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CONSOLIDATION OF THE FOOD PACKAGING CENTRE CETEA, WITHIN ITAL

DP/BRA/88/017

FEDERAL REPUBLIC OF BRAZIL

Technical report: Laboratory testing of paper
and board transport packages*

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

Based on the work of L. -E. Eriksson, expert in
transport packaging laboratory - paper and board

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SUMMARY

For one month in 1990 (April 23 - May 22), Lars-Erik Erkiison was on assignment as an expert in packaging - paper and board - at ITAL (Instituto de Tecnologia de Alimentos), CETEA, Campinas, Sao Paulo, Brazil, for the UNIDO project DP/BRA/88/017.

During the mission, briefings were given on paper, carton-board and corrugated board properties. Research activities and standard testing methods were discussed. Demonstrations were conducted on some of the testing instruments for paper and board at CETEA and additional information was given about current laboratory testing equipment available in the market.

The information concentrated on properties of corrugated board and its components including corrugated board box performance related to board composition and the transportation environment. Since most packages in modern transportation are subjected to load, compression strength of materials and boxes was given special attention.

All this information was presented to the CETEA staff at a number of laboratory training sessions, at project discussions, at six internal seminars and at one external seminar. References to literature completed the information and copies of a number of interesting articles and some data sheets for testing equipment were left at CETEA.

Four visits to Brazilian paper and board companies were made and the above-mentioned information was transmitted to the industry at a one day external seminar.

Five articles to be translated into Portuguese for the newsletter "CETEA Informativo" were prepared.

The short span compression test method is today recommended for measurements on paper and board. In considering investments in new laboratory equipment at CETEA, I would give the short span tester top priority.

By setting up a laboratory carton board creasing instrument during the mission, CETEA now has the ability for research and service to industry. An instrument for bending force measurement on creased and uncreased samples would complete this testing system.

The testing laboratory at CETEA was comparatively well equipped and the staff group involved had a good basic knowledge in paper technology, which was improved by the mission.

INTRODUCTION

In an integrated programme between the Brazilian Federal Government and the United Nations Development Programme through the United Nations Industrial Development Organization, UNIDO, project number DP/BRA/88/017, was planned for a project at ITAL (Instituto de Tecnologia de Alimentos) in Campinas, Sao Paulo, Brazil.

Within this project, an expert in packaging - paper and board - was requested for CETEA (Centro de Tecnologia de Embalagem de Alimentos) which is a department of the ITAL institute. A job description listing the work that was to be performed is shown in Enclosure 1.

After a visit by Dr. Madi, Head of CETEA, to Packforsk in October 1989, I received an invitation to work on the project in January 1990. This project work at CETEA was then performed during the period 23 April 1990 to 22 May 1990.

On my arrival at CETEA, a more detailed day-to-day programme, prepared by my special contact person at CETEA, Elisabeth de F.G. Ardito, was presented. This included checking some laboratory equipment and procedures, repairing a carton board creasing instrument, taking part in some CETEA projects, giving six internal seminars, performing a one-day external seminar and visiting four factories.

At a CETEA staff meeting on 15 May 1990 a briefing on the Swedish Packaging Research Institute was given, including financial and organizational aspects.

An additional requirement to prepare some articles for the "CETEA Informativo", an information newsletter for the Brazilian industry, was also on the programme.

ACTIVITIES IN THE MISSION

Training of CETEA staff in the laboratory

In the "laboratory" parts of the mission programme, I had discussions with persons involved in the CETEA mechanical testing laboratory and made demonstrations of some of the paper and board testing instruments in the laboratory (see Enclosure 2).

Bursting strength testing of paper and corrugated board was one of the tests covered. Details in the testing procedure according to different standard methods, checking and calibration techniques and influencing factors were dealt with.

The use of laboratory crush testers, both "bending beam" and load cell based instruments, for standard compression tests such as CCT - column crush test, CLT - concora liner test, CMT - concora fluting medium test, FCT - flat crush test, and RCT - ring crush test, were discussed. Typical stages in the force/deflection curve for flat crush testing of corrugated board were explained.

Different aspects and details on procedures for ECT, corrugated board edge crush test, e.g. test piece shape, cutting procedures and influence from

dimensional errors were also discussed. Detailed information was given to me by Assis Garcia and Elisabeth de Ardito on the Brazilian standard for ECT testing.

During the training sessions, information was presented on the Swedish agreement regarding a code for food packaging materials, Normpack. This agreement will protect consumers by ensuring that food packages are safe to use under normal circumstances and will help package manufacturers and users to ensure product safety.

