



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

RESTRICTED

07223

DP/D/SER.S/67
8 July 1976
English

**QUALITY CONTROL
PROGRAMME
FOR MANUFACTURE
OF RUBBER GOODS
FOR EXPORT**

IS/SRL/74/068

SRI LANKA,

TERMINAL REPORT

Prepared for the Government of Sri Lanka by the
United Nations Industrial Development Organisation,
executing agency for the
United Nations Development Programme



United Nations Industrial Development Organization

United Nations Development Programme

QUALITY CONTROL PROGRAMME FOR MANUFACTURE
OF RUBBER GOODS FOR EXPORT

IS/SRL/74/068

SRI LANKA

Project findings and recommendations

Prepared for the Government of Sri Lanka
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Base on the work of F.R. Ibrahim, quality control technician

United Nations Industrial Development Organization
Vienna, 1976

Explanatory notes

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

A comma (,) is used to distinguish thousands and millions.

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

The following abbreviations are used in this report:

BSS	British Standard Specifications
CISIR	Ceylon Institute for Scientific and Industrial Research
ICI	International Chemical Industries
PVC	Polyvinyl chloride
RRI	Rubber Research Institute

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 concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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

ABSTRACT

The project "Quality control programme for manufacture of rubber goods for export" (IS/SRL/74/068) arose from a decision by the Government of Sri Lanka, within the framework of its policy of export expansion and diversification, to take steps to overcome the considerable difficulties experienced by the rubber products export industry of Sri Lanka on world markets. A request for assistance from the United Nations Industrial Development Organization (UNIDO) was made in October 1974 and approved by the United Nations Development Programme (UNDP) in December 1974, with UNIDO acting as the executing agency and the Sri Lanka Ministry of Industries and Scientific Affairs as the counterpart agency.

The three-month project began in late March 1976, and led to the identification of major shortcomings such as the continued use of old machinery, the lack of various types of essential equipment, faulty or incomplete manufacturing techniques, and insufficient compliance with established international specifications and standards. Specific proposals were made with a view to remedying those shortcomings and for establishing appropriate quality control systems.

CONTENTS

<u>Chapter</u>	<u>Page</u>
INTRODUCTION.....	6
I. PROJECT ACTIVITIES	8
A. Establishments visited, findings and recommendations	8

INTRODUCTION

Export expansion and diversification have been major goals of the economic policy of Sri Lanka. Such expansion would involve the promotion of traditional products in non-traditional form and on more competitive terms. The rubber products export industry, for example, has in the past experienced considerable difficulties meeting world market requirements. The Sri Lanka Ministry of Industries and Scientific Affairs, through its Export Promotion and Development Division, is therefore particularly anxious to assist manufacturers of rubber products with export potential to adopt products and to improve production processes to meet competition on world markets. In this connexion, a survey, carried out by the Geneva-based International Trade Centre, of rubber products manufactured in Sri Lanka has indicated an urgent need for quality control. Many of the plants currently exporting such products or with export potential face urgent problems in organizing their production on the basis of a well-defined quality control programme. In order to help the rubber products export industry to overcome its many difficulties, the Government of Sri Lanka, in October 1974, therefore made a request for UNIDO assistance, with particular emphasis on quality control problems. Sri Lanka was already receiving assistance in export promotion and marketing through a large-scale project carried out by the International Trade Centre (UNCTAD/GATT), and a quality control programme would supplement this project. The request was approved by UNDP in December 1974, with UNIDO acting as executing agency and the Ministry of Industries and Scientific Affairs as the counterpart agency, and with a project budget involving a UNIDO contribution of \$8,500, subject to later adjustments to reflect actual expenditure.

The quality control expert began his three-month mission in late March 1976, having been entrusted with the following duties:

- (a) To assist in improving and setting up a quality control test centre ensuring adequate quality for export;
- (b) To review the quality control methods currently in use and identify shortcomings;
- (c) To recommend quality control systems for new ventures;
- (d) To train counterpart staff in quality control problems.

