than if made into patent or corrected-grain finishes. For these reasons the fees listed are for illustration only. A much more definitive system for fees (based on sample finishes and other factors) will be established and used in actual practice at the Bang Pu facility.

For the purpose of estimating plant revenues herein, a factory fee per side of US$ 2.86 (1.90 = tanning; 0.96 = finishing) is assumed. At 22 square feet per side, factory fee per square foot of finished leather would be US$ 0.13. Adding the cost for chemicals, the total processing cost is 0.13 + 0.29 = US$ 0.42 per square foot of finished leather (adding the cost of the imported blue chrome-tan, starting material to this processing cost, would indicate the final selling price per square foot of leather charged by the Trading Company in Bangkok.)

4. Profit and Loss Calculation.

For calculation of operating profits and losses, several assumption are made:

1. That the plant will operate at 60% capacity in the first year, 80% in the second, and 100% in the third and succeeding years.
2. That pre-operating expenses are charged off in the first year.
3. That the proportional shares of volume as between tannery and finishing plant are in the ratio of 1,500 to 4,000.
4. That the splits are not processed in this plant.
5. That interest is caclulated at 10% on the mid-life holding value of assets.

A pro forma profit and loss statement is given in Table 7. In the first year, a small profit would accrue operation at 60% of capacity, but substantial profits would be experienced in succeeding years.

(b) Revenues from Splits:

Splits are marketed by the Trading Company, as they frequently are in Thailand, in the blue chrome-tan state, for palms of work gloves, shoe lining, etc. They would yield no added cost or revenue to the tannery division, since splitting fees would already be applied to the grain leather piece in process.

If the splits are given further tannage, (retan, dye, and fat-liquor followed by wringing, set-out and vacuum-drying each piece, as well as buffed and staked for suede leather), the tannery would receive additional processing revenue (about $1.60 per piece and the the market price of split leather would be increased from an estimated US$ 0.15/ft^2 to US$ 0.30/ft^2.

On the basis of 0.36 square feet of split area per square foot of blue chrome tanned leather imported, the

benefits from selling splits at the higher market price, with further processing described above, would be approximately US$ 1.65 per blue chrome-tanned piece imported. At full capacity this revenue from split leather could yield as much as US$ 1.2 million a year for the Trading Company.

D. Financial Projections.

1. Financial Projections.

The pro forma profit and loss statement shown in Table 7 projects performance of the plant at three levels of output over a three-year period based on capital costs, operating expenses and sales revenue. The levels of operation are percentages of full capacity capability.

2. Sensitivity Analysis.

An important tool for analyzing the interaction of costs and revenues at various levels of production is the breakeven point analysis. The BEP is the level of operation below which losses are sustained and above which profits accrue. By categorizing costs into those that are variable and those that are fixed, profits and losses can be projected under a variety of conditions. For the purpose of this analysis, amounts that are not materially influenced by the level of short-term activity are termed fixed costs and those that are a function of activity (increasing or decreasing) are termed variable costs.

The breakeven point considers revenue from sales volume which can be expected from the capital investment's full production, fixed, and variable costs. The breakeven point is expressed by the formula:

$$\text{BEP} = \frac{\text{Fixed costs}}{1 - \frac{\text{Variable expenses}}{\text{Revenue}}}$$

$$\text{BEP (US\$ 000)} = \frac{1,648}{1 - \frac{414}{3,238}} = 1,894$$

The breakeven point of US$ 1,894,000 in revenue is achieved at an annual operating level of approximately 66%.

The data used in the computation are:

Fixed costs	(US$ 000)
Depreciation	480
Interest	700
Maintenance	50
Admin. salaries	393
Misc. admin. expense	25
	1,648
Variable cost	
Plant labor	306
Fuel and water	108
	414
Revenue	3,238

E. Conclusions Regarding Feasibility.

1. Ratios.

The ratio of net profit to sales for the second year is 377/2,591 = 15%; for full capacity 981/3,238 = 33%. The first year shows a loss.

The ratio of net profit to investment is 57.2/11,905 = 4.8% and 1,176/11,905 = 9.8% for the second and third years respectively.

The payback period is just short of ten years on the basis of pro forma earnings.

2. Other Factors.

For the purpose of this analysis, the pro forma statement was based on the following assumptions and computations: it is assumed that the project will have promotional

privileges and will be exempt from machinery and equipment import duties and taxes. No costs for these were included in the profit and loss statement. Also no costs are included for property damage, casualty or workmen's compensation insurance. Annual sales represent services only.

The relevant technological and financial factors relating to the project which were examined in this study indicate its feasibility as an investment opportunity.

A list of United States firms and agencies that have interests in hides and leather is shown in Annex D.

F. Conclusions.

The tannery and finishing plant concept described in this analysis represents a major redirection of the leather and leather goods industries of Thailand. Its establishment will mean a substantial number of shoe and other leather goods factories will be needed to buy leather, make products, and export them to world markets. The footage of leather finished at the factory in a year will mean many thousands of new jobs in Thailand factories.

Timing would be a critical factor in the establishment of the tannery - finishing plant. The major use of the leather would be in shoe manufacturing. But while the proposed plant might come on stream within a year's time, any new shoe plant might take twice as long from inception to start of manufacture. Thus all related projects must be carefully coordinated to insure proper dovetailing of planning, constructing, and operation.

LIST OF TABLES, FIGURES AND ANNEXES

TABLES

FIGURES

ANNEXES

TABLE 1

U.S. Imports of Leather Footwear

(Ranked by Value in 1976) 1971, 1974, and 1976

Country of Origin	1,000,000 Pairs			Value $1,000,000			Average Price - 1976
	1971	1974	1976	1971	1974	1976	
Total	130	128	182	510	707	1,056	US$ 5.82
Italy	69.7	43.7	36.7	260	251	267	7.29
Spain	28.2	28.4	31.6	117	168	201	6.35
Korea	0.8	3.5	35.3	3	17	149	4.21
Brazil	7.7	20.3	26.5	23	86	139	5.25
Taiwan	0.6	1.6	12.5	1	7	49	3.90
France	2.6	2.5	2.6	14	21	26	10.04
Yugoslavia	0.5	1.8	2.8	3	13	26	9.00
Greece	0.8	2.0	3.2	5	13	23	7.25
Mexico	3.2	2.9	2.8	9	16	20	6.90
Poland	0.6	1.7	5.0	1	6	19	3.83
Romania	0.7	2.8	3.7	2	11	18	4.90
Canada	0.9	1.0	1.2	7	11	16	13.25

TABLE 1 (Cont'd)

(Ranked by Value in 1976)

Country of Origin	1,000,000 Pairs			Value $1,000,000			Average Price - 1976
	1971	1974	1976	1971	1974	1976	
							US$
West Germany	2.0	1.5	1.4	14	14	15	10.60
India	3.0	2.9	5.8	3	4	13	2.20
Uruguay	-	0.2	2.1	-	1	12	6.00
United Kingdom	2.2	0.8	0.8	17	8	9	11.56
Ireland	0.4	0.8	0.8	3	8	9	11.50
Switzerland	0.5	0.3	0.3	6	6	7	23.30
Japan	1.8	0.6	1.0	6	4	7	6.46
Czechoslovakia	1.6	0.8	1.0	4	4	6	6.00
Chile	-	-	0.7	-	-	5	7.44
Colombia	-	1.1	0.8	-	5	4	5.13
Argentina	0.3	5.1	0.5	1	23	4	7.47
Hongkong	0.4	0.1	0.5	1	1	1	3.11
Others	1.5	1.6	2.4	10	9	11*	5.00

Source: U.S. Dept. of Commerce.

TABLE 2

Factory Equipment Costs for Tannery for Blue, Chrome-Tan to Finished Leather.

Department and Equipment-(Block Nos. in Fig.2)	Number	Total Cost	Salvage Value	Annual Depreciation	Estimated Service Life-Years
		----- 1.000 US Dollars -----			
Blue and Crust Sorts (1,2,3)					
Electronic measuring machine	1	30.0	3.0	2.7	10
Mobile wood pallets 1/	150	6.0	3.6	0.8	3
Sub-total		36.0	6.6	3.5	
Receiving (9a)					
Receipt recorder	1	0.2	-	-	
Files	4	0.1	-	-	
Crust sort and shipping (9)					
Billing machine	1	0.5	-	-	
Sorting belt conveyor	1	4.7	0.5	0.5	8
Electric measuring machine w/recorder	1	34.5	3.5	3.1	10
Horses, high-type 1/	150	24.0	14.4	3.2	3
Sub-total		64.0	18.4	6.8	
Split and shave (5)					
Splitter machine (63")	3	254.3	25.0	22.9	10
Shaving machine (50")	4	124.0	25.0	9.9	10
Mobile wood pallets 1/	200	8.0	4.8	1.1	3
Sub-total		386.3	54.8	33.9	
Retan, dye, and fat liquor					
Color drum 10 x 10 Electronic control variable speed	6	367.3	183.3	18.4	10
Horses-high type Stainless hard-ware 1/	25	5.0	3.0	0.7	3
Sub-total		372.3	186.3	19.1	

TABLE 2 (Cont'd)	Number	Total Cost	Salvage Value	Annual Depreciation	Estimated Service Life-Years
Set-out, paste, and condition (7,7a)		----- 1,000 US. Dollars -----			
Set-out machine	4	92.9	9.3	8.4	10
Plate, paste dryer system (250 hds per 8 hrs.)	2	505.2	50.6	45.5	10
Take off table, washer & conditioning machine	2	60.0	6.0	6.0	10
Mobile wood pallets 1/	200	8.0	4.8	1.0	3
Sub-total		666.1	70.6	60.9	
Staking (8a, 8b)					
Auto-stake machines	3	138.9	13.9	12.5	10
Brushing machine	2	30.1	3.0	2.7	10
Auto-stacker	2	21.5	2.2	1.9	10
Vacuum dryer	1	30.1	3.0	2.7	10
Horses, high type 1/	50	7.0	4.2	0.9	
Sub-total		227.6	26.3	20.7	
Tannery total 1/		1,752.0	363.0	145.0	

TABLE 2 (Cont'd)

Finishing Division

		Number	Total	Salvage	Annual Depreciation	Estimated Service Life Years
			----- 1,000 US Dollars -----			
Receive and survey	(1,2,3)		(With tannery division)			
Crust sort	(2)		"	"	"	
Condition	(7c)		"	"	"	
Split & shave	(5)		"	"	"	
Buff						
Buffing machine	(8b)	8	100	10	9	10
Sub-total			100	10	9	
Stake and dry mill	(8a)					
Auto-stakers		6	280	28	25	
Sub-total			280	28	25	
Seasoning and bolster line -- with plating and embossing	(12,16,17)		98	10	9	10
Rotary sprayer line - with plating and embossing	(13,16,17)		180	18	16	10
Rotary-sprayer line - with padding and rotary plating	(14,18)		200	20	18	10
Curtain or flow-coater with plating polishes	(15,18)		150	15	14	10
Sub-total			628	63	57	

TABLE 2 (Cont'd)	Number	Total	Salvage	Annual Depreciation	Estimated Service Life Years
Other equipment		------ 1,000 US Dollars ------			
Finish solution mixers	2	1	-	-	
Air compressors (40 hp.)	4	24	12	1	10
Mobile pallets 1/	400	16	12	2	3
Sub-total		41	24	3	
Finishing lines total		669	87	60	
Final sort (19)					
Electronic measuring machine, with auto recorder-accumulator	1	31	3	3	10
Sorter-table (belt type with motor drive)	2	9	1	1	8
Horses, high type 1/	150	24	14	3	3
Sub-total		64	18	7	
Storage, packing shipping (20,21)					
Scale (25 kg. dial	1	1	-	-	
Fork-lift-high rise		17	1	3	5
With recorder (3,000 kg.dial)	1	6	1	1	10
Miscellaneous small equipment		1	-	-	
Sub-total		25	2	4	
Finishing division total 2/		1,138	145	105	
Factory total 2/		US$2,890	US$ 508	US$ 250	

1/ Thai-made equivalent to U.S.products -- Salvage value estimate is based on metal parts and structural wood re-use, for renovation every 3 years, in factory maintenance department.

2/ Totals are rounded to nearest US$ 1,000.