The objective of the Normpack agreement is to safeguard and promote the interests of industry, commerce and consumers on the subject of food packaging safety. The code is based on voluntary undertakings by the associated companies in the package and food manufacturing industry. The Normpack requirements are based on requirements and regulations in the FDA, BGA and Warenwet specifications in the USA, Germany and Netherlands, respectively.

At CETEA there was a research project in process on the influence of relative humidity on strength properties of Brazilian corrugated board. Some surprising results found on non-linear strength/RH relationship, were discussed. Some suggestions on how to check the results, the conditioning atmospheres used and also concerning ideas for construction of simple conditioning chambers were given.

The aim for other project discussions were, for example, to take part in analyzing a project plan for finding possible reasons for taste and smell changes, probably caused by the carton board packaging material and to estimate the weakest part in a package system consisting of a number of inner carton board cartons combined with an outer corrugated board box.

Information regarding paper and board testing methodology and instruments, both applied in research institutions and markets available, were given. Information sheets regarding apparatus produced by the Lorentzen & Wettre Co. were left to CETEA.

A number of literature references was copied and left at CETEA as documentation material to be kept in the library. A copy of the book "Testing Methods and Instruments for Corrugated Board" by Hakan Markström was also left.

Setting up laboratory carton board creasing instrument

The testing instruments at the CETEA laboratory included a carton board creasing instrument designed by H.E. Messmer Ltd., London. This instrument, I was told, was comparably new at the laboratory and had not been in use.

Examination of the instrument showed that it could not directly be used to produce proper laboratory creases in carton board samples.

The instrument was disassembled, cleaned, lubricated and reassembled in the correct way. During reassembly it was found that some additional shims had to be placed in position in the chase for the creasing rules (or grooves), in order to position the rules centrally in the grooves.

After reconditioning, the creasing instrument ran correctly.

In the Messmer instructions for performing tests on the instrument, there is information about the zero setting. I would suggest a somewhat different zero setting. Set the zero position of the upper chase to a position so that the creasing rules are just in contact with the upper surface of the material to be tested. This procedure has the advantage that it is more convenient and is easier to locate the zero point (without risk to damage the rule). This also gives simpler and more direct calculations for the crease depth used when testing the board.

New industry service opportunity at CETEA

When producing carton board packaging blanks, the result of the board creasing operation is most important. The performance of the blanks in filling machines to a great extent depends on the creases and they also influence to some extent the performance during transportation and use.

For CETEA, having this Messmer crease producing instrument working, it gives the laboratory a new opportunity to serve the Brazilian carton board mills and converting industry. This can be done both in joint research projects and/or on a consultancy basis.

Internal seminars

Six internal seminars of two to three hours each were performed as planned in the detailed programme for the mission. The titles and main headlines for the six internal seminars are listed in Enclosure 3.

The aim of the internal seminars was to give the staff of CETEA a research orientation and a basic knowledge in paperboard, paperboard testing and paperboard package design, especially related to corrugated board and its raw materials.

My intention at the seminars was not only to teach just formulas but also to provide a basic understanding of different phenomena regarding paperboard packaging materials.

In these seminars, information was given in testing and evaluation methods for paper, paperboard and corrugated board material and packaging and also research information with regard to corrugated board box performance as related to corrugated board composition, all in accordance with items 5 and 6 in the job description (Enclosure 1).

Different aspects of the concept "performance" for paperboard packaging materials and packages were discussed. Stresses during transportation and their impact to the strength of packages and also different theories/formulas for predicting strength and performance of packages were explained. Since most packages in modern transportation are subjected to load, compression strength of materials and boxes was given special attention.

Some research theories and activities in different laboratories regarding fundamental behavior of paperboard was referenced. Guidelines found for practical use of the new knowledge according to ideas from different researchers were also discussed.

The participants at the internal seminars are listed in Enclosure 4.

The staff of CETEA participating in the internal seminars had a sufficient basic knowledge in the field of paper and board for packages and most of them had a good knowledge in the English language, so there was no obvious problem in communication. My impression was that the members of the group were very active during the seminars, making notes, asking questions, discussing details and giving examples related to Brazil.

"CETEA Informativo"

The CETEA organization produces an information journal called "CETEA Informativo".

The "CETEA Informativo" is a publication prepared by the CETEA staff every second month. This service newsletter will give actual information on the research and development work at CETEA and other actual package information. The "CETEA Informativo" is distributed to associated Brazilian industries and organizations.