The objectives of the project were substantially achieved. In particular, the major shortcomings identified included the continued use of old machinery, the lack of various types of essential equipment, faulty or incomplete manufacturing techniques, and insufficient compliance with established international specifications and standards. Specific proposals were made for remedying those shortcomings and for establishing appropriate quality control systems.

I. PROJECT ACTIVITIES

In order to enable the expert to become acquainted with the quality control systems applied by chemists and technicians in the rubber factories and testing centres, a series of visits to various establishments was arranged. The findings and recommendations arising from those visits are given below for each of the establishments concerned.

A. Establishments visited, findings and recommendations

Associated Rubber Industries/Associated Motorways Ltd, Kalutara

This company produces bicycle tires and inner tubes (seamless and jointed), batteries and cables, soles and heels, slipper straps, paddy husk rolls, microcellular sheets, pedal covers and bicycle grips, car mats, and tire retreads.

Findings

1. Most of the rubber chemicals and cord (used in bicycle tires) are imported. The chemicals used as fillers and the iron oxide are obtained on the local market.
2. Bicycle tires and inner tubes and camelback for retreading tires are produced for export.
3. The testing laboratory has the following equipment: an abrasion Wallace apparatus, a rapid plastimeter, a Zwick hardness machine, a nick cutter, a thickness gauge, a De Mattia apparatus, a Shawbury curometer, a Mooney viscometer, a tensile testing instrument, a tire cord tensile testing machine, an ageing block, a densimeter, and a mill and press.
4. The laboratory technicians and the factory workers are well trained.
5. All the tests, except the rebound resilience test, are conducted in a satisfactory manner according to local specifications.

Recommendations

1. The production of seamless inner tubes should be expanded.
2. Rubber chemicals on the local market should be analysed according to international specifications (the relevant Indian and international specification numbers have been indicated).
3. A rebound resilience testing machine should be acquired.

Bata Shoe Co. of Ceylon Ltd, Ratmalana

This company produces foot-wear and microcellular sheets.

Findings

1. The different foot-wear and microcellular sheets produced by the factory are of good quality. They are for both export and the local market.
2. The post-curing of the microcellular sheets is done satisfactorily.
3. Quality controls are carried out in the production line and on the raw materials.
4. Testing of the finished products is done in the laboratory. The tests are for wear strength, the abrasion index, the tensile strength of the canvas, hardness, adhesion and plasticity.
5. The factory is well organized and the workers are highly trained under excellent management.

Recommendations

1. A new tensile testing machine should be acquired.
2. A Mooney viscometer should be acquired for determining the scorch time of the rubber compounds.

Ceylon Institute for Scientific and Industrial Research (CISIR), Colombo

This research institute has a rubber section which includes the following units:

- (a) A pilot plant for compounding rubber for research and testing purposes;
- (b) A testing laboratory for testing the physical properties of rubber products. The following testing equipment is used: tensile testing machine, Lupke pendulum and Dunlop tripsometer, hardness tester, ageing block, thickness gauge, plastimeter and Mooney viscometer.

Findings

1. All the testing equipment consists of old models.
2. Research is carried out on different rubber compounds.
3. Testing of the rubber compounds (sent by the rubber factories) for their physical properties is conducted by technicians of the institute.
4. There is a staff shortage in the rubber section.

Recommendations

1. Old equipment should be replaced by modern instruments.
2. The rubber section should be provided with sufficient staff to meet the increasing demands of testing and the necessary certificates should be issued for testing purposes.

Ceylon Malayan Rubber Goods (SINWA), Dehiwela.

This company produces canvas foot-wear, polyvinyl chloride (PVC) upper foot-wear, cycle tires and inner tubes, pedal covers, gum boots, rubber bands and adhesives.

Findings

1. Canvas shoes and cycle tires are the main export products. The canvas shoes have some external defects.
2. The cycle inner tubes are produced by the mandrel method.
3. The gum boots are full of blisters.
4. Quality controls are carried out visually. There is no testing equipment or set of standard specifications.
5. The workers are well trained.

