



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

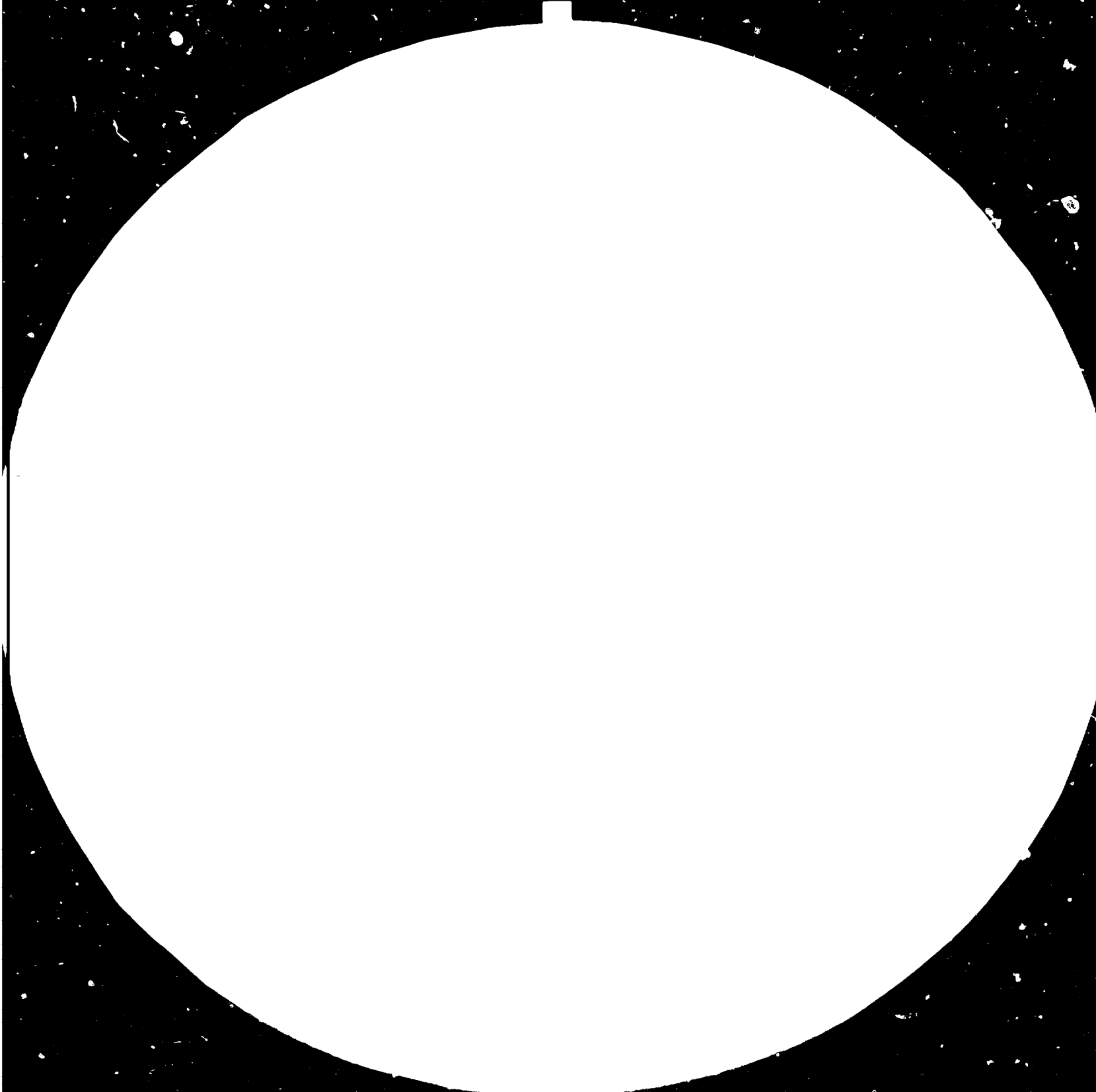
FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org





2.8



METRIC RESOLUTION TEST TARGETS

1.0 1.1 1.25 1.4 1.6 1.8 2.0 2.2 2.5 2.8

RESTRICTED

12795

DP/ID/SER.A/468
21 March 1983
ENGLISH

LEATHER AND LEATHER PRODUCTS INDUSTRIES DEVELOPMENT

DP/URT/72/010

UNITED REPUBLIC OF TANZANIA

Technical report: Footwear design and pattern-cutting course and product development at the Tanzania Leather Associated Industries Corporation

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

Based on the work of Don Russel, expert in footwear design

United Nations Industrial Development Organization

Vienna

827

7.32-53661

Explanatory notes

Reference to dollars (\$) are to United States dollars, unless otherwise stated.

TSC is the Tanzania Shoe Company Ltd.

Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

As part of the project "Leather and leather products industries development" (DP/URT/78/010), an expert in footwear design was sent to the United Republic of Tanzania by the United Nations Industrial Development Organization (UNIDO), acting as executing agency for the United Nations Development Programme (UNDP). During the three-month mission, which began on 14 September 1982, the expert:

(a) Organized a 12-week course in practical footwear design and pattern cutting for 12 participants who were nominated by the Tanzania Shoe Company Ltd. (TSC) (6), Morogoro Shoe Company (5) and Tanzibar State Leather Company (1);

(b) Made recommendations for longer term training aimed at design and product development at TSC;

(c) Gave instruction and training in design specification and product costing while producing a manual on costing for designers (see annex 1);

(d) Developed a range of canvas footwear that could be considered for future production and marketing.

In addition, at the suggestion of the General Manager of TSC and the international team leader, the expert made suggestions for cost-saving measures, with recommendations for import substitution, and for applying new techniques in specifications and costing operations.

The expert carried out these activities mainly at TSC, with a one-week operational course at the Morogoro Shoe Factory.

As a measure of the success of the project, over 200 pairs of shoes were produced by participants of the course, and certain styles were earmarked for the project.



- 5 -

CONTENTS

	<u>Page</u>
INTRODUCTION	6
FINDINGS AND RECOMMENDATIONS	8
Findings	8
Recommendations	9
TRAINING AND PRODUCT DEVELOPMENT	10
The design and pattern-cutting course	10
Heat embossing	11
Canvas shoe project	11
Prototype footwear	14
Specifications and costing	14
<u>Annexes</u>	
I. Cost control for the footwear designer	15
Appendix. Specification Chart	33
II. Participants in the design and pattern-cutting course	34
<u>Figures</u>	
I. The forming and sock stitching	12
II. Styles submitted to the design selection committee	13
III. Diagram of woven material	24
IV. Examples of layout	25
V. The Russ and Small scaling method	27
VI. Scaling form	28
VII. Layout considerations	30
VIII. Layout of an Oxford style shoe	31
IX. Wastage scale	32

INTRODUCTION

As part of the project "Leather and leather products industries development" (DP/URT/73/010), an expert in footwear design was sent to the United Republic of Tanzania by the United Nations Industrial Development Organization (UNIDO), acting as executing agency for the United Nations Development Programme (UNDP). During the three-month mission, which began on 14 September 1982, the expert:

(a) Organized a 12-week course in practical footwear design and pattern cutting for 12 participants who were nominated by the Tanzania Shoe Company Ltd. (TSC) (6), Morogoro Shoe Company (5) and Zanzibar State Leather Company (1);

(b) Made recommendations for longer term training aimed at design and product development at TSC;

(c) Gave instruction and training in design specification and product costing while producing a manual on costing for designers (see annex I);

(d) Developed a range of canvas footwear that could be considered for future production and marketing.

In addition, at the suggestion of the General Manager of TSC and the international team leader, the expert made suggestions for cost-saving measures, with recommendations for import substitution, and for applying new techniques in specifications and costing operations.

The expert carried out these activities mainly at TSC, with a one-week operational course at the Morogoro Shoe Factory.

The participants worked on individual tasks at their own pace. Personal taste was allowed in design matters but practical considerations in the making up of prototype shoes taught the more adventurous to be more cautious in later efforts. Criticism and instruction was mainly on an individual or small group basis.

Each participant was issued a costing manual with prepared notes for future reference. The amount of time available for practical application was limited owing in part to the chronic shortage of certain items, especially in the marking up of materials procedures. Specifications and costing charts were designed and printed and their introduction on a trial basis was discussed.

The canvas shoe project was carried out during the last seven weeks of the mission. A range of styles was prepared on two newly available moulds. Following the original prototype, participants produced over 200 pairs of footwear. These came under the scrutiny of the Design/Production Committee, and certain styles were earmarked for early introduction into the production plans of the Tanzania Shoe Company Limited.

During the course of the project the expert received assistance from the following persons: A.O. Ngamilo (General Manager) and senior staff and personnel of the Tanzania Leather Associated Industries; Y.J. Mwalilo (General Manager), B.N. Kiyuga (Director of Finance), N.S.K. Tumbo (Director

- 7 -

of Manpower Development and Administration), Maria Mtalo (Senior Manpower Development Officer), M. Azim (Chief Designer) and E.V. Shiyo (Design Manager) of the Tanzania Shoe Company Ltd.; the General Manager and senior staff of the Morogoro Shoe Company; staff of the United Nations Development Programme at Dar-es-Salaam; and members of the UNIDO project team.

FINDINGS AND RECOMMENDATIONS

Findings

Training

1. The participants of the training course worked very hard. They learned much from the instruction and from their own mistakes and should be able to use correct procedures in the future. Working in groups helps to overcome personal shortcomings and adds impetus to the training by avoiding stalemates and tedious operations. There was also a need to build up a team spirit between the two manufacturing units, Morogoro Shoe Company and TSC.
2. The level of education of the participants was good.

Supply of raw materials and equipment

3. The supply of materials is unstable, varying from week to week and suitable alternative sources of supply are difficult to find.
4. The tools and equipment available for training are still well below normal international standards. The procurement of simple personal tools is almost impossible, which hinders improvements in accuracy and quality levels.