A requirement was raised within my mission to prepare some articles in English, which are going to be translated into Portuguese by Elisabeth de Ardito, member of the CETEA staff. These translated articles are then to be published in the information newsletter "CETEA Informativo".

During my stay at CETEA in Campinas, I prepared four such articles and one more was sent from Sweden. The intention is that one article will appear in every one of the five nearest issues of the "CETEA Informativo".

The titles of the articles for "CETEA Informativo" were:

- The Swedish Corrugated Board Specification;
- SUW, the Swedish Corrugated Board Research Group;
- The Flap Folding Operation in Cartonboard Blanks;
- Corrugated Board Runnability in Packing Machines;
- The Short Span Compression Test Method.

External Seminar

16 May 1990 was the date for the external seminar. There were 14 Brazilian industry representatives in the audience and a number of the CETEA staff. An attendance list is given in Enclosure 5.

According to CETEA, the number of attendants was judged as quite good in view of the financial situation of the Brazilian industry during the period.

The programme for the external seminar started with a presentation of the Swedish Packforsk organization (Swedish Packaging Research Institute), dealt with corrugated board and components testing, box performance and package testing. The seminar ended with a presentation on carton board and carton board packages in accordance with the programme.

The papers read at the external seminar contained to a great extent the same information as given at the six internal CETEA seminars, but adjusted to an industry point of view.

Industry visits

During the mission, visits were made to paper, carton and corrugated board industries in the Sao Paulo city. A group from CETEA consisting of Elisabeth de Ardito, Assis Garcia and Eloisa Garcia accompanied me on four such visits (Enclosure 6).

The companies visited were:

Indústrias Klabin
Rua Samuel Klabin s/n
05089 Sao Paulo, SP

Ripasa S.A. Celulose e Papel
Estrada de Itapeccerica da Serra
Km 27,5 Embu
06800 Sao Paulo, SP

Cia. Suzano de Papel e Celulose
P.O. Box 56
Suzano
01452 Sao Paulo, SP

Fábrica de Papel Santa Therezinha S.A.
Rua Aracati, 275
Penha
CEP 03630 Sao Paulo, SP

The company representatives I met during the visits were kind and good at explaining the production and specialities of their company. They guided me through their factories and laboratories and in some companies I was allowed to take photos.

Referring to discussions, the companies obviously showed also a lot of interest in research, development and production control. Their laboratories were mostly well equipped and I met active laboratory staff.

During the visits we also had interesting discussions about the good Brazilian opportunities for papermaking and raw material supply.

During the period of my visits, several of my guides were concerned about the present financial situation in Brazil.

RECOMMENDATIONS FOR NEW EQUIPMENT AT CETEA

Short span tester

Compression strength of corrugated board raw materials and carton board is considered today a very interesting and important property. The modern testing method recommended for such compression strength measurements is the short span method (sometimes also called STFI), developed at the STFI institute in Sweden and based on the testing instrument produced by the Lorentzen & Wettre Co. (Identification no - SE 052, with built-in moisture sensor - SE 053).

The CETEA laboratory for normal mechanical testing of paper and board for packaging purposes is relatively well equipped, but does not have the short span testing equipment.

An instrument for compression testing of paper and carton board using the short span testing method is recommended for CETEA. Considering investments in such new laboratory equipment at CETEA, I would give the short span tester top priority.

Instrument for bending force measurements

If the new CETEA capability for crease testing service on carton board is accepted by industry, an instrument for bending force measurement, related to bending angle, would be recommended.

The options are to buy such a special instrument or to build (ore bue) an attachment for the Instron Tensile Tester. Some examples of design principles for such an attachment are separately being sent to CETEA.

Such a special instrument for bending force measurements which received a good response, is the Lorentzen & Wettre instrument, ref. no. SE 015.

Box compression tester

Compression strength of cartons, boxes and other packages is often referred to as one of the most important properties. The box compression tester at CETEA has relatively small platens which reduce its use only to smaller packages.

This is my reason for setting a high priority on a box compression tester of modern design on the CETEA instrument investment list.

Four point beam bending instrument for corrugated board

In several box compression strength formulas, the bending stiffness of the board is included. Measurements of the bending stiffness of corrugated board has been somewhat complicated and inaccurate.

There is relatively new testing instrument on the market, based on four point beam bending method and developed by the Lorentzen & Wettre company. This instrument has good references and would be of interest to CETEA.

COMPILATION OF FINDINGS

During my mission, a lot of impressions, reflections and thoughts besides the direct technical aspects, contribute to form a basis for judgment. Below are some findings, both mentioned in other parts of this report and additional ones.