Recommendations

1. The moulds (15 years old) of the canvas foot-wear should be replaced by recent ones.
2. A new line for the production of seamless inner tubes should be developed.
3. The rubber sheets of the gum boots have to be calendered and layed on a polished smooth surface.
4. Quality controls must be performed on the raw materials (rubber compounds, canvas and local market chemicals) and the finished products according to the international specifications (numbers of the British Standard Specifications (BSS) and Indian specifications of the products manufactured in the factory are given). This can be done at the RRI of the CISIR.

Cylon Rubber Industries, Nugegoda

This company produces balloons, childrens' toys, rubber bands, teats and gloves.

Findings

1. Balloons are the main export product.
2. The balloons are full of patches and air bubbles. They are tested by inflation with compressed air (many of them burst).
3. The formers used for the production of the balloons are made from wood which is covered with scratches.
4. Rubber bands are simply coloured and cut by hand.
5. The teats comply with Indian specifications (according to the certificate given by the CISIR).
6. Glove production is under strain because of the high cost of the formers.

Recommendations

1. New smooth porcelain or polished wood formers for balloon manufacture should be introduced.
2. Various proposed methods for the preparation and storage of prevulcanized latex used in the manufacture of dipping articles should be applied, and exact dipping techniques should be adopted.
3. An automatic mechanical device for cutting the rubber bands should be acquired.

D. Samson Industries, Calle

This company produces microcellular sheets, foot-wear and beach slippers.

Findings

1. The beach slippers are produced for export.
2. There are problems with the manufacture of the microcellular sheets. These include variation in dimensions and blister formation at the time of pressure release and post-curing.
3. The grinding of scrap resulting from punching the soles is made on an open rolling-mill (only 30% of the scrap is used and the particle size is large).
4. Carbon black mixing is done on open rolling-mills.
5. The hardness of the microcellular sheets has been established, and other tests will be conducted after receiving the new testing machines (a Du Pont

abrasion tester, a De Mattia flex cracking machine, a compression set and a specific gravity machine).

6. The workers are well trained.

Recommendations

1. The necessary corrective action should be taken to deal with the problems which arise in the manufacture of microcellular sheets.
2. An internal mixer should be acquired for carbon black mixing.
3. A special grinding machine should be acquired in order to obtain a higher percentage of scrap crumb, to increase the quality of the crumb, and to bring down the cost.

Don Somapala Co. Ltd, Kelaniya

This company produces floor tiles, black soles, rubber straps for beach slippers, miscellaneous rubber goods (such as hot water bottles, ice bags, radiator hose, playballs, baby mats and balloons), football bladders and tyre retreads.

Findings

1. All the products are for the local market.
2. There is a project for the export of football bladders.
3. The main product, namely floor tiles, is of good quality.
4. The playballs are full of flashes and defects owing to the use of old aluminium moulds full of cavities.
5. Camelback for retreading is produced from an old ram-type extruder.
6. Carbon black is mixed on an open roll-mill.
7. Testing of Mooney viscosity, hardness and elongation is done in the factory. Tensile testing and compression and ageing tests are sometimes conducted at the CISIR.
8. Complaints have been made about the separation of the tread in retreaded tires.

Recommendations

1. A new extruder (screw type) and an internal mixer for the carbon black should be acquired.

2. The tire should be dried after buffing and before cementing in order to ensure good adhesion.
3. The relevant BBS and Indian specifications for the different products should be applied.

Elasto Ltd, Bentota

This company produces microcellular sheets, beach sandals, foot-wear, rubber straps for garments and baby mats.

Findings

1. The beach sandals are made from black microcellular sheets. The coloured sheets are not now manufactured because of the lack of pigments.
2. The microcellular sheets suffer from shrinkage (post-curing is done at 60°C for 20 minutes).
3. The rubber straps and the baby mats produced by the factory are good and of export quality.
4. The factory has its own workshop manufacturing various machines.
5. There is an electroplating unit.
6. The tests relating to the hardness of the microcellular sheets are the only ones carried out in the factory (the sheets are for the local market).
7. The workers are well trained.