Export potential

5. Styles are still well behind competitive international standards. Efforts to upgrade styles are being made but owing to the ease with which sales are made on the domestic market and shortages of raw materials there is little incentive to attack the problem.
6. There has been no improvement in the supply and variety of sole units. No new moulds are contemplated in the near future, so exports would be limited to prefinished leather soles.
7. There are good possibilities for exports to neighbouring countries, but, again, the limits of the raw material supply prevents expansion.

Design and development

8. An adequate number of partly trained design and development personnel from both factories have now received instruction to an intermediate level.
9. Last making is of concern both at present and in the future, as the factories rely heavily on imports.
10. Some economies have been achieved by using more natural-type linings rather than pigmented ones.
11. The pace at which knives and dies are produced has been speeded up, and additional specialized machinery has been ordered.
12. There appears to have been an improvement in the conservation of adhesives, but some wastage can still be seen.

13. The maintenance and running condition of many machines seems to have improved. Considerable difficulties were experienced in the closing and making of the canvas shoe samples and trials.

Recommendations

1. The time is now ripe for major decisions to be made regarding the structure and staffing of design and development units at both TSC and the Morogoro Shoe Factory. This should be done with an eye on current problems in the short term, followed by a longer range expansionist policy. There are adequate design and development personnel on board or in training at both factories.

2. The graduates from the courses have experience in certain functions only and should be gradually trained in selected specialized areas. It should be remembered that they will still require supervision and assistance when preparing patterns for bulk production.

3. It is still essential to allocate about \$1,000 to procure or replace essential tools and cutting boards.

4. Critical analyses should be made of the impact of new styles with a view to achieving maximum economies and improving work flow and productivity.

5. The specification charts need additional testing. Necessary adjustments incorporated in a new draft.

6. There is still room for further economies, especially in the cutting of raw materials. Tight costing procedures and cutting performance control would point out the faults so that steps could be taken to rectify problems.

7. When the heat-embossing machine is installed, a good deal of thought should be given to making full use of its potential in order to relieve the overworked sewing operations.

8. More efforts are required to update the canvas shoe range periodically. Now that two new moulds have been commissioned, the basic ground work is laid for a gradual development over the next year or so.

TRAINING AND PRODUCT DEVELOPMENT

The design and pattern-cutting course

As part of the long-term training programme in the United Republic of Tanzania, two UNIDO design and pattern-cutting courses, both of three months duration, were held in mid-1980 and early 1982. There are now some 25 aspiring designers and pattern cutters in three factories, each individual having varying degrees of skills, aptitudes, capabilities and potential. During the period covered by the present project, a number of these individuals were abroad taking courses in Europe; however, four of the participants in the third course, who had also participated in the first course, had just returned from nine months training in Italy. All designers and cutters who have undergone training should form the nucleus of personnel for the design and development offices at the Tanzania Shoe Company Limited and the Morogoro Shoe Company.

With the co-operation of the Training Officer of TSC, a preliminary survey was made of the facilities available, and nominees for the course were discussed. The classroom used for the second course in early 1982 was reactivated and suitably equipped. New wall display boards were installed for the exhibition of instructional and general information.

Because the level of previous training was so varied, the participants were divided into three groups:

<u>Group</u>	<u>Previous training</u>	<u>Number of Participants</u>
A	Participants who had attended the first course and had recently returned from a nine-month course in Europe	4
B	Participants who attended either the first or second course who had not been nominated to go to Europe for additional training	4
<u>ca/</u>	New participants who had been nominated by management to fill the remaining places	3

a/ The participant from the Zanzibar State Leather Company did not attend the course as two of the Company's personnel were already in Europe.

The activities of each group are described below.

Group A. Each participant was to create designs and patterns for at least one style each of men's, women's and children's shoes, based on lasts in use at TSC. At least one additional style was to be based on hand-sewn mocassin construction. Materials were to be chosen from those readily available.

Group B. Tasks, set according to individual choice, were to become progressively more difficult, the goal being to cut a pattern and make a prototype hand-sewn mocassin.

Group C. Some basic instruction was given in form cutting and essential pattern-cutting principles. Once this was mastered, each member of the group joined up with a participant from group A who monitored the daily progress of the "junior counterpart". This was found to be a useful method to develop training ability for the future for participants in group A.

The names of the students and their affiliation are given in annex II.

Heat-embossing

During the third week of the mission, the expert became involved in assisting the design office of TSC to prepare for the installation of a heat-embossing and punching machine. One design each for men's, women's and children's shoes was settled upon and these styles were group graded to conform to the most economical approach possible for bulk production, a technique that TSC had not used before. The machine will be installed by a fully qualified technician upon arrival.

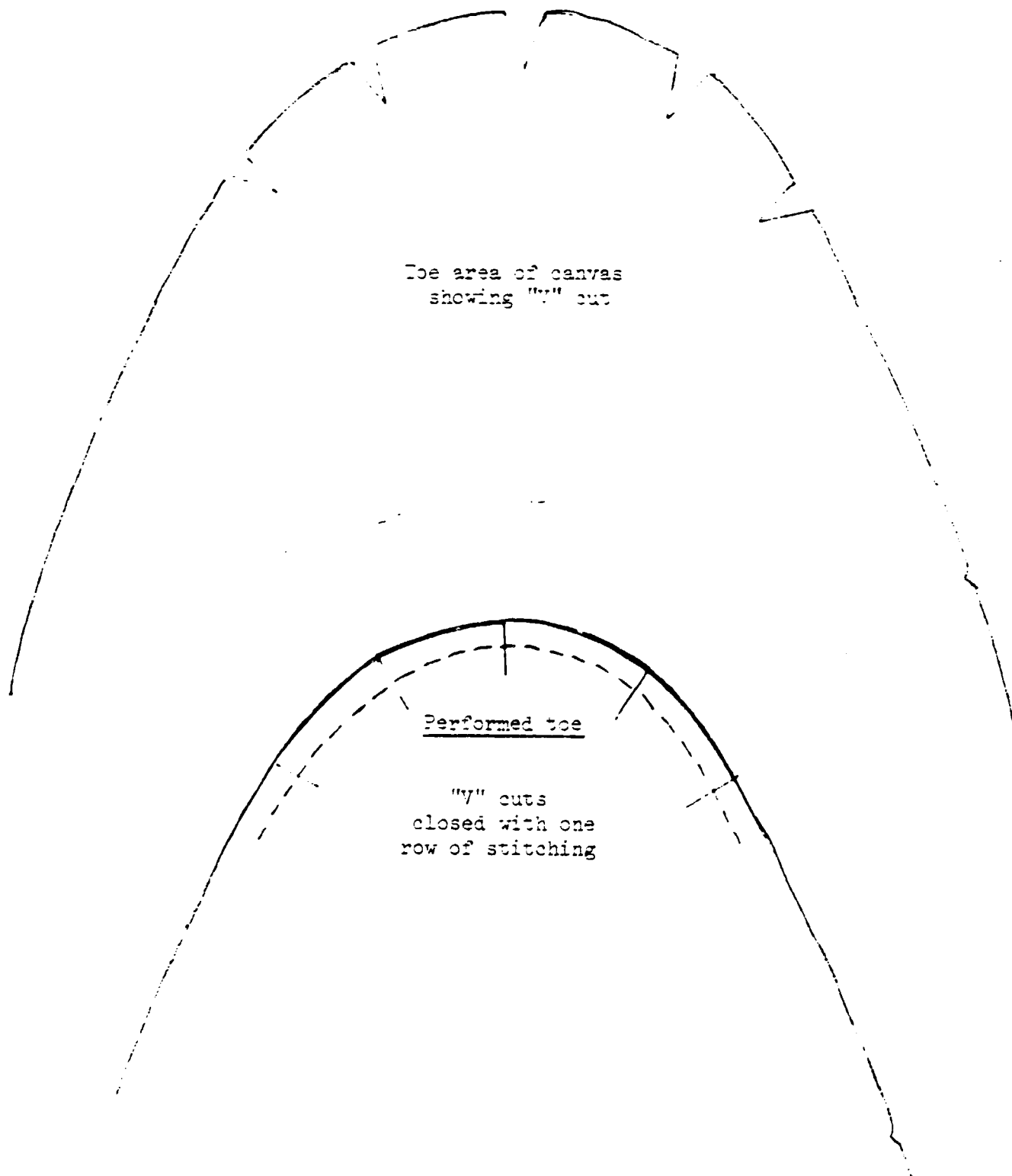
Canvas shoe project

The expert found that the styles in production at the canvas shoe factory have remained the same over many months, and there were no plans for the introduction of new styles. Two new and complete sets of vulcanizing moulds have been available for nearly two years, but tooling up had been delayed owing to initial pattern and trial problems. It was explained that the basic problems were that string-lasting machinery was not available and that the stitching machinery could not cope with the difficulties encountered when the mould closed. The solid aluminium last had a very pronounced "bump" toe and did not easily allow the rather rigid canvas to conform to its shape. It soon became obvious that it would be necessary to change the patterns and to dispense with those originally adopted.

In order to allow the bottom mould of the sole to rise up the feather edge of the last, the sock seam had to be undercut by a small margin ranging from 2 mm to 5 mm. This meant that the periphery of the lasting edge of the upper was considerably longer than that of the sock. In order to counteract this, a series of 5 "V" cuts were made around the toe area, and this was gradually perfected until the problem was overcome (see figure I). Once the departmental heads were satisfied that the trials had proven practical production possibilities, a range of eight new styles was developed.

The split-bottom mould would not permit any type of overlay seam or bound edge as the lip of the mould cut into any protrusion. The only type of seam which appeared possible was the closed seam. These restrictions placed considerable constraints on the design possibilities.