- I found the personnel at CETEA interested, active and efficient.

- The leaders and persons in the group attending the "Internal Seminars" had a good knowledge of the English language and most persons of the CETEA staff had at least some knowledge of English.

- The persons whom I met from the CETEA paperboard packaging group had a good basic knowledge of paper, paperboard and packaging.
- At CETEA, I found warm, harmonic and emotional atmosphere among all the members of the staff.
- At CETEA, they had made very good arrangements for my mission.
- "Semi joint subsidiary industry groups", companies interested in the same research area, is an efficient organization to be considered for CETEA activities.
- If possible, CETEA should perform comparative laboratory testing on investigations for clients.
- The paper and board mechanical testing laboratory at CETEA was comparatively well equipped but investment in a short span compression tester is recommended.
- By repairing a board creasing instrument, my mission gave CETEA new research and industry service opportunities.
- I found the industries that I visited during my mission to be of modern design.
- Klabin Co was a modern corrugated board company, with a very well equipped laboratory.
- Collection of used corrugated board and the raw material supply at Ripasa Co, indicated an interest in recycling fibres.
- The industry representatives I met were aware of pollution and environmental aspects.

JOB DESCRIPTION

Title: Paper, Paperboard and Corrugated Board Packaging Laboratory Expert

Activities: The expert is expected to work with technical staff of CETEA under the supervision of the National Project Coordinator and develop the following activities:

- 1- Short courses related to paper, paperboard and corrugated board material and packaging;
- 2- Appraisal of the equipment available at paper, paperboard and corrugated board laboratory;
- 3- Training CETEA personnel in the equipment already available;
- 4- External seminar on paperboard properties and machinability;
- 5- Orientation in testing and evaluation methods for paper, paperboard and corrugated board material and packaging;
- 6- Research orientation with regard to corrugated board box performance related to corrugated board composition;
- 7- Prepare a final report in English on the activities developed during the mission.

THE EQUIPMENTS AVAILABLE AT CETEA'S PAPER AND BOARD LABORATORIES ARE:

1. MICROMETER L S W
2. MATERIAL TESTING MACHINE - INSTRON
3. BURSTING STRENGTH TESTER - H.E. MESSMER
4. STIFFNESS TESTER (TABER) - REGMED
5. AIR PERMEANCE TESTER (GUERLEY) - REGMED
6. CRUSH TESTER - LS W AND REGMED

ACCESSORIES: PAT, RCT, CCT

7. CONCORR MEDIUM FLUTER - CCA
8. COMPRESSION TESTER - (BUILT AT CETEA)
9. PUNCTURE TESTER - KARL FRANK
10. ELMENDORF TEAR TESTER - REGMED
11. CARTON BOARD CREASER - H.E. MESSMER

Internal Seminar I, April 27, 1990

Title:

Package testing philosophy, corrugated board testing methods and presentation of the Swedish corrugated board specification

Headlines:

Why do we test?

To predict performance
Evaluate accordance with requirements
Development and research work
(To analyze compounds)

Different performance aspects

Printing
Conversion
Filling machinability
Transportation
Information

Main types of packages

"Sacks and boxes"

Corrugated board testing

Flat crush test
Material compression strength
Bursting strength
Puncture test
Printing aspects
Box compression strength

The SIS corrugated board specification

Background for working groups in the Swedish
Standardisation Organisation
SUW trials evaluated transport performance

Philosophy for the SIS specification

Main property is ECT (compression strength)
Additional requirements; burst, flat crush, thickness
and absorption
Asks for limit values
No Grammage or Puncture requirements

Internal Seminar II, May 3, 1990

Title:

**Compresson test methods for corrugated board components
and complete board**

Headlines:

Raw material Compression strength testing methods

CLT-test

Ring Crush test

CCT-test

Short Span Compression test

FPL (research) method

CMT-test

ECT (=compression strength) testing of corrugated board

"Pure" compression strength

Compression strain

Different testing methods

Cutting and measuring equipment

Cutting accuracy

Raw material influence

Strength related to conditioning atmospheres

Internal Seminar III, May 4, 1990

Title:

Relationship between raw material properties, the corrugated board and the box strength in compression

Headlines:

"The compression strength chain"

Liner material

Corrugating medium

Corrugated board

Box

Corrugated board failure analysis

"Additional force" theories

"Strain limitation" theories

Microbuckling investigations

Box Compression strength predicting theories and formulas

McKee

Wolf

Fox

Some other investigations

Internal Seminar IV, May 08, 1990

Title:

Transportation and storage factors influencing the load resistance capacity of corrugated board boxes, SUW specification for corrugated board aimed for packaging machines.