Recommendations

1. The optimum temperature and time for the post-cure of the microcellular sheets should be used and the capacity of the oven increased.
2. To save foreign exchange, different tools for the workshop should be made available to keep the workers busy with the manufacture of the different machines.
3. The electroplating unit should be supplied with the necessary equipment for plating the moulds to give the rubber products a good finish.
4. The necessary equipment for the rubber strap unit should be acquired.

Mins Ltd, Dehiwala & Dickwella

This company produces handbags, leather goods, foot-wear and beach sandals.

Findings

1. Beach sandals are produced for export.
2. The microcellular sneets and upper straps of the beach sandals are manufactured in Dickwella, while the other products are made in Dehiwala.
3. The workers are not well trained.
4. The hardness of the rubber sheets is determined.
5. There is a high percentage of shrinkage and irregularity in the microcellular sheets.
6. A large amount of unused rubber scrap results from punching soles from the microcellular sheets.

Recommendations:

1. The specific gravity of the rubber sheets should be determined according to BSS 903 (methods of testing vulcanized rubber).
2. An analysis should be made of local market chemicals (Indian specifications for industrial rubber chemicals have been indicated).
3. The production line should be extended (one mill and two presses have been ordered).
4. A grinding machine should be acquired in order to grind and recycle the rubber scrap, and to obtain a cheaper product with better physical properties.
5. The correct process for post-curing microcellular sheets should be applied on the basis of the analysis made of the causes of the observed irregularity and the corrective action advised.
6. Training should be provided for management and workers.

Richard Pieris & Co. Ltd, Navinna

This company produces microcellular sheets, play balls, rubber bands, soles and heels (black), floor mats and tiles, cycle pedal covers, hoses, conveyor belts, latex foam mattresses and seats, tire retreads, and miscellaneous rubber goods such as toys, gloves, erasers, printing rolls, oil seal rings, car rubber products, etc.

Findings

1. The rubber bands, soling sheets, play balls and black heels are the main export products.
2. Most of the rubber chemicals and the synthetic rubber are imported from Bayer and International Chemical Industries (ICI). Some of the rubber chemicals are produced by the local market.
3. The microcellular sheets are made on the same press where the ordinary rubber soles and heels are produced.
4. No chemical analysis is carried out for local market chemicals.
5. The testing equipment (tensile testing and resilience rebound instruments, durometer, plastimeter, hardness and flex-cracking machines) has not been installed because the laboratory building is still unfinished.
6. Some of the moulds are old and need to be cleaned.
7. The workers are well trained.
8. The factory has a contract for the export of household gloves, but the high price set by the Government for latex supplies raises the price of the finished product to levels which make it non-competitive on world markets.

Recommendations

1. Raw materials (rubber compounds and local market chemicals) and finished products should be tested according to international specifications (a complete list of British Standard Specifications (BSS) for rubber products and rubber testing has been provided, together with the Indian specification numbers for the chemicals used in the rubber industry).
2. The optimum temperature and cure time for each rubber compound should be determined. This can be done at the CISIR or the RRI until the testing laboratory is finished and the testing equipment installed.
3. Efforts should be concentrated on a limited range of products and on the extensions required for the production lines of export products.
4. Decayed ball moulds should be replaced by new ones.
5. A suitable new automatic press should be acquired for the satisfactory manufacture of microcellular sheets.

Rubber Research Institute (RRI), Ratmalana

This institute is specialized in testing raw rubber and rubber products. The following equipment is used to test vulcanized rubber: Lupke pendulum (Wallace) and Dunlop triposometer, Wallace-De Mattia flexing machine, hardness tester, Du Pont abrasion tester, tensometer, stress relaxometer, curometer, Mooney viscometer, Rheometer, Wallace ageing block.