Two participants were selected to specialize in pattern cutting, hand cutting of uppers and closing procedures. They proved able to cope with the step-by-step procedure set up by the expert. This meant registering minor pattern changes and supervising accuracy at all stages. Following some three weeks of trials, six styles (see figure II) were presented to a design selection committee of TSC, on 1 November. Because of the interest, a special

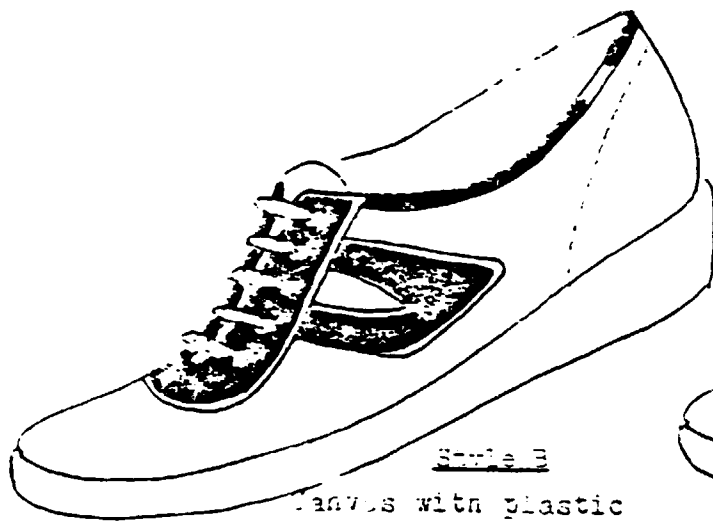


Toe area of canvas
showing "y" cut

Performed toe

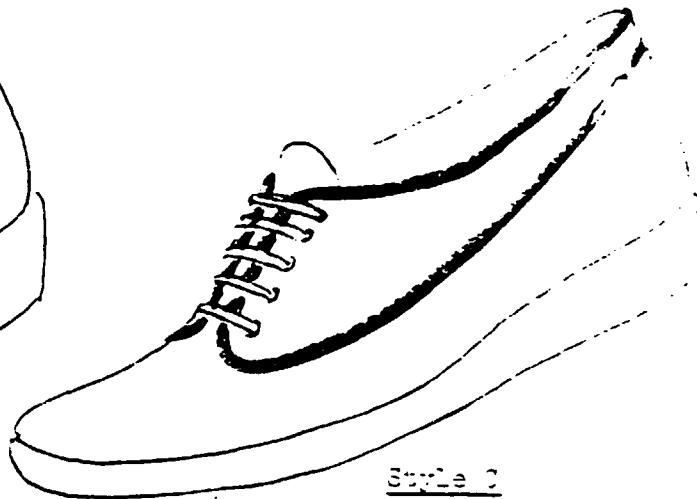
"y" cuts
closed with one
row of stitching

Figure I. Toe forming and sock stitching



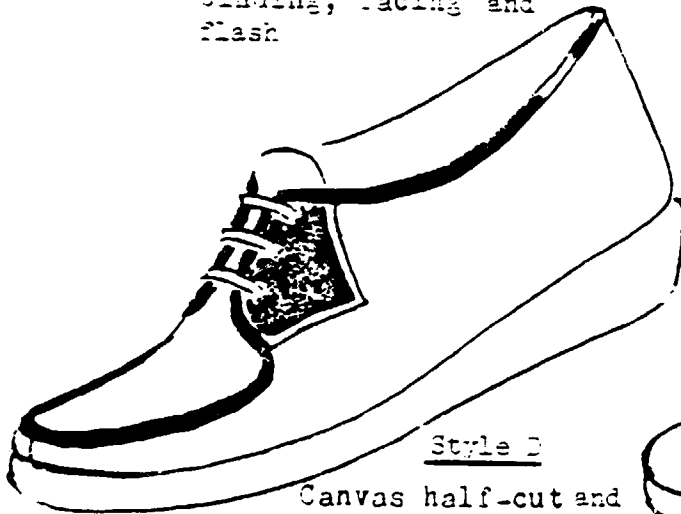
Style B

Canvas with plastic binding, facing and flash



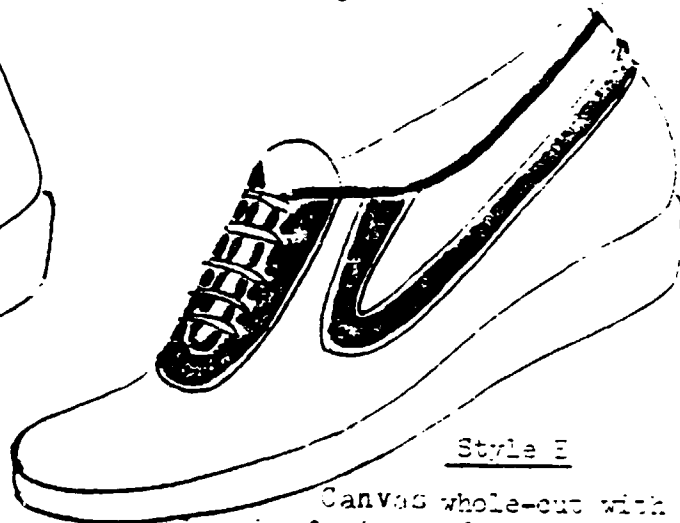
Style C

Canvas whole-cut and top quarter, with plastic binding



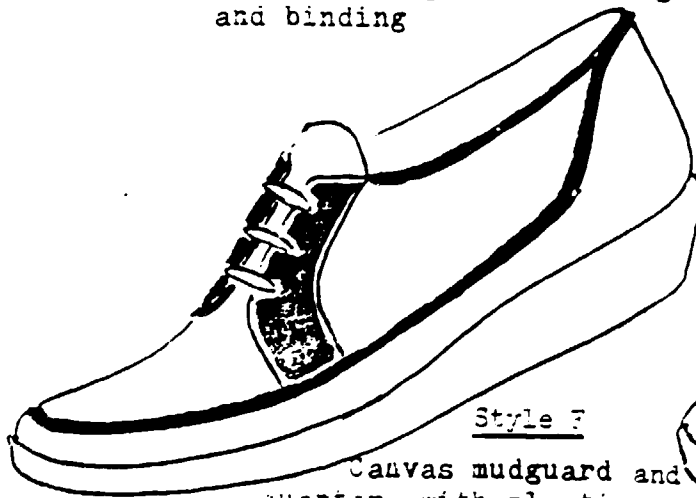
Style D

Canvas half-cut and panel, with plastic facing and binding



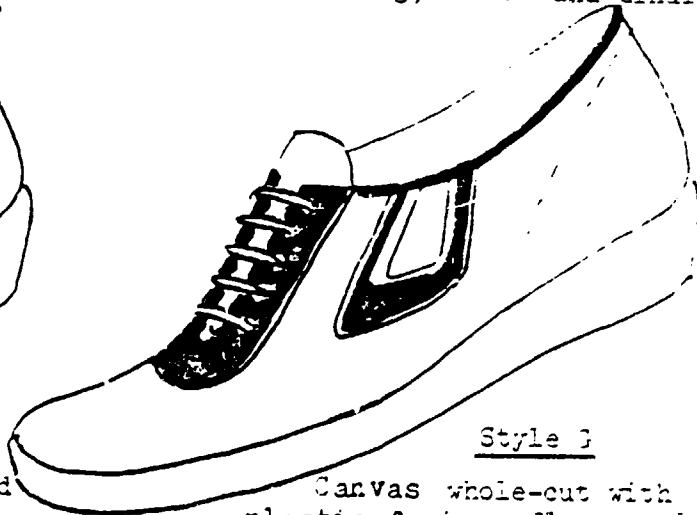
Style E

Canvas whole-cut with plastic facing, flash and binding



Style F

Canvas mudguard and quarter, with plastic facing and binding



Style G

Canvas whole-cut with plastic facing, flash and binding

Figure II. Styles submitted to the design selection committee

meeting was held on 6 November to adopt a plan to introduce at least one new style. The design committee decided to initiate a trial pilot line of 120 pairs of style G, made on the four sizes of the moulds (men's and ladies' sizes 2, 3, 4 and 5 - 30 pairs per size).

Hand grading of upper patterns was carried out in the classroom and single-pair size trials were completed with minor modifications. The 30 pairs of uppers of each size were completed by 18 November and were handed over to the vulcanizing unit for field trials. Certain difficulties were encountered by the production unit, but these were outside the control of the project since they involved electrical and thermostatic faults and also the need for a formula that would lighten the weight of the rubber sole. The fit of the uppers themselves as well as the fit of the uppers into the bottom mould was satisfactory and pattern problems were overcome. During various delays, the General Manager of TSC was kept informed.

It is now contemplated that the first style has been converted into press cutting knives. The first production run of several thousand pairs has been successfully completed. The second set of vulcanizing moulds (1,509) in sizes 5 to 11 was assessed and initial pattern cut for a good fit. This was achieved by 15 November, but the soles could not be tested immediately because all the stations of the vulcanizing plant were required for bulk production or for the above-mentioned pilot lines. Five prototype styles were prepared ready for submission to the design and production committee. The expert advised that a short period of production, say four weeks, should be allowed on the 1121 last project before commencing serious production on the 1509 styles.

Prototype footwear

The participants showed a great deal of enthusiasm in designing and producing the prototypes. In cases where there were obvious technical faults or bad proportions, the participant was asked to remake the shoe until a reasonable result was obtained. This process often took several days but proved well worth while, as the class generally offered their contribution in rectifying the problems. The standard of craftsmanship of some of the prototypes was very good, especially considering the limitations of materials and components. More than 80 acceptable styles were made up (excluding the canvas project), which gives some idea of the work accomplishment.

Specifications and costing

Details on specifications and costing are presented in annex I in the manual "Cost control for the footwear designer". Some of the participants had little idea of what was entailed in costing because many sectors of the factory are unaware of its importance. The reasons for this may be that, in the first place, TSC can sell all the shoes it could produce on the domestic market, secondly, the competition is almost negligible so tight pricing is not as essential as in other markets and, thirdly, there is at present no means of assessing the accuracy of the costing during and after manufacture. Specification charts were made by participants for some of their styles, and these were cross-checked by other participants in order to bring out all the details. Some constructive attempts were made to complete costings, but this was frustrated in some cases due to the inadequacy of information. The exercise was very well worth while, if only because it initiated considerable discussion in various sections of the factory.

Annex I

COST CONTROL FOR THE FOOTWEAR DESIGNER*

All personnel involved in the design and product development of footwear play an important part in controlling cost, both at the initial stage when evolving new styles and during the later stages of production. No matter what size the manufacturing unit - 10 workers, 100 workers or over 1,000 workers - the designer's responsibilities remain the same.