Conclusion for corrugated board

Headlines:

Load resistance capacity of boxes and pallet loads

- Stacking height**
- Load distribution**
- Load duration**
- Stacking pattern**
- Stacking alignment**
- Transportation vehicle and vibrations**
- Humidity, moisture and liquid water (rain)**

Specification for corrugated board in packaging machines

- SUW investigations**
- Important properties**
- The SUW specification**

Corrugated board main disadvantage

- Moisture sensivity**

Corrugated board has several advantages

- Fibresaving basic construction**
- High strength/weight relationship**
- Easy to convert**
- Low blank volume**
- Simple erecting procedure**
- Recycable material**
- Relatively cheap**

Internal Seminar V, May 10, 1990

Title:

Carton board and carton board packages, importante aspects and properties

Headlines:

Material properties

Compression strength

Bending stiffness

Creasability

Z-strength

Curl & Twist

Printing aspects

Smoothness

Absorption

Surface strength

Hygro expansion

Runnability aspects

Blank dimensions

Crease properties

Bending stiffness

Bulgeing

Curl

Compounds analyses

Swedish Code for food packaging materials

Analyses for toxic compounds

(Taste and smell analysis)

Internal Seminar VI, May 14, 1990

Title:

**Paper structure theories, common strength testing methods
and some printing related properties.**

Headlines:

Elastic properties of paper

Ortotropic behaviour
Net work models
MD, CD and ZD directions
Strength envelope

Basic strength properties

E- and G-modulus
Fracture propagation

Common testing methods

Tensile strengt
Compression strength
Bending stiffness
Bursting strength
Tear strength
Folding endurance

Printed related properties

Wetting
Absorption
Surface smoothness
Surface strength
Hygro expansion

Participants at the Internal Seminars

	Internal seminar no						Sum
	I	II	III	IV	V	VI	
Rosa Alves	x	x	x	x	x	x	6
Elisabeth de Ardito	x	x	x	x	x	x	6
Silvia Dantes	x	x	x	x	-	x	5
Eliete Faria	x	x	x	x	x	-	5
Assis Garcia	x	x	x	x	-	-	4
Eloisa Garcia	x	-	x	x	-	-	3
Henry Kogayama	x	(x)	x	-	-	-	3
Lea Oliveira	x	-	-	-	-	-	1
Marisa Padula	x	x	x	-	-	-	3
Clarie Sarantópoulos	x	x	-	x	x	x	5
Roger Soler	x	x	x	x	-	-	4

List of Participants

Enclosure 5

Seminar in "Development of fibre board and corrugated board packages"

15/05/90

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21. ROSÂNGELA MAURI - ramal 103
22. SYLVIO ALVES ORTIZ - ramal 100/103

Visit to Klabin Co

On the morning of May 2, L-E Eriksson and the group from CETEA consisting of Elisabeth de Ardito, Assis Garcia, and Eloisa Garcia, visited the Klabin corrugated board plant in São Paulo city.

The tour of Klabin Co was conducted by Juares Pereira of the Technical department (Depto. Técnico, according to his business card). We also met the director Marcos Sardas (Gerente Geral - Filial São Paulo) who supplied more information about the family owning company Klabin. He was also interested in the Swedish corrugated board industry and received some information on industries, raw materials, production and quality aspects.

We also had a discussion with Mr Pereira about e.g. Klabin, raw material compression testing methods, the variation within Brazilian raw material properties, ECT-testing methods, use of puncture test results, relation between different board materials and corrugated board specifications.

After the discussion we were guided by Mr Pereira through the material testing laboratory, the package testing room and the production and converting hall.

The laboratory at Klabin Co was very well equipped. Beside normal paper and board testing apparatus, it included equipment for package testing e. g. box compression tester, incline plane tester, rotating drum and manufactures joint tester.

The corrugated board at Klabin is to a great extent converted by die cutting. A figure of 70 % of the production was mentioned. Their production includes a lot of white surface material, often coated or impregnated, and a number of interesting special constructions was shown.

There were two corrugated board production machines producing in three shifts more than 45 000 metric tonnes of board per year.

The corrugator shown was a 2.2 m S&S machine of conventional type and production average speed was said to be 120 m/min.

The converting equipment were to a great extent of modern design including several die cutting machines, both of plane and rotary model.

Ripasa S.A. Celulose e Papel

On the afternoon on May 2, the group visited Ripasa