Findings

1. Most of the testing equipment consists of old models.
2. The Institute gives advice to factories on their rubber compounds.
3. Raw rubber is tested according to the specifications.
4. Spare capacity is available for testing the rubber products of the various factories.

Recommendations

The measures recommended below are needed to enable this Institute to serve as the centre for testing raw rubber, rubber compounds and rubber products for factories which cannot afford their own testing laboratory:

1. Old types of testing machines should be replaced by more recent equipment.
2. The Institute should be provided with a sufficient number of qualified chemists and technicians.
3. The physical testing laboratory should conform to international specifications.

In conclusion, pending the implementation of the above-mentioned recommendations, the RRI and the CISIR can co-operate in testing rubber products and giving advice to the rubber factories.

Sri Lanka Tyre Corporation, Kelaniya

An initial visit was paid to the factory to become acquainted with its quality control system, and two other meetings were held in the factory at the request of the General Manager for further discussions with the chemists and technicians.

This company produces truck and car tires and inner tubes.

Findings

1. The factory covers 80-85% of the local market consumption of truck and car tires and inner tubes.
2. The factory has a spare capacity (unused) of about 25%.
3. The tires and inner tubes are manufactured from natural rubber.
4. The tread and sidewall rubber compounds are extruded from a single barrel extruder using the same compound containing HAF or ISAF blacks.
5. Quality controls are carried out on the raw materials and along the different parts of the production line. The nylon cord is tested for tensile strength and elongation. Vulcanized tires from each batch are tested for ply separation and wheel tests are carried out. Road tests are conducted on tires used by buses on country roads.
6. The main defects found in the tires are the following:
 - (a) The sidewalls of the car tires appear to be hard and lack the necessary resilience;
 - (b) The tread tends to separate from the carcass, the sidewall from the chafer, and the plies from the sidewall;
 - (c) The beads become displaced and twisted;
 - (d) It has been reported that the pressure of the inner tubes has to be checked frequently in service.

Recommendations

1. The level of production should be brought up to the factory's full capacity.
2. Styrene-butadiene rubber (SBR) should be imported for use in car tires.
3. Butyl rubber should be imported for the manufacture of inner tubes with good air impermeability.
4. FEF black should be used in the rubber compound of the sidewalls of tires.
5. The undertread rubber compound should be softer than the tread, and the cushion should be made from a rubber compound softer than the undertread.
6. The tread should be securely rolled down by rollers (the workers need to be trained for this operation). The bead area should be wiped by paraffin wax to prevent twisting of the bead during the shaping operation.

7. The correct placing of the tire in the press should be verified.
8. The moisture content of the chemicals and fillers should be checked before incorporating them in the rubber compound. The nylon cord should also be tested for moisture content.
9. A double-barrelled extruder should be used as an essential element in the production of different rubber compounds for the tread and sidewalls.

Wijemanne & Co. Ltd (Ceypa), Navinna

This company produces microcellular sheets, beach sandals, straps and foot-wear.