TABLE 3

Other Fixed Capital Costs (Supportive)

Item	Reference Fig. and (Block)	Mode of Estimation	Cost Factor (US$)	Total Cost (US$ 1,000)	Service Life (Years)
Water Storage	4(2)(11)	4,000 m^3	106	424	20
Water Treatment	3(11)	4,000 m^3/day Package Plant		120	20
Chemicals bulk liquid storage	4(5)	100 m^3	125	13	10
Sewage Treatment	3(12)	5,000 m^3/day Package Plant		260	20
Power Plant	3(10)	3-600 Kw elec. Generator sets with jacket heat-exchangers	Package Plant	405	20
Maintenance Bldg (Factory and Supportive)	2(22)	150 m^2 + 3% of total Table 2	250	included in factory 88	10
Air-exhaust System	2(3)	4-15,000 cfm units	2,500	10	10
Paved Areas	3(4,5,6, 7 & 8)	10,000 m^2 8" reinforced concrete	14	140	20
Security fence	3(13)	1,200 m	10	12	40
		Total		1,472	

TABLE 4

Land and Building Costs

Item	Reference	Mode of Estimation	Cost Factor (US$)	Total Cost (US$ 1,000)	Service Life (Years)
Land	Fig.3	6 hectares	93,750	563	
Buildings					
(a) Factory	Fig.2	20,000 m^2	250	5,000	40
(b) Support	Fig.3,4	10,000 m^2	198	1,980	40
				7,543	

TABLE 5

Labor Costs per Year (at full capacity)

Employee Class	Number and Type 1/	Annual rate	Fringes at 15%	Total	Grand Total
		----- US Dollars -----			
(Salaried)		(Factory Direct)			
General Manager 2/	1F	30,000	4,500	34,500	34,500
Manufacturing 2/ Superintendent	1F	25,000	3,750	28,750	28,750
Engineering & Superintendent	1F	25,000	3,750	28,750	28,750
Laboratory and Quality Control Supervisor	1F	22,000	3,300	25,300	25,300
Finishing Supervisor	1F	20,000	3,000	23,000	23,000
Tennery "	1F-T 3/	20,000	3,000	23,000	23,000
Receiving and Shipping "	1F-T 3/	20,000	3,000	23,000	23,000
Department heads	15F-T 4/	12,000	1,800	13,800	207,000
(Wage-rated)	22	(Sub-Totals)			393,300
Skilled	54T	1,500	225	1,725	93,150
Unskilled	43T	700	105	805	34,615
Laborers	53T	413	62	475	25,175
	150	(Sub-Totals)			152,940
	172	(Total factory direct) 5/			546,240
(Salaried)		(Indirect)			
Business manager	1F	25,000	3,750	28,750	28,750
Controller	1T	20,000	3,000	23,000	23,000
Personnel Officer	1T	18,000	2,700	20,700	20,700
(Wage-rated)	1 T or F	18,000	2,700	20,700	20,700
	4	(Sub-Totals)			93,150

TABLE 5 (Cont'd)

Employee Class	Number and Type 1/	Annual rate	Fringes at 15%	Total	Grand Total
		------- US Dollars -------			
(Salaried)		(Indirect)			
Clerical, Accounting and staff	18T	1,500	225	1,725	31,050
Technical Services	30T	700	105	805	24,150
Laborers and Cuetodial	10T	413	62	475	4,750
	58	(Sub-Totals)			59,950
	62	(Total Indirect 5/)			153,100
	212	G r a n d T o t a l			699,340

1/ F = Foreign, T = Thai

2/ Base salary only..as the owner's management people in Thailand, these three would have appropriate income or bonus incentives for production and profitability of the enterprise in addition to their base salaries.

3/ Several Thais with excellent foreign training school backgrounds in leather technology and Thai production experience were met during the Area Study interviews. These would be optimal choices for these assignments, since they are both Thai nationals and technically qualified in modern tanning and in Thai leather industry practices.

4/ A training program to develop operating and management skills among selected Thai personnel is envisioned for early years of the enterprise.

5/ Apportioned labor costs are 30 percent tannery and 70 percent finishing at full capacity for each division.

TABLE 6

Annual Depreciation Charges

	US$ Cost	Salvage Value a/ US$	Service Life	Depreciation US$
Factory Equipment	2,890,000	508,000		250,000 a/
Buildings				
Factory	5,000,000 -	500,000	40	112,500
Support	1,980,000 -	198,000	40	44,550
Sub-total	6,980,000	698,000	Total	157,050
Other Plant				
Water storage	424,000 -	42,400	20 =	19,080
" Treatment	120,000 -	12,000	20 =	5,400
Sewage plant	260,000 -	26,000	20 =	11,700
Power Plant	405,000 -	40,500	20 =	18,225
Paved areas	140 000 -	14,000	20 =	6,300
Security fence	12,000 -	1,200	40 =	270
Chem. storage	13,000 -	1,300	10 =	1,170
Main equipment	88,000 -	8,800	10 =	7,920
Air-exhaust	10,000 -	1,000	10 =	900
Sub-total	1,472,000	147,200		70,965
Grand Total	US$11,342,000	1,353,200		478,015
			Round off	480,000

a/ See Table 2 for calculation

TABLE 7

Pro Forma Profit and Loss Statement

	First Year	Second Year	Third and Succeeding Years
Operating level- % of capacity	60	80	100
Annual Output-sides (000)			
Tannery	436	581	726
Finishing plant	1,162	1,549	1,936
		($ 000)	
Revenues:			
Tannery- $1.90/side	828	1,104	1,379
Finishing plant- $.96/side	1,116	1,487	1,859
Total revenue	1,944	2,591	3,238
Operating costs:			
Raw materials	Nil	Nil	Nil
Labor	614	656	699
Fuel and water	65	86	108
Maintenance	50	50	50
Depreciation	480	480	480
Misc. overhead	25	25	25
Total operating costs	1,234	1,297	1,362
Operating profit	710	1,294	1,876
Preoperational expense	30	-	-
Interest	700	700	700
Net profit or (less)	$ 10	$ 594	$ 1,176
Cash flow			
Net profit	(63)	572	1,176
Depreciation	480	480	480
	$ 417	$ 1,052	$ 1,656

TABLE 8

Estimated Fee Schedule for Tanning and Finishing Operations

Process	Fee per Side (US Cents)	Added Charge for Chemicals (Cents/ft^2) 1/
Process		
Split	8 2/	
Shave	8 2/	
Retan, dye, fat-liquor	100	9
Set-out & paste dry	70	3/
Stock & Condition	10	
Stake	31	
Buff	10	
Crust sort	20	
Measure & Mark	10 2/	
Total Tannery Division	287	9
Finish Coating (per single pass)	25	20
Plating	15	
Embossing	15	
Measure & Mark	10 2/	
Grade & Sort	5	
Total finishing Div.	70	20

1/ Charged on the basis of footage processed.
2/ Fees for domestic tanneries in Bang Pu. (From Thai Tanners Association)
3/ Mainly starch paste--included in retan, dye, and fat-liquor charge above.

FIGURE 1

Sequence of Salted and Alternative Fresh Cattle Hide-to-Leather Processing Steps

Processing and Marketing Steps	Salted Hides to Leather	Fresh Hide-to-Leather Alternative I (blue-chrome)	Fresh Hide-to-Leather Alternative II (crust)	
Buy fresh hides (hide processor):	X	X	X	
Hidehouse				
Wash, demanure, flesh, trim ...:	X	X	X	
Brine cure .....:	X			
Wring .....:	X			
Class, weigh, tie, palletize...:	X			
Store .....:	X			
Sell salted hides.....:	X			
Buy hides (tannery) .....:	X			
Hideroom				
Receive, store, sort, retrim...:	X			
Side.....:	X 1/			
Beamhouse				
Soak, wash, dehair, bate.....:	X	X	X	
Sort, retrim, split .....:	X 1/	X 1/	X 1/	
Relime, bate, pickle, chrome-tan. .....:	X	X	X	
Wring and setout .....:	X	X	X	
Blue sort .....:	X	X	X	
Side .....:	X 1/		X 1/	
Pallet, wrap, store .....:		X		
Sell blue, chrome-tanned leather:		X		
Buy blue, chrome-tanned leather (tannery) .....:		X		
Receive, store .....:		X		
Laboratory analysis .....:		X		
Wring and setout .....:		X		
Side and retrim .....:		X	X 1/	
Blue sort .....:		X		
Split and shave .....:	X 1/	X 1/	X 1/	These steps must be carried out near source of fresh hides.
Tan and dyehouse :				
Retan, dye, fat-liquor.....:	X	X	X	
Setout and paste dry .....:	X	X	X	
Take-off, stack, condition ....:	X	X	X	
Stake .....:	X	X	X	
Buff .....:	X	X	X 1/	
Crust sort .....:	X	X	X	
Measure, pack, mark, store ....:			X	
Sell crust leather .....:			X	
Buy crust leather (finisher or leather goods manufacturer)				
Receive, measure, sort, store .:			X	These steps are carried out nearer to markets for leather
Buff .....:			X 1/	
Finishing :				
Color and plate .....:	X	X	X	
Sort and measure .....:	X	X	X	
Pack, mark, store .....:	X	X	X	
Sell leather	X	X	X	

1/ Optional at this point.

FIGURE 2 -- Ground Floor Schematic Diagram Tannery and Finishing Plant

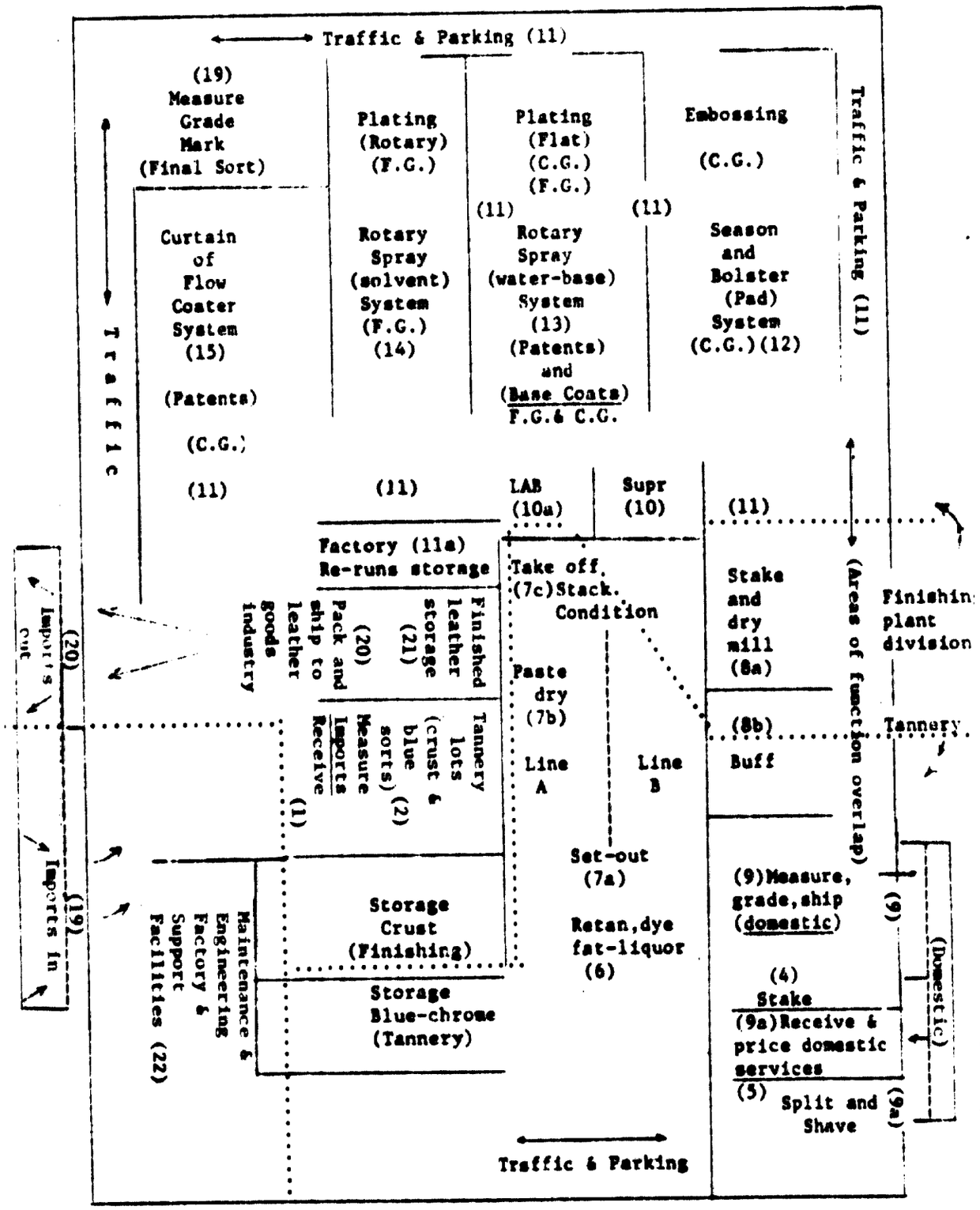
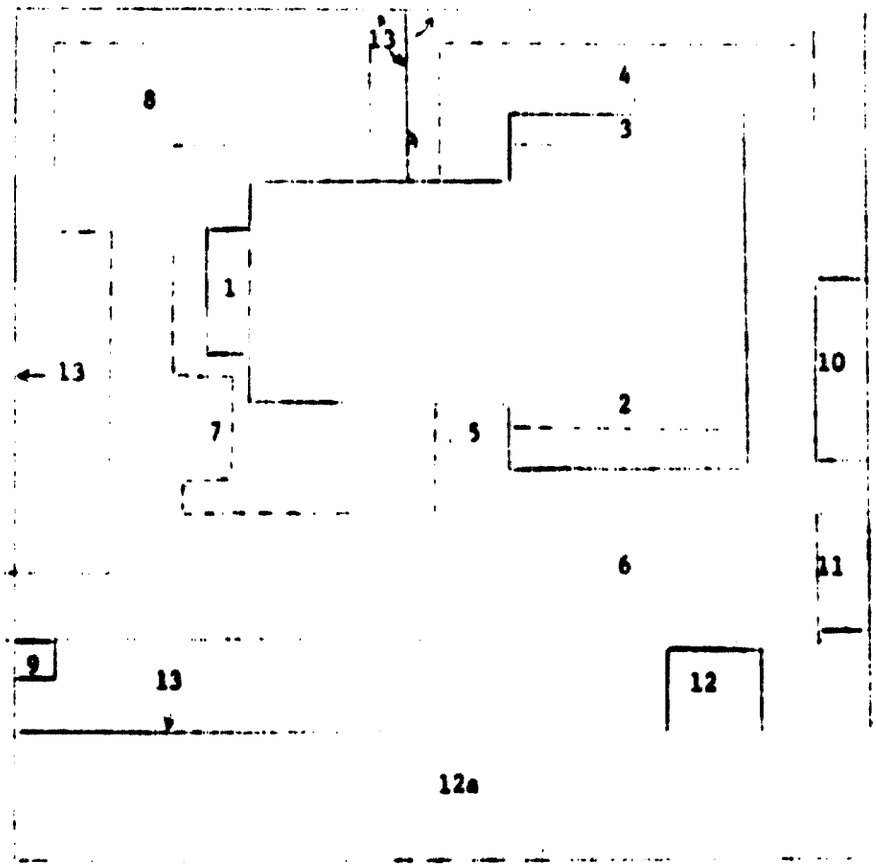
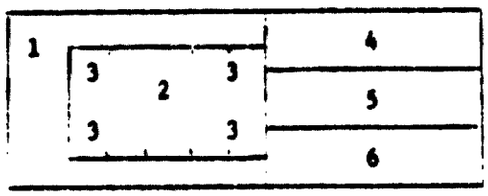