The designer's role

The main role of the designer is to satisfy the needs and taste of present and prospective customers within the capabilities of the factory. In order to do this the designer must have up-to-date knowledge of the factory and:

- (a) The supply of raw materials;
- (b) The capabilities of the work-force in respect of production targets;
- (c) The quality standards that can be achieved;
- (d) The capabilities and restrictions of the plant and machinery.

The designer also bears part of the responsibility of helping to make a profit for the factory in order to have future funds to improve the assets of the company and to secure a viable future for the work force.

Financial considerations

The profit element

The financial surplus or "profit element" is an essential goal of the entire team working in a manufacturing unit, and no one person can achieve it alone. The major responsibility for the profit element lies in the hands of the general manager and the financial controller. The delegation of responsibilities to various specialists calls for good communications and co-ordination. If the system is not efficient, serious financial losses can result.

*By Don Russell, footwear design expert. This manual was prepared as a guide for personnel working in close association with accountants and cost office administrations and should not be regarded as comprehensive for use in specialized training or functional purposes.

Fluctuations in price

The cost of raw materials and components etc. is constantly fluctuating; thus costing requires constant adjustments. In some cases it is necessary to make intelligent predictions well in advance so that the company does not suffer too many set-backs. This particularly applies to the major component sectors such as upper materials, soling materials etc.

If prices of hides etc. increase on the world market (because of drought or disease among animals, for example), it may be best for the company to stockpile some materials. This would help ensure continuity of production and avoid wide fluctuations in the prices of footwear the company sells.

Where raw material prices are falling (because animal rearing conditions have been excellent or stocks are large), it is probably best for the company to withhold further purchases so that it can buy at most advantageous prices.

The design specification

One of the principle functions of a good designer is to prepare a complete specification for new sample shoes. The specification usually consists of three parts:

(a) Items. A specification should contain a check-list of all items used to produce the sample, whether large or small;

(b) Quantities. The quantity of each item used should be given, e.g., area of upper leather needed per pair (or per dozen or per hundred), number of eyelets per pair. No matter what the price variations, the quantities will not change, or if they do, there should be a new sample and a new specification);

(c) Prices. Since these can vary, there should be a number of columns that can be used when revision is necessary. In some organizations, an up-to-date cost list is superimposed over the outdated one, but it should be remembered that it is sometimes useful or necessary to refer back to previous data of the changes made.

Requisitioning materials from outside suppliers for prototypes and samples

When ordering sample leathers and components (bottom unit, buckles etc.), the designer should record the price (delivered price to the factory, i.e., including transportation etc.) and date, a description of the item and the maker's reference number. This information should be kept in a central register.

Compiling the specification

When patterns have been cut for a new styles, they normally receive a style number, prototype number and sample number. In some organizations a prototype ticket is prepared to accompany the pattern bag on its route through the factory. This ticket contains much of the information that will eventually appear on the specification form.

Progress of the prototype

As the prototype or sample shoe progresses through the various departments, the ticket should be carefully read by the department head or Foreman to see what work is required and to conform it to the procedures. Any holdup should be reported to the design office. The ticket should be amended to supply additional information, or to note where components, such as threads etc., were not available and others were substituted. Spaces can be left for comments on:

- (a) Faults;
- (b) Production problems that are likely to arise in the future;
- (c) Estimated labour costs for each department;
- (d) Extra costs for the utilization of more materials, such as cements etc., than is normal;
- (e) Extra costs for extra labour (e.g. extra manual work where a machine can not cope);
- (f) Machines not performing to requirements because new parts may be needed.

In fact, anything that is likely to impede the smooth flow of work as far as the new prototype is concerned should be noted and discussed with the designer immediately.

It is important that everyone concerned, even the individual operators, pay serious attention to the speedy progress of the prototype and its specification ticket. Correct procedure can avoid many problems and bottle-necks in future production.

Summary

In summary, the purpose of the specification is:

- (a) To give an adequate and accurate description of the assembly of the sample shoe;
- (b) To provide complete information for detailed material estimates;
- (c) To enumerate all components for accurate requisitioning;
- (d) To insure that realistic labour costs can be predicted;
- (e) To point out possible future bottle-necks or problems in production by drawing attention to deviations from normal practice.

Final survey

When the finished prototype returns to the design department, all the reports, comments and cost estimates etc. should be examined by the designer and changes should be made to rectify serious faults. At this stage it may also become apparent that the target price for the item is out of line, calling for major or minor changes in design.

In principle, the final prototype should bear the closest possible resemblance to the item that would be bulk produced.

Customer requirements

The prototype might satisfy all the needs of the factory but might not be in line with what the customer desires, in which case it would be necessary to make a customer's confirmation sample that includes alterations or deviations to suit the customer. Changes should be adjusted on specification chart and the cost should be re-checked.

Basic elements of shoe costing

Sometimes elaborate and complicated terms are used that tend to confuse the newcomer to this subject; it is hoped that the following will help to simplify some of the terms.

When any product is made using a number of items or parts, it is logical to list these items to determine a realistic price for the finished goods. Based on the resulting figure, a sales price can be established. No matter what the product - bread, a bicycle, a pair of shoes or 100 pairs of shoes - the procedure described below should be followed.

Headings

The categories in the costing should be:

Overheads

Items not included in overheads (advertising etc.)

Financial surplus allowance or profit margin

Materials

Labour

There are various methods to allocate the many expenses within a footwear factory. A typical example is presented here.

Materials and labour are the major areas where the designer can provide details. The other items listed above are usually the responsibility of the financial controllers of the company. However, the designer must have some knowledge of these three items; they are described briefly below.

Overheads

This is a term used to cover items that are not used in the shoe itself. These which may be a one-time only expense (building construction) or recurring expense (electricity), include: construction or rent of factory and office buildings; power supply (electricity, gas, oil etc.); insurance; purchase or rental of machinery; general maintenance; machinery maintenance; salaries of office and supervisory staff; transport; canteen; and sports facilities. Overheads are often expressed as a percentage of the materials and labour costs, and this is calculated and added into the total.

Other items

Other expenses might be for advertising, exhibitions and special travel expenses to overseas exhibitions in order to arrange for the purchase of new machines or materials. An accounts department usually provides for such expenses in its annual budget, and someone in top management must control such expenditures to ensure that the figures are not exceeded. These operations are usually outside the responsibility of the designer.

Profit margin

Senior management usually sets profit targets at regular intervals, depending on the trading conditions, in order to achieve a financial surplus over the financial year. From time to time the designer may be informed, perhaps through monthly reports showing the periodic financial performance, whether the profit target is being met. The designer's responsibility is usually small in this sector.

Materials

Using the prototype ticket, the designer can begin to produce a complete list of items used in making the shoe. The most expensive items will usually be the upper and soling materials.

Upper materials

A layout of pattern pieces for all upper parts (vamps, quarters, facings etc.) can be made, usually on paper but sometimes on the actual material, to achieve the optimum utilization of material. (It is essential that the correct number of each piece be used; for example, there may be two vamps, four quarters, four facings, two caps, two counters and two tongues.) Separate layouts must be done for each colour or material. For example, the vamp, quarters and tongue could be tan leather and the facings, caps and counters brown leather; or the vamps and quarters could be canvas and the caps, facings and counters suede. Obviously the upper area layouts must be done individually because the parts cannot be interlocked when cutting for bulk purposes nor can the material purchasing requirements be assessed where two or more combinations of type, weight or colour of material is concerned. Designers must apply all their knowledge at this stage in order to make a correct assessment, and constant control checks must be made. (The layout of upper parts to assess the area of material required to cut a certain quantity of pairs is dealt with later.)

Bottom materials

Where a moulded or prefabricated bottom unit is being used, the price should be obtained from the supplier. Where sheet materials such as rubber or plastic are being used, it is usual to make pattern layouts to estimate the yield from each sheet and the cost per pair. Layouts should also be made where sole leather is being used. Owing to the variations in quality of this natural material, special allowances have to be made for waste due to marks or faulty areas. Often trial quantities have to be cut and checked for quality to determine the effective yield.

Calculations for bottom leather are often based on the weight of acceptable parts in relation to the original weight of material because bottom leather is bought from the tannery by weight. Some waste pieces - known as reusable offal or recoverable offcuts - have other uses; for example, heels can be built from leather that is unsuitable for soles, and even the smallest pieces can be ground for leather fibreboard. Compensation for used waste can be made at some stage of the costing process.

Important components that come under the heading of bottom materials include insoles, seat pieces (for moccasins), stiffeners, puffs, welts, rands, separate heels, shanks and any other item associated with the lasting or soling of the shoe.

Additional items

Additional items include buckles, eyelets, decorative adornments, threads, adhesives, laces, spray treatments, inks, dye, shoe boxes etc. In some cases prices for individual items are available from the supplier, in other cases an intelligent estimate has to be made e.g. stitching thread, where a rough measurement of the amount of stitching can be compared to the length of a reel of thread or cement, where a trial can be made to ascertain how many pairs per tin can be produced. It is usual to make allowances for wastage. It should be stressed that the number of items per pair of shoes must be correctly noted; for example, in a single shoe the number of eyelets used in each facing might be, say 3. This means 6 eyelets per shoe or 12 per pair.

Labour costs

In any costing, labour costs are usually divided into direct and indirect labour costs; because they can vary in different ways, it is advisable to keep a separate control on them.

The amount of labour or work employed in making shoes can be recorded in several ways. Past records, for example, will indicate productivity. It is possible to arrive at fixed costs for carrying out certain operations: sport or training shoe uppers in plastic or a similar shoe uppers in canvas or leather would vary in price according to the amount of skill and care required and on whether cutting was by hand or press. After a period of time, a company can build up information that permits it to make estimates on individual or group labour costs. Such information can be used in a system known as standard costs, which can be updated periodically using an adjustment factor. As an example, in 1976 a standard price could have been fixed for pulling over toes on a certain type of lasting machine. In 1977, the cost of living increased while the productivity remained the same, so an appropriate percentage was added to the cost of labour. In 1979 the performance of the machine was improved and corresponding reduction was made in the cost but an upwards adjustment had to be made for a rise in the cost of living. In 1980 a new type of adhesive was introduced, which speeded up performance, so a further reduction in costs was called for. In each department of the factory, supervisors should inform the designer of developments that are taking place and how these will effect costs in the future.