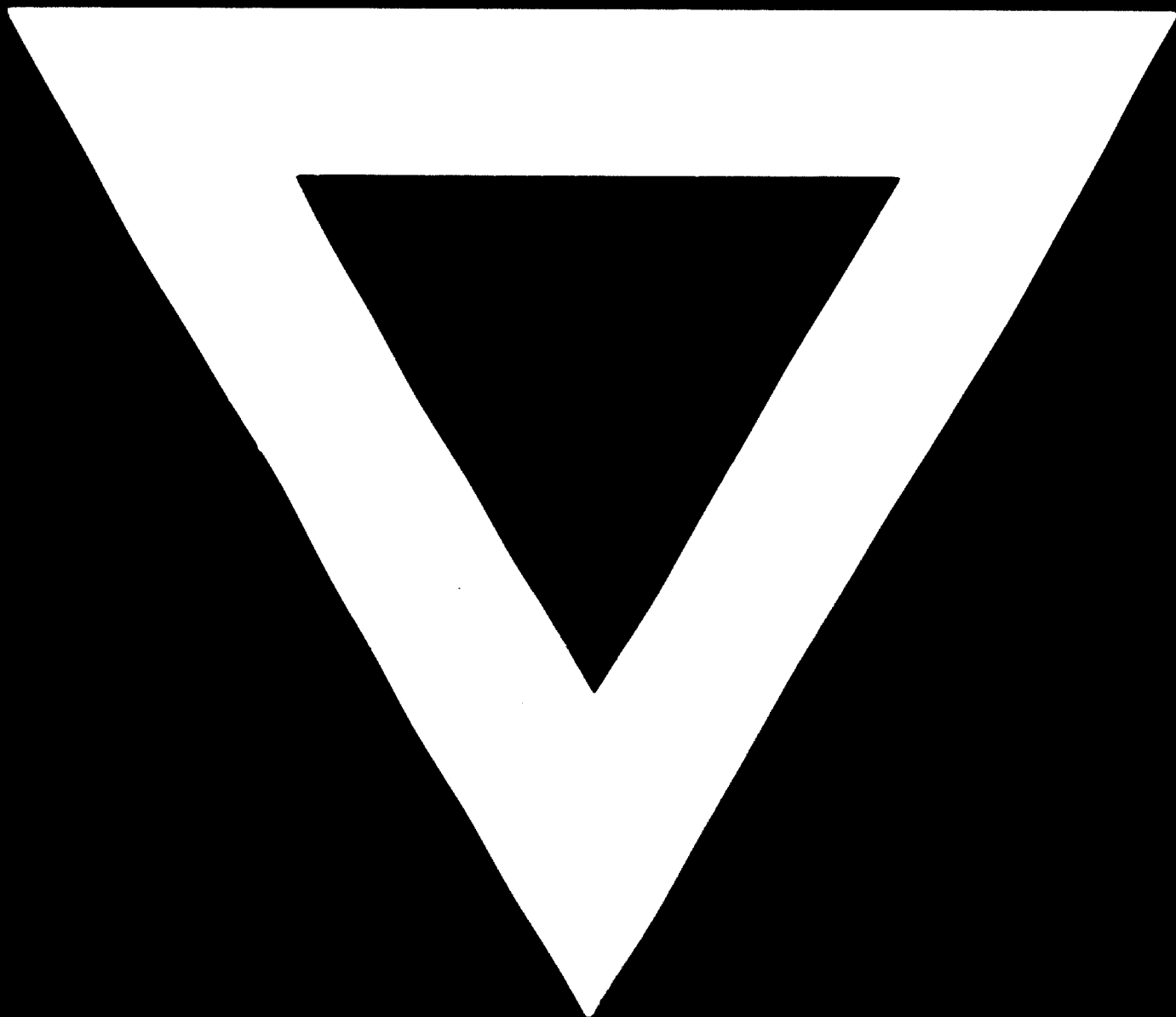
Findings

1. The factory is small and has three roll-mills, one press and three punching machines (two for rubber and one for leather). The output of the factory is large owing to its skilled work force.
2. The microcellular sheets are black and suffer from shrinkage defects because post-curing is not done (there is no oven).
3. The beach sandals are black (for the local market). The straps are black and in various other colours. The 5% of coloured straps are exported to the Fiji Islands.
4. The rubber scrap is ground in an engineering workshop at a site different from that of the company. Approximately 60% of the scrap is recycled.
5. A new site (about 5 acres) has already been chosen for a new factory. Three roll-mills have been ordered.
6. No quality controls or testing is carried out in the factory.

Recommendations

1. An oven or heated chamber for post-curing the microcellular sheets should be acquired and the specified optimum temperature and time limits observed.
2. Three motors for the new roll-mills and a new punching machine should be acquired.
3. Testing of rubber compounds, hardness and the specific gravity of the rubber sheets should be conducted at the CISIR or the RRI until the company has obtained the following testing machines: a Mooney viscometer, a hardness tester and a specific gravity device (densimeter).

C-272



77 .07.04