FIGURE 3 -- Factory at Bang Pu, With Supportive Facilities (ground level)



1. Reception
2. Receiving and Shipping (import items)
3. Receiving and Shipping (local tenneries)
4. Truck parking for 3 above
5. Sea-land container storage
6. Truck parking for No. 2 above
7. Customer & visitor parking
8. Employee parking
9. Gate House
10. Power Plant
11. Water purification and storage
12. Waste treatment + 12a
13. Security fence

FIGURE 4 -- Second Floor Spaces to Factory Support Functions



1. Officee
2. Open space to 1st floor-window walls office area
3. Exhaust fan ducts to roof
4. Water storage
5. Bulk liquid chemicals storage
6. Space for future solar-heated evaporators

TECHNICAL ANNEX A.
Process Sequence

Supplementary Information on Processes and Sequence of Operations in the Bang Pu Plant (text reference VB-2.)

Technical Processes-Domestic Leather and Blue-Chrome-tanned Crust Imports.

The material flow sequence from blue, chrome-tanned leather to crust leather for the leather finishing plant's tannery is given below.[1/]

Receiving and storage: Receives, measures, sorts, and stores imported blue-chrome tanned leathers (unsplit), (Figure 2--Blocks 1,2,3.).

Blue-sort: Grades for quality and sorts sides as to quality measured weights and surface area for tannery lots, (Figure 2--Block 2.).

The linkage to domestic tanneries (Bang Pu) for contract fee services (Figure 2--Block 4) receives, counts pieces, and prices services of tannery for each process function. (Figure 2--Blocks 5,6,7,8 and 9).

Split and shave: sides are split to desired thickness and the flesh side is shaved by machines to obtain a smooth underneath surface of even thickness. (Figure 2--Block 5.).

Retan, color, and fat-liquor: sides are retanned to add properties of more than one tanning agent to the leather, colored with a selected dyeing material, and fat-liquored to lubricate the fibers in the leather. (Figure 2--Block 6.).

Setout Paste-drying and Conditioning: Setout and wringing smoothes the wrinkles and wrings excess moisture from the sides. Sides are then dried on pasting equipment. To condition, a

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1/ Developed from material in Leather Facts, published by New England Tanner's Club, P.O. Box 371, Peabody, Mass., 01960, U.S.A. 4th Printing, 1972, 41 pp.

specific amount of water is added to each side, after drying, after which they are wrapped and allowed to mull overnight to make hides pliable and have 25% moisture. (Figure 2--Blocks 7a, 7b, and 7c.)

Staking: Staking stretches and softens the leather mechanically. Each piece is then buffed or sanded to minimize blemishes. (Figure 2--Blocks 8a and 8b).

Crust sort: Sides are sorted by grade characteristics and defects, trimmed of major defects, measured, and surface area for each side is recorded. (Figure 2--Block 2 for imports, Block 9 for domestic.).

Technical Process-- Pre-Finishing:

Includes receiving quality control, storage,and pre-finishing of imported crust leathers.

The material flow sequence from unload of containers of imported crust leathers through pre-manufacturing is given below.

Receive and survey: All receipts of imported leather are weighed, graded, and measured for area of usable (marketable) leather, tested for quality, sorted into finishing plant lots by characteristics, and recorded and stored in raw materials inventory. (Figure 2--Blocks 1,2,9, and 10.)

Conditioning: Sometimes called "wetting back", prepares incoming crust stock for finishing steps that follow by bringing moisture content of leather up to 25 percent. (Figure 2--Block 7c.)

Stake and buff: Staking stretches and softens the leather mechanically. Each piece is then buffed or sanded to minimize blemishes. The buffing steps are seldom required on full-grain (F.G.) finishing stocks. They are required for all corrected grain (C.G.) finishing stocks (for example, all domestic-source leathers are expected to go through typical C.G. finishing modes). (Figure 2--Blocks 8 and 8a.).

Split and shave: If rough crust leathers are imported, splitting and shaving to desired grain leather thickness for each piece will be necessary. Conditioned leather crust-splitting capability in the split and shave department is an assumed technical processing requirement for the finishing plant. (Figure 2--Block 5.).

Technical Processes--Finishing

Finishing, quality control, storage, and shipment of leathers to Thai shoe manufacturers and other leather goods making factories. Four lines for finishing leather are shown in Figure 2. Each line is capable of using a class of finishes to obtain a group of finish types with colors or tints and surface effects associated with them in modern leather usages.

Season and bolster: A surface-covering and flaw-filling coating and curing sequence in the corrected grain (C.G.) leather finishes class to be flat-plated or embossed. (Figure 2--Block 12.).

Rotary spray, (water system): Synthetic polymer surface coverings of low density, with high mar and scuff resistance, cured, and dried for C.G. leathers to be flat-plated. (Figure 2--Block 13.).

Rotary spray, (solvent release system): Single or multi-pass thin tinting and coating layers, cured for full-grain (F.G.) leathers in natural grain effects, to be rotary (polish) plated. (Figure 2--Block 14.).

Curtain or flow-coater system: Single-pass coater system for synthetic resin patent leathers (may receive added scuff-resistance by rotary-spray pass-through system for a clear overcoating). May be flat- or rotary-plated. (Figure 2--Block 15.).

Embossing: Controlled heat and high pressure machines put permanent grain-leather or fancy leather effects, such as so-called "elephant leather", crocodile, and various imitation hand-tooled designs already used in Thailand. (Figure 2--Block 16.).

Plating (flat-line): Controlled heat and pressure plates iron out wrinkles and blemish depressions in C.G. leathers. (Figure 2--Block 17).

Measure, grade, and mark: Under supervision of a highly-skilled leather grader, each piece is trimmed of faulty edges, graded, measured, and marked with area, thickness, and quality. Several "sorts" of market leathers are defined and separated in this step. (Figure 2--Block 19).

Finish lots (processing and holding area): This is essential for a multi-line finishing plant. It is an area where lots (a) to be finished, (b) semi-finished, and (c) finished-but-not graded are held in stacks on wheeled pallets until further processing required can be scheduled.

Laboratory-quality control center: All of the tannery raw materials, processes, and products are monitored and adjusted, when necessary, from this key department of the whole plant operation. (Figure 2-- Block 10).

Factory reruns: Mistakes that are correctable in finishing are routed here for inventory. The flaws detected in finish leather at Block 19 are often correctable, if a system of rerun inventories is a part of factory operations. (Figure 2--Block 11a).

Finished leather storage: Holding point for partially completed lot orders on pallets. (Figure 2--Block 21).

Pack and ship: Delivery point for finishing plant products to leather goods industry. (Figure 2--Block 20).

TECHNICAL ANNEX B

Quality Standards for Leather

It is proposed that the leather quality and performance to be provided by the Bang Pu Tannery and Finishing Plant at Bang Pu. Shall be the guideline standards in "Acceptable Quality Levels in Leathers" UNIDO - United Nations, Vienna, Austria, U.N. Pub. (sales) No. E.76II(B.6) p-42-44, 1976, (Price: US$ 2.50).

Since most leathers passed through the plant will be produced and tanned to crust elsewhere, these guidelines are mainly "standards" of quality and performance for sellers of products to the Bangkok Trading Co. for processing at Bang Pu.

TECHNICAL ANNEX C

LEATHER GLOSSARY

Definitions of Common Industry Terms

On the following pages there is a glossary of common terms used by the tanner and leather product industries to identify leather. The number of such terms is considerable and is a natural consequence of these facts:

1. HIDES and SKINS: There is a great variety of hides and skins throughout the world for conversion into leather.
2. TANNING PROCESSES: The tanner has at his disposal a wide choice of processes for producing many different types of leathers.
3. LEATHER GOODS: Leather is used in an endless number of consumer goods and for many industrial applications.

Oftentimes a combination of terms is used to describe leather or leather items. Thus, you may own a pair of shoes that have uppers made from calfskin that was chrome tanned. "Leather Uppers" -- "Calfskin Upper Leather" -- "Chrome Tanned Uppers" -- "Chrome Tanned Calfskin Uppers" -- all these are bonafide descriptions. The more common terms follow, and are divided into the three categories mentioned above.

TERMS RELATED TO HIDES AND SKINS

ALLIGATOR	Alligator, crocodile, and related types.
BUCKSKIN	Deer and elk skins, having the outer grain removed.
BULLHIDE	Hide from a male bovine, capable of reproduction.

CALFSKIN	Skin from a young bovine, male or female.
CAPESKIN	From a sheep raised in South Africa.
CARPINCHO	A water rodent native to South America; like pigskin.
CATTLEHIDE	General term for hides from a bovine of any breed or sex, but usually mature; includes bullhide, steerhide, cowhide, and sometimes kipskins.
CORDOVAN	From a section of a horsehide called the shell.
COWHIDE	Hide from a mature female bovine that has produced a calf.
DEERSKIN	Deer and elk skins, having the grain intact.
DOESKIN	From sheep or lambskins, usually with the grain removed.
FLESHER	The underneath (flesh side) layer of a sheepskin which has been split off. Used to make chamois.
GOATSKIN	Skin from a mature goat.
HAIR SHEEP	Sheep from several species whose "wool" is hair-like.
HEIFER	A female bovine, under three years of age, that has not produced a calf.
HIDE	The whole pelt from large animals (cattle, horse, etc.).
HORSEHIDE	Hide from a horse or colt.
KANGAROO	From the Australian kangaroo or wallaby.
KIDSKIN	Skin from a kid, or young goat.
KIPSKIN	Skin from a bovine, male or female, intermediate in size between a calf and mature animal.
LAMBSKIN	Skin from a lamb, or young sheep.
LIZARD	Any of a great number of the lizard family.
MOCHA	Middle-east hair sheep, usually with the grain removed.
OSTRICH	From the two legged animal native to North Africa.
PECCARY	From a wild boar native to Central & South America; like pigskin.
PELT	An untanned hide or skin with the hair on.
PIGSKIN	Skin from pigs and hogs.

RAWSTOCK	General term for hides or skins that a tanner has received in a preserved state, preparatory to tanning; a tanner's inventory of raw material.
SHARKSKIN	From certain of the shark species.
SHEARLINGS	Wooled sheep and lambskins, tanned with the wool intact.
SHEEPSKIN	Skin from a mature sheep.
SKIN	The pelt from small animals (calf, sheep, goat, etc.).
SKIVER	The thin grain layer split from a sheepskin.
SNAKE	Any of a number of the snake species.
STEERHIDE	Hide from a mature male bovine, incapable of reproduction, having been raised for beef.
WALRUS	Skin from a walrus; also, sometimes sealskin.
WATER BUFFALO	Flat-horned buffalo, primarily from the tropics.
ANILINE FINISH	Full grain leather which has been colored with dyestuffs rather than pigments. Usually topped with a protein, resin, or lacquer protective coating; can also be waxed.
BARK TANNED	See "VEGETABLE TANNED".
BOARDED	A grain effect produced by folding a skin grain against grain and mechanically rolling the two surfaces back and forth against each other.
CHROME TANNED	Leathers which have been tanned with soluble chromium salts, primarily basic chromium sulfate. Currently the most widely used tannage in the U.S.A.
COMBINATION TANNED	Leathers tanned with more than one tanning agent. For example, initially chrome-tanned followed by a second tannage (called a RETAN) with vegetable materials.
EMBOSSED	A mechanical process of permanently imprinting a great variety of unique grain effects into the leather surface. Done under considerable heat and pressure.
FULL GRAIN	Grain leather in which only the hair has been removed. Usually carries either an aniline or glazed finish.

GLAZED FINISH	Similar to an aniline finish except that the leather surface is polished to a high lustre by the action of glass or steel rollers under tremendous pressure.
GRAIN LEATHER	Hides and skins which have been processed with the grain, or outer surface, dressed for end use.
IMITATION	A variety of materials which have been made to resemble genuine leather. The great bulk of these are rubber or plastic coated fabrics. It is unlawful to use terms connoting leather to describe imitations.
LEATHER	The pelt of an animal which has been transformed by tanning into a non-putrescible, useful material.
MINERAL TANNED	Leathers which have been tanned by any of several mineral substances, notably the salts of chromium , aluminum, and zirconium.
OIL TANNED	Leathers tanned with certain fish oils. Produces a very soft, pliable leather such as chamois.
PIGMENT FINISH	A process of coloring and coating the leather surface with colored pigments dispersed in film-forming chemicals called binders. The latter can be tailor-made to produce surfaces that are highly resistant to wear, fading, etc.
RETAN	See "COMBINATION TANNED".
SIDE LEATHER	Cattlehide grain leather which, prior to processing, has been cut in half forming two "sides". Purpose is to reduce the size to better accommodate tannery equipment. Represents the largest volume of commercial leather currently produced.
SNUFFED	Grain leather which, in addition to hair removal, has had the outer surface lightly removed by buffing.
SPLIT	The underneath layer of side leather which has been "split" off. Devoid of a natural grain, it may be either sueded or pigment finished and embossed.
SUEDE	Leathers that are finished by buffing the flesh side (opposite the grain side) to produce a nap. Term refers to the napping process, and is unrelated to the type of skin used.

SYNTHETIC	See "IMITATION"
TOP GRAIN	See "FULL GRAIN".
VEGETABLE TANNED	Leathers which have been tanned with vegetable materials that are derived from certain plants and woods, often called BARK tannins.

TERMS RELATED TO LEATHER GOODS

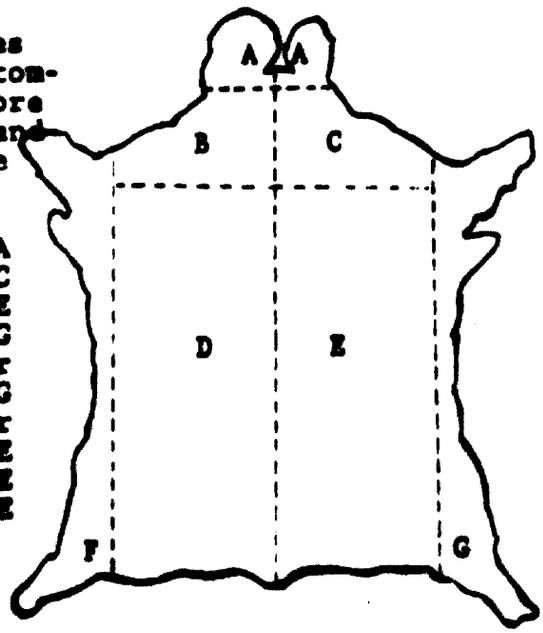
BAG, CASE, & STRAP	Cattlehide leather used to make travel bags and suitcases. Does not include HANDBAG leather
BELT	Leather from which waist belts are made. Not to be confused with BELTING leather.
BELTING	Heavy cattle leather used to make belts for the transfer of power in machinery.
BOOKBINDING	Used for covering books, picture frames, etc.
CASE	See "BAG, CASE & STRAP"
CHAMOIS	The product of oil tanning the underneath layer (called a "flesher") that has been split from a sheepskin.
DIPLOMA	Usually vegetable tanned sheepskin used in making diplomas.
GLOVE	Sheep, pig, deer, and kidskin that has been tanned to produce a soft, stretchy leather for dress gloves. Also, cattlehide splits, sheepskin, and others that are tanned for garden and work gloves.
HANDBAG	Any of a variety of leathers used for women's handbags.
HARNESS	Vegetable tanned cattlehide leather finished for harness and saddlery use.
HAT	Vegetable tanned calf or sheepskin leather used for hat sweatbands.

INSOLE	A shoe leather used for the inner sole which the foot rests upon. Usually from cattlehide.
LINING	A shoe leather used for lining the inside portions. Made from all kinds of hides and skins, either grain or suede finished.
NOVELTY	Any of a variety of leathers, frequently vegetable tanned, used for billfolds and small leather goods.
OUTSOLE	A shoe leather used for the outer soles. From vegetable tanned cattle-hide, often quite thick.
PATENT	A shoe leather, heavily finished to give a highly lustrous, baked-enamel type appearance, used for shoe uppers. Generally from cattlehide.
SHOE	General term including all upper, lining, and sole leathers.
SLIPPER	Cowhide and sheepskin leathers, usually chrome tanned, used for slipper uppers.
SOLE	See "INSOLE" and "OUTSOLE".
STRAP	See "BAG, CASE, & STRAP".
SWEATBAND	See "HAT".
UPHOLSTERY	Large cattlehide, split thin, and tanned for use as furniture and automobile seat coverings.
UPPER	A shoe leather used for the upper portions. Predominantly from cattlehide and calfskins, although a great variety of skins are used. Usually combination tanned.

THE SUBDIVISIONS OF A HIDE

In the processing of most hides from large animals, it is customery to cut them into two or more smaller sections for easier handling. The nomenclature of the various parts is shown below.

HEAD	A
SHOULDER	B or C
BEND	D or E
BELLY	F or G
SIDE	A+B+D+F or A+C+E+G
CROP	A+B+D or A+C+E
BACK	B+D or C+E
CROUPON	D+E



Source: Leather Facts, published by New England Tanner's Club, P.O. Box 371, Peabody-Mass. U.S.A. 01960 (4th Printing - 1972.4(p).

ANNEX D: U.S. Firms and Agencies that have Interests in Hides and Leather

Company	Chief Officer	Address
American Leather Chemists Assoc.	Jean J. Tancour, Pres.	University of Cincinnati, Cincinnati, Ohio. 45221.
Beggs & Cobb, Inc.	Harry Remis, Chairman	179 South Street, Boston, Mass. 02111.
Eagle-Ottawa Leather Co.	Anders Segerdahl, Pres.	200 No. Beechtree Road, Grand Haven, Mich. 49417.
Flavorland Industries Inc.	William B. Foxley, Pres.	10050 Regency Circle, Omaha, Neb. 68114.
S.B.Foot Tanning Co.	H.W. Mansur, Jr. Exec .V.P.	P.O. Box 73, Red Wing, Minn. 55066.
General Split Corporation	Don Hollaway	5050 South Second Str, Milwaukee, Wisc. 53207.
Iowa Beef Processors, Inc.	David W. Delph	Dakota City, Nebraska 68731.
A.C.Lawrence leather Co. (Div. of Esmark, Inc)	W.E. Marshall, Pres.	Essex Co. Bank, Route 128, Peabody, Mass. 01960.
Leather Tanning Assoc, Consultant	Robert M. Lollar	216 Eastern Ave, Clarendon Hills, Ill. 60514.
Legallet Tanning Co.	Paul Legallet, III, Pres.	1099 Quesada Ave, San Francisco, Calif. 94124.
Pfister and Vogel	John T. Justen, Pres	1531 North Water St., Milwaukee, Wisc 53202
Prime Tanning Co.	Richard H. Goldberg, Pres.	Sullivan Street, Berwick, Maine 03901.

ANNEX D (Cont'd):

Company	Chief Officer	Address
Fred Roeping Leather Co.	C. David Wilson, Pres.	96 Doty Street, Ford du Lac, Wisc. 54935.
A.K. Salz Leather Co.	Stuart E. Miller, Jr.	P.O. Box 1120, Santa Cruz, Calif. 95060.
Sexton Company	Philip D. Kaltenbacker, Chairman	844 Broadway, Newark, NJ. 07104

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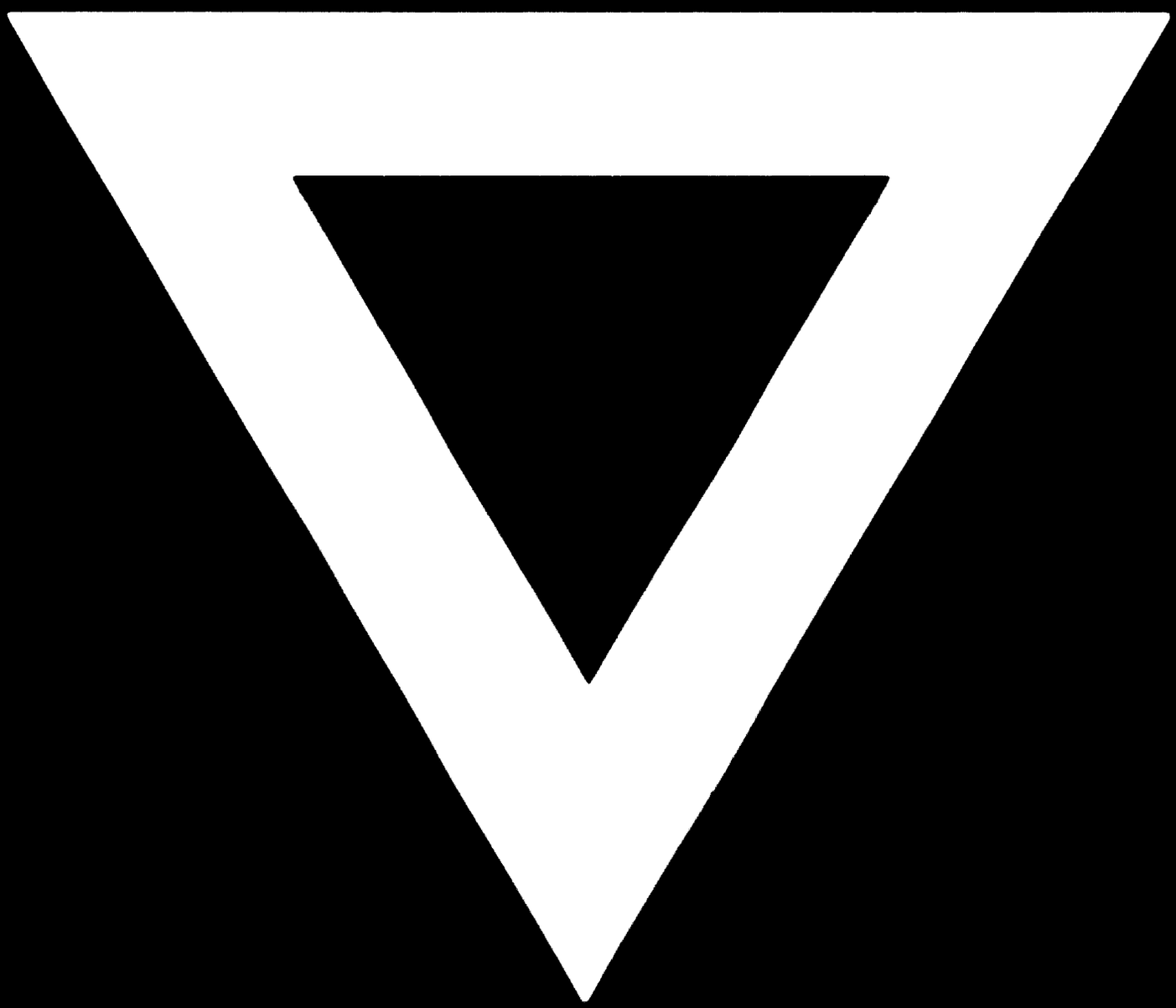

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