Direct labour

Shoes being produced in a factory pass from hand to hand, from person to person or from machine to machine, and, at each stage, various operations are performed. The results of these operations will be visually obvious and add to the tangible construction of the shoe, for example the clicker cuts the upper parts, the closers stitch various parts and the sole attacher fastens the lasted upper and sole together using a press and adhesives. Direct labour costs are the wages of staff who perform such operations.

Indirect labour

Indirect labour is work that is not tangible; it is performed by, for example, those who unload and store the raw materials, examine the quality of the product at various stages, record production figures or calculate wages, help train new workers, supervise the production line etc. In some cases it is not easy to determine whether tasks are direct or indirect production functions, but a decision has to be made. The figure applied to the costing for indirect labour often comes from historical statistics that are processed by the financial controller and passed on to the design office.

The duties of designers and pattern cutters

Designing footwear that is economical to produce

Designers and pattern cutters should be aware that while they are creating new styles, they are at the same time creating problems for the production process because every style differs.

Minor changes can be dealt with easily. For example, for minor changes to decorative stitch rows or to punching effects - assuming the sewing machines, needles and threads remain the same - need only new marker patterns to create the desired effect.

On the other hand, where radical changes are introduced, fundamental changes may be necessary involving new:

- Production lines
- Assembly areas
- Machines or attachments for existing machines
- Materials or components for uppers
- Lasts and heels
- Sole and heel moulds
- Sole materials
- Constructions of bottom attachment

Whenever designers contemplate major changes they should work in close collaboration with the senior managers of the company because many things will have to be considered, such as:

- (a) Extra capital expenditure for new machines, new accommodation or work space, new materials or components, new spare parts, new staff etc.;
- (b) Plans for possible new production layouts;

- (c) Additional power and other essential services;
- (d) Additional training or retraining;
- (e) Costings for new processes.

Designers may not be personally responsible for carrying out the above duties, but they should be aware of what is being done and should speak up if they think the project is not likely to meet expectations.

Designers must be very cost conscious in pre-production planning; they must take the lead by designing the most attractive and economical product possible.

Procurement materials and components is usually carried out in liason with the purchasing officer. Designers should be persistent in trying to achieve the best quotations on prices and delivery times.

Continuous control of specifications by the designers is imperative. If a substitution of materials or components is necessary owing to procurement difficulties, designers must be notified - indiscriminate substitution could be disastrous for the quality or appearance of the product, for example if a synthetic were substituted for leather without changing the adhesive so that it would be compatible with the materials.

Specification and costing charts

The specification chart (appendix I) shows how detailed designers must be in planning the make up of the footwear. Some of the items common to most footwear can be preprinted on the chart, but a number of empty spaces must be left for items required for a particular style. The chart in appendix I has no spaces for prices - it is a complete list of items and quantities needed for one pair of shoes.

As mentioned above, the amount of upper material utilized in cutting a style must be accurately determined. This figure can fluctuate considerably, depending on:

- (a) The way the pattern for the style has been cut into separate pieces;
- (b) The way these various parts interlock when laid out on the material;
- (c) The way that the upper is constructed by different types of seam or attachments.

In addition to the specification chart, there should be a costing chart. Each entry on the specification chart is numbered; this number, the name of the item or part, the quantity per pair and the price should be recorded on the costing chart.

As regards direct labour costs, each process or group of processes should be entered with the cost. This can be complicated because well over 50 separate operations could be involved in the make up of a single style. Depending on the size of the factory and the degree of specialization, each operative's name may be recorded on the specification (in a small factory) or a separate costing sheet may be issued to departments (in a large factory) that need to record many details (e.g., where the greatest variations take place, such as the cutting and closing departments). In a small factory, both the uppers and linings may be cut by one clicker, whereas in a larger factory at least three people may be involved, for example an upper cutter, a lining cutter and a third, less experienced cutter for socks and incidental backing pieces.

The costing is carried out step by step for each segment of work that is being carried out. Whenever a new process or method of work is introduced, a price per piece of work (piece-work price) should be determined. Since certain operations will have an established standard cost, this figure can be used for a similar operation on another style and the costing process becomes simpler with time. In an approach called work study, performed by work-study engineers, the quantity produced in a period of time is recorded and a cost calculated at the hourly rate of pay, making allowances for rest periods, general breakdowns and downtime of machines. (Downtime is non-productive time, e.g., during the course of, say, one hour's work on a sewing machine, there might be the need to adjust the length of stitch, alter guides or attachments, replace or change needles or threads for both shuttle and top thread, or a mechanical failure could occur. In the case of larger and more complicated machines, such as injection moulders, it could take several hours to change the many moulds and the colours of the compounds.)

To summarize the procedure so far, the major responsibilities of designers should be:

- (a) To fill out a progress ticket for the sample;
- (b) To examine the finished sample and make adjustments to the sample and the ticket if necessary;
- (c) To complete the specification chart;
- (d) To complete the costing chart for materials and components and transmit to the buying and costing offices in order that quantities and prices are filled in;
- (e) To transmit the specification and costing charts to the financial control office for cross-checking and for the inclusion of confidential figures such as overheads, profit margins etc.;
- (f) To ensure that the specification and the costing charts receive the signatures of the respective executives.

Pattern layout and cutting

Designers should examine carefully the paper patterns used in cutting the various parts of the shoe. Designers must know the type of material to be used for each part and should check how these will interlock on paper.

Layout

Layouts on fabrics are more straightforward than on leather. The consistent width of the fabric and the even surface of the material means that the layout of the patterns can be arranged in a regular repeat manner.

A major consideration when cutting material is the direction of the tightness or the amount of stretch of the material. Normally, the upper should have a tight feel or least stretching characteristic when pulled in the direction of heel to toe. Most woven fabrics have a tendency to be tight along the length of the material (known as the warp), to have a small degree of stretch across the material (the weft), and to have the greatest degree of elasticity diagonally (the bias) (see figure III). The woven structure of the fabric must be tested by pulling the material in various directions. Where fabrics have been combined with adhesives, it could occur that the material will have no stretch at all; this is usually known as a "dead" material.

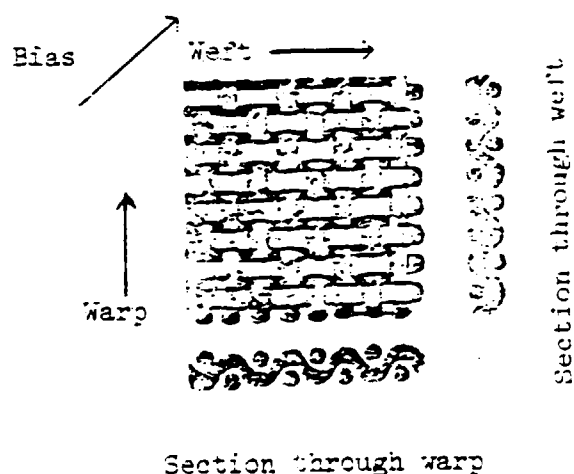


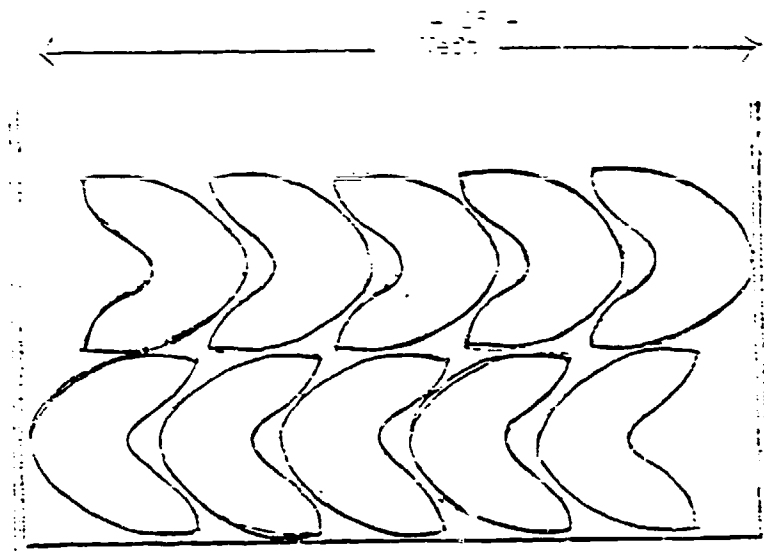
Figure III. Diagram of woven material

Knitted fabrics stretch in many directions, so whether used alone or covered with a plastic-coated surface care must be taken to produce a good result (adequate tests should always be carried out before production begins).

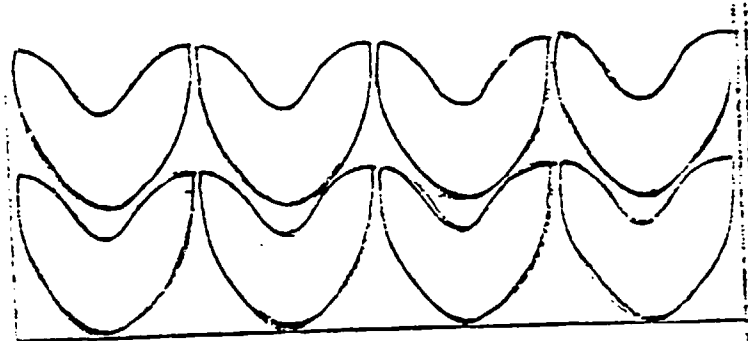
Examples of layouts are shown in figure IV.

Cutting

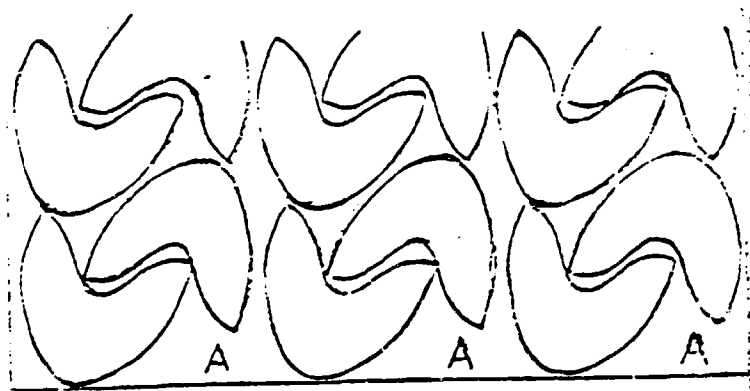
From a cutting point of view, fabrics and plastic materials (or synthetics) can be created alike when assessing the area needed to cut a particular quantity. The standard width of the material should be measured and a trial layout of patterns either on paper or on the actual material should be made. Sometimes it is necessary to use various sizes in the layout to take full advantage of the spread of material during cutting; if all the largest size pieces are cut first (which is normal practice) excessive waste would result (see figure IV.D). Two or more pattern shapes can be laid out on the material if this results in economy. Supervisors should be aware of the most efficient pattern layouts for a particular style and it should be their responsibility to ensure that the work is cut in this manner. Some larger factories provide diagrams for constant reference by the many cutters.



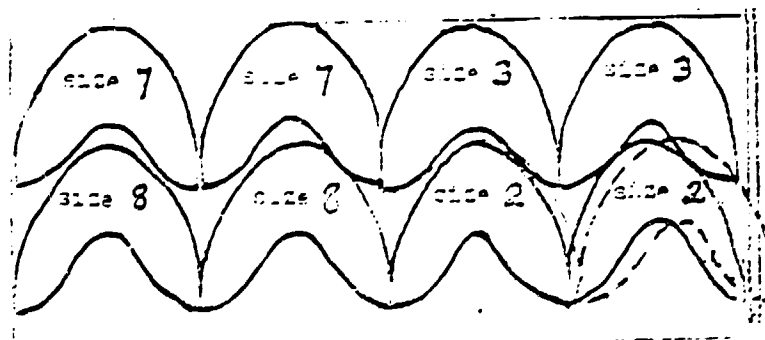
A. Waste layout



B. Warp layout



C. Bias layout (note waste at A, which is not repeated in subsequent cutting layers)



D. Layout with small and large pattern sizes to achieve the most economical use of material (note that only three pairs of size 3 could be cut in this width)

Another cost factor that must be considered is that of hand vs. mechanized production; e.g., when does it become economically viable to cut uppers with a press knife rather than by hand. Most factories establish a breakeven point - the number of pairs at which it becomes advisable to order press knives. This depends upon the labour costs for hand cutting, the availability of skilled labour, the speed of production and the uniformity of materials.

Special tools and jigs

Designers can offer ideas for equipment that could be used in the production processes, based on experience gained in making the prototype.

Material calculations (uppers)

In some countries electronic devices that would lay out patterns economically and calculate the area of the material required are being tested; however, their usefulness for small companies or developing countries has yet to be proven. Thus, it is necessary to mark up skins or hides to be "scaled" or to adopt one of the more scientific techniques for calculations such as the Russ and Small method or the scientific leather measurement method.

The size assortment may vary from order to order. Consequently, the average size must be ascertained for each order for the scaling calculation, for example:

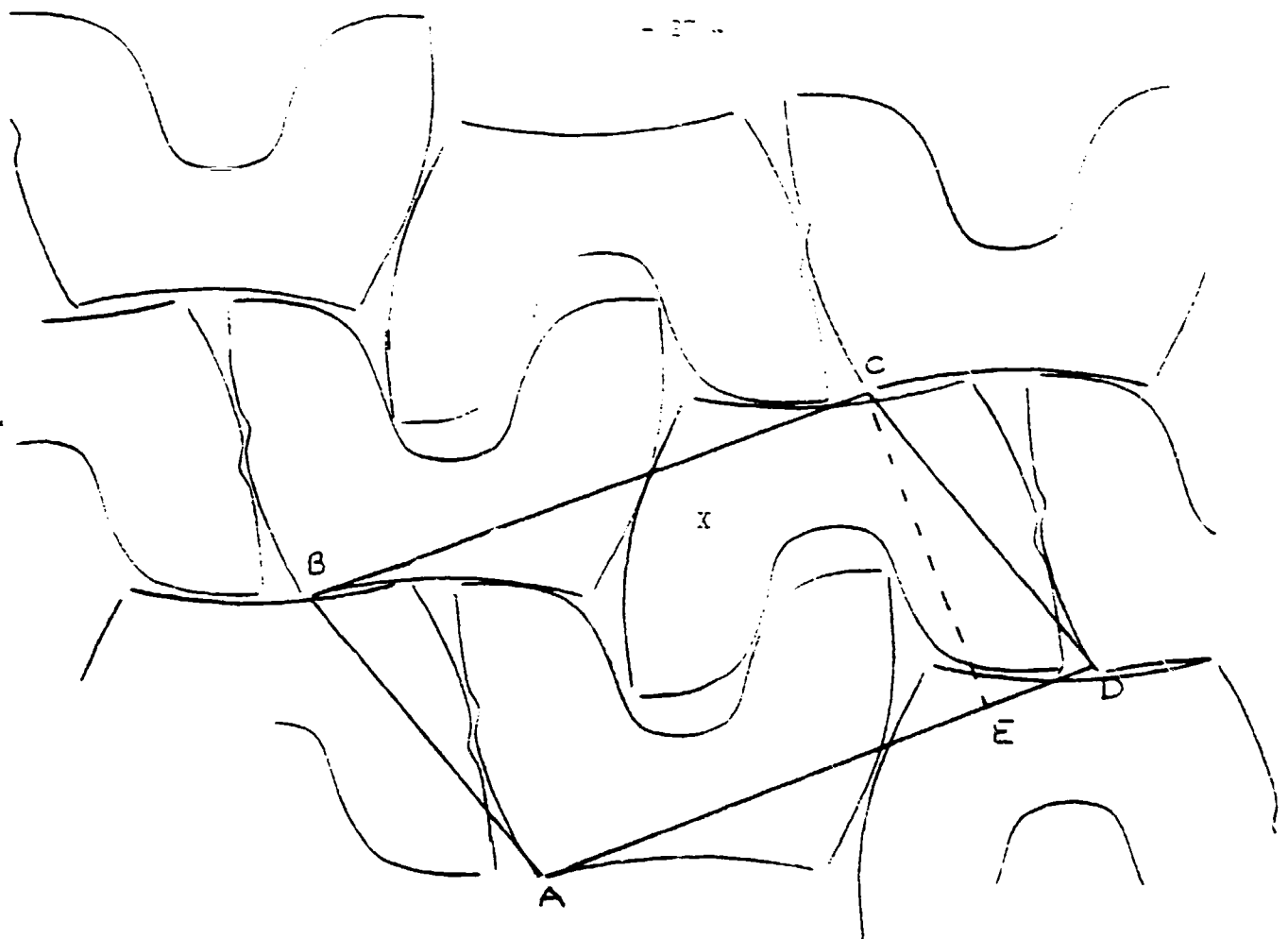
<u>Size</u>	<u>Number of pairs</u>	<u>Size x number</u>
3	10	30
4	20	80
5	30	150
6	30	180
7	20	140
8	10	80
Total	<u>120</u>	<u>660</u>

The figure 660 is then divided by 120 to give the figure 5.5. Thus, size 5 1/2 (or 6, if no half sizes are being produced) would be used for the scaling.

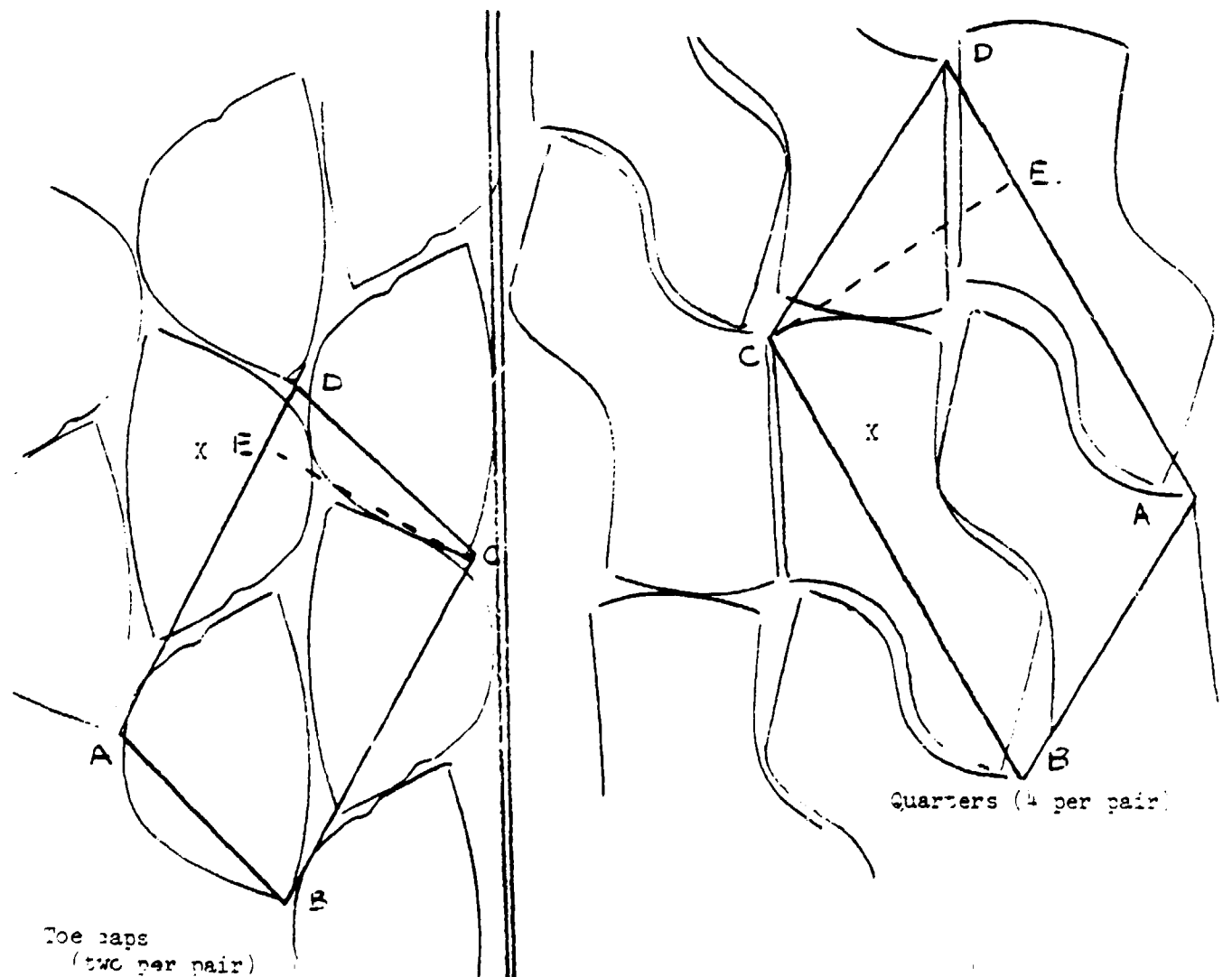
The Russ and Small method

In this method calculations are mainly on standard pieces of paper, with allowances being made for additional factors. In the example of an Oxford pattern (figure V), each pattern part of the upper is traced in the centre of a separate piece of paper (marked with an X on figure V); the first outline is then completely surrounded by the same pattern pieces. The pattern pieces must not be turned over, the relative positions of the pattern pieces must be either the same or turned 180° and the pattern pieces should be positioned as close together as possible.

To calculate the material needed (called scaling), select any definite point A and connect it by a straight line to exactly the same position (point B) on the next pattern facing the same way. Draw a line parallel (C-D on the next two patterns either above or below) and join the ends of the two lines to form a parallelogram. This parallelogram contains the area of two pattern pieces plus waste. The area of the parallelogram is obtained by multiplying the base A-B by the perpendicular height C-E. A suitable form on which to record the scaling is shown in figure VI.



Vamps (two per pair)



Toe caps
(two per pair)

Quarters (4 per pair)

Ref No _____

DESIGN-		AV. SIZE			LAST				
DESIGN NO.		SIZE RANGE			MAKE				
UPPER LEATHER	BASE	HEI-GHT	SCALE	NO. OF Pcs.	LINING	BASE	HEI-GHT	SCALE	NO. OF Pcs.
CAP					VAMP				
CAP WING					QUARTER O/S				
VAMP					QUARTER I/S				
GOLOSH					COUNTER				
QUARTER O/S					INSOCK				
QUARTER I/S									
BAR									
STRAP									
COUNTER									
SADDLE					TEXTILE				
TONGUE									
STRIP/TRIM									
TOTAL					TOTAL				

FOOTAGE ALLOWANCE	UPPER		LINING	
A. PAPER FOOTAGE (Scale)				
B. PARTS IN A SINGLE SHOE				
C. AVERAGE SCALE OF PARTS (A+B)				
D. AVERAGE SIZE OF SKIN				
E. SECOND WASTE PERCENTAGE				
F. BASIC ALLOWANCE PER PAIR				
G. LEATHER ALLOWANCE (Type)				
H. QUALITY ALLOWANCE				
I. SIZE AVERAGE				
J. TOTAL ADJUSTMENT				
K. FOOTAGE ALLOWANCE PER PAIR (FXJ)				
L. FOOTAGE ALLOWANCE PER 100 PAIR				

Scaled by

Checked by

Date

Figure VI. Scaling form

It is important to assess the area and shape of the skin as this gives the "second waste" figure, which can vary according to the size and shape of the individual patterns pieces, the irregular outline of the skins, stretch, shading and surface defects (see figure VII). Figure VIII shows a trial layout on a 6 sq ft (0.56 m²) calfskin, which would yield two pairs of shoes. Figure IX shows the percentage of second waste that can be expected for given pattern and skin sizes. After adding the second waste percentage to the pattern scale area prepared according to figure V (Russ and Small scaling methods), additional allowances must be added to allow for variations in the leather quality, shoe sizes and shoe quality required. These adjustments are made by establishing separate percentage allowances for each factor and by multiplying the basic allowance by the aggregate of these percentages. Since every leather has its own special characteristics that will require specific extra allowances, the following factors should be considered: type of leather, grade or quality of leather and efficiency of the clickers. It is difficult to include a figure for the efficiency of the clickers in a cost estimate; therefore, strict control is needed for the first two items.

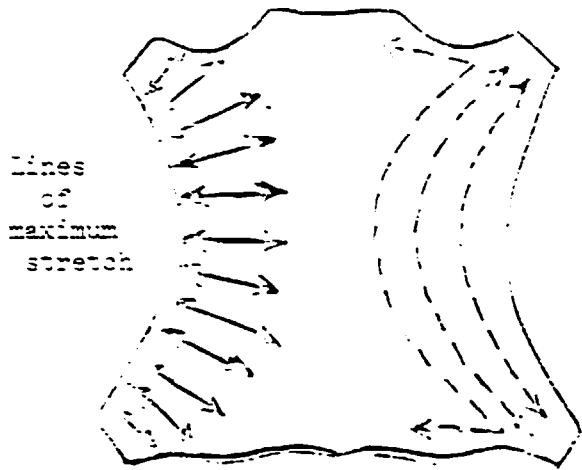
Type of leather. Each type of leather has its own cutting value which can be expressed as a coefficient applicable to a particular type of leather. A table of leather coefficients is shown below, but these figures would have to be modified after testing.

	<u>Black</u>	<u>Brown</u>	<u>Fancy colours</u>
Uppers - Calf	1.01	1.02	1.03
Veal	1.01	1.02	1.03
Printed and grain sides	1.00	1.00	1.00
Smooth sides	1.01	1.02	1.03
Grained goats	1.01	1.01	1.01
Glace kid	1.03	1.04	1.04
Suede calf	1.05	1.05	1.05
Suede splits	1.05	1.05	1.05
Lining - Calf	1.00	1.00	1.00
Kips	1.01	1.01	1.01
Goats	1.02	1.02	1.02
Sheep	1.05	1.05	1.05

Type of leather
 Grade or quality of leather
 Efficiency of the clickers

Leather grades. The quality of leather is based on finish (surface blemishes or growth marks) tightness of grain, amount of stretch, colour etc. These qualities will effect the proportion of the total area that can be used effectively in shoe uppers. The difference between grades is about 5-6 per cent in quality and price.

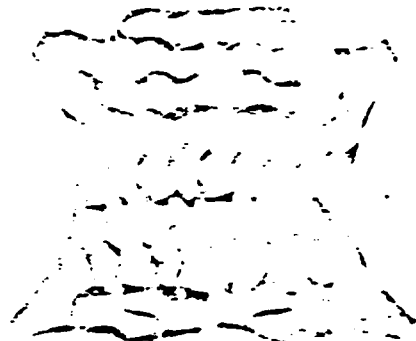
Shoe quality. The use of tables and grade difference will take account of the wastage necessary to achieve minimum quality levels. If higher qualities are to be made additional allowances will be required.



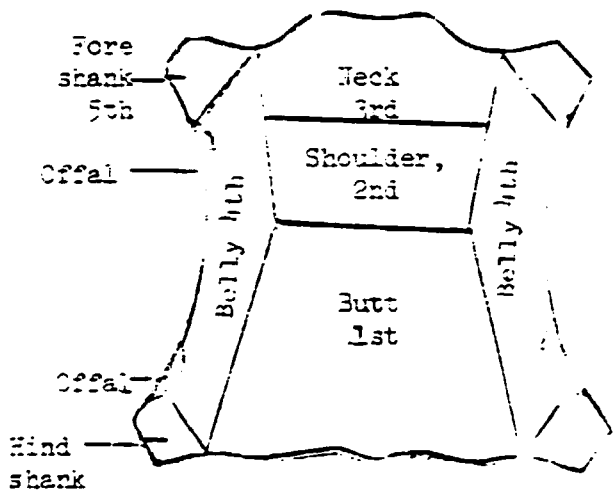
Beatskin with three-quarter court shoe and heel cover layout



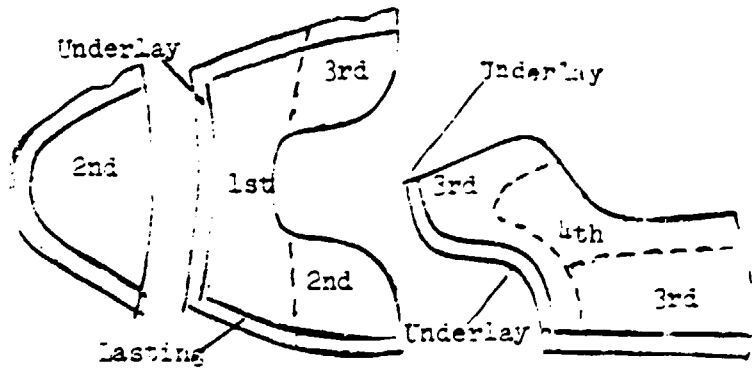
Small calfskin with quarter lining layout



Leather quality



Medium-size calfskin with Oxford shoe layout

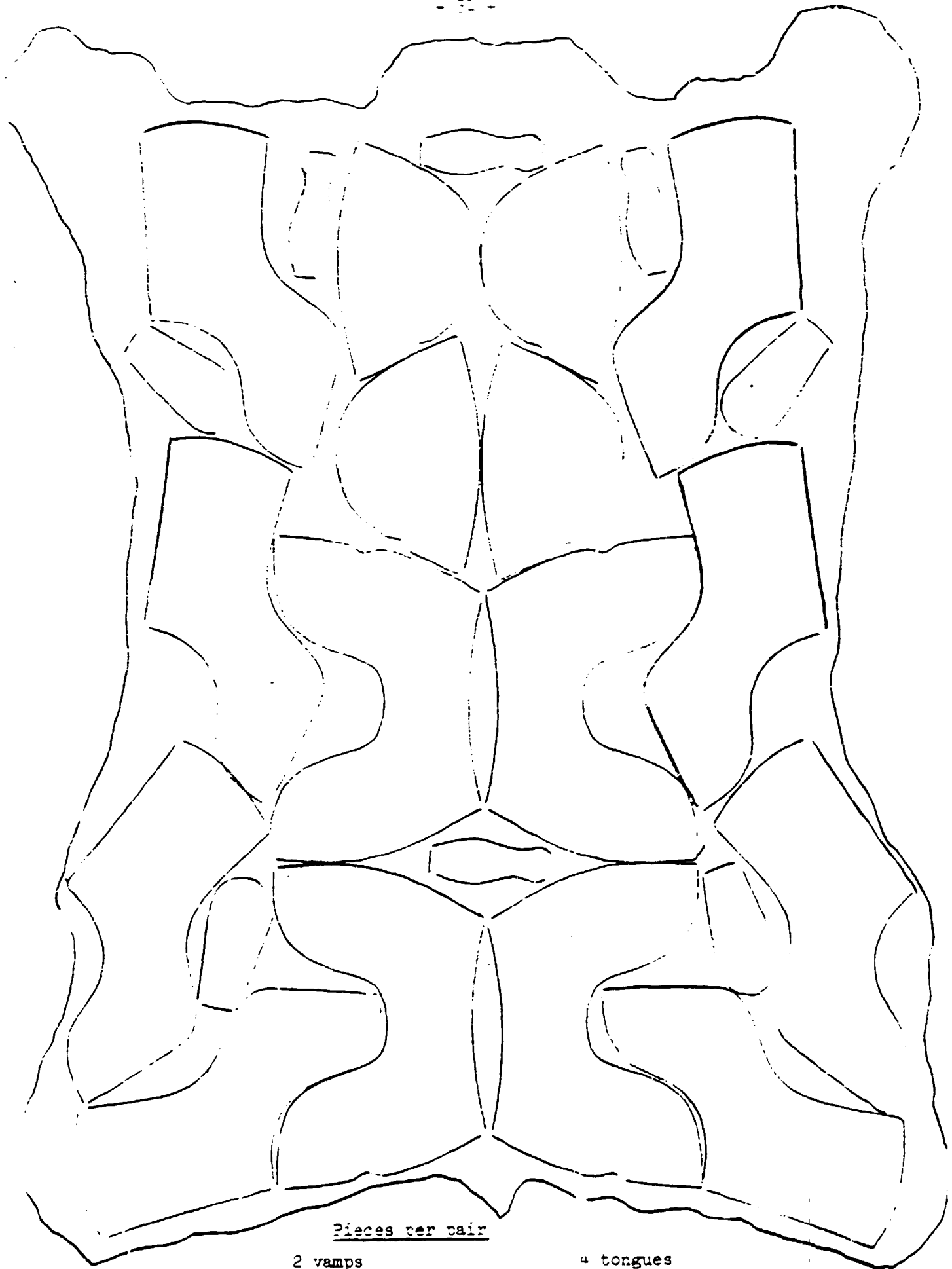


Box side with Oxford shoe layout



Lasting
Grades of leather needed for toe cap, vamp and quarter of an Oxford style

Figure VII. Layout considerations



Pieces per pair

2 vamps
2 quarters
2 toe caps

4 tongues
4 backstraps

Figure VIII. Layout of an Oxford style shoe

Scale of pattern (sq ft ^{a/})	Size of skin (sq ft ^{a/})											
	3	4	5	6	7	8	10	12	15	20	25	30
0.050	22.2	21.7	21.5	21.3	21.2	21.1	21.0	20.9	20.8	20.7	20.7	20.7
0.075	23.0	22.4	22.0	21.8	21.6	21.4	21.2	21.1	21.0	20.9	20.8	20.7
0.100	23.8	23.0	22.5	22.2	21.9	21.7	21.5	21.3	21.2	21.0	20.9	20.8
0.125	24.7	23.6	23.0	22.6	22.3	22.1	21.7	21.5	21.3	21.1	21.0	20.9
0.150	25.5	24.2	23.5	23.0	22.7	22.4	22.0	21.7	21.5	21.3	21.1	21.0
0.175	26.3	24.9	24.0	23.4	23.0	22.7	22.3	22.0	21.7	21.4	21.2	21.1
0.200	27.2	25.5	24.5	23.8	23.4	23.0	22.5	22.2	21.9	21.5	21.3	21.2
0.250	28.8	26.7	25.5	24.7	24.1	23.6	23.0	22.6	22.2	21.8	21.5	21.3
0.300	30.5	28.0	26.5	25.5	24.8	24.2	23.5	23.0	22.5	22.0	21.7	21.5
0.350	32.2	29.3	27.5	26.3	25.5	24.9	24.0	23.4	22.8	22.2	21.9	21.7
0.400	33.8	30.5	28.5	27.2	26.2	25.5	24.5	23.9	23.2	22.5	22.1	21.9
0.450	35.6	31.7	29.5	28.2	26.9	26.1	25.0	24.3	23.5	22.7	22.3	22.0
0.500	37.2	33.0	30.5	28.8	27.6	26.8	25.5	24.7	23.8	23.0	22.5	22.2
0.550	38.8	34.2	31.5	29.7	28.4	27.5	26.0	25.1	24.2	23.2	22.7	22.3
0.600	42.0	35.6	32.5	30.5	29.1	28.0	26.5	25.5	24.5	23.5	22.9	22.5
0.650	45.3	36.7	33.5	31.3	29.8	28.6	27.0	25.9	24.8	23.7	23.1	22.7
0.700	48.7	38.0	34.5	32.2	30.5	29.2	27.5	26.3	25.2	24.0	23.3	22.8
0.750	52.0	39.5	35.5	33.0	31.2	29.2	28.0	26.7	25.5	24.2	23.5	23.0
0.800	55.3	42.0	36.5	33.0	31.9	30.5	28.5	27.2	25.8	24.5	23.7	23.2
0.850		44.5	37.5	34.7	32.6	31.1	29.0	27.5	26.2	24.7	23.9	23.3
0.900		47.0	38.5	35.5	33.4	31.7	29.5	28.0	26.5	25.0	24.1	23.5
0.950		49.5	40.0	36.3	34.1	32.4	30.0	28.4	26.8	25.2	24.3	23.7
1.000		52.0	42.0	37.2	34.8	33.0	30.5	28.8	27.2	25.5	24.5	23.8
1.250			52.0	43.8	38.4	36.1	33.0	30.9	28.8	26.7	25.5	24.7
1.500				52.6	44.9	39.5	35.5	33.0	30.5	28.0	26.5	25.5
2.000						52.0	42.0	37.2	33.3	30.5	28.5	27.2

a/ One square foot (sq ft) equals 0.09 square metres.

Figure IX. Wastage scale
(Percentage)

TANZANIA SHOE COMPANY, LIMITED

SPECIFICATION CHART

DESCRIPTION

CODE	PART No.	MATERIAL	GAUGE	QUANTITY	STYLE DRAWING	STYLE
UPPER	1	Vamp				COLOUR
	2	Qtr.				CUSTOMER
	3	Binding				
	4	Facing				
	5	Toe-cap				CONSTR
	6	Straps				LAST
	7					FITTING
	8					DATE
	9					
	10					
	11					SIZE RANGE
LINING	12	Counter				
	13	Vamp				
	14	Qtr.				
	15	Sock				
	16					
	17					
	18					
	19					
	20	Insole				
	21	Stiffener				
MIDSOLE	22	Toe Puff				
	23	Middle				
	24	Soie				
	25	Heel				
	26	Toonose				
	27	Heel Filler				
	28	Lift				
	29					
	30					
	31					
UPPER CLOSING	32					
	33	ITEM	DETAILS	NEEDLE/THREAD/ST/CM		
	34	Qtr. Top				
	35	Qtr./Vp. Side				
	36	Counter				
	37	Back				
	38					
	39					
	40					
	41					
MATERIALS	42					
	43					
	44					
	45					
	46					
	47					
	48	Lining				
	49					
	50					
	51					
FINISH	52	Sole Edge				
	53					
	54	Edge Colour				
	55	Upper Finish				
	56	Bottom Finish				
57	Heel Finish					

CODE	ITEM No.	DESCRIPTION	CONS. P/2 PAIR
	58	Elastic	
	59	Tap.	
	60	Eyelet - Zip	
	61	Buckle	
	62	Straps	
	63	Shank	
	64	Bottom Filler	
	65	Rivets	
	66	Lasting Tacks	
	67	- -	
	68	- -	
	69	- -	
	70	- -	
	71	Bonding Agent	
	72	Sole Attach Cement	
	73		
	74		
	75		
	76	Leas	
	77		
	78		
	79	Lining	
	80	Insole	
	81	Sock	
	82	Shoe Fill'g	
	83	Paper	
	84	Bag	
	85	Carton	

<p style="text-align: center;">SPECIAL INSTRUCTIONS</p>	
---	--

DESIGNER	COSTING MANAGER	PRODUCT. MANAGER	
----------	-----------------	------------------	--

- 2 -

Annex II

PARTICIPANTS IN THE DESIGN AND PATTERN-CUTTING COURSE

Tanzania Shoe Company Ltd.

Simon Kasembe, group A - Participated in the first course and had nine months' training in Italy.

Hashim Waziri, group A - Participated in the first course and had nine months' training in Italy.

Samweli Nduguru, Group A - Participated in the first course and had nine months' training in Italy.

Charles Masiya, group A - Participated in the first course and had nine months' training in Italy.

Arbogasy Kailembo, group C - Background in canvas footwear manufacture; participated in UNIDO stitching in 1982.

Eshy Nassor, group B - Attended the first design course.

Susan Mzuwanda, group C.

Morogoro Shoe Company

Hawa Jatim, group B - Attended the second course.

Lawrence Ndunguru, group B.

Christian Novat, group B.

Salih Mbicky, group C.

Jele Magulemengi, group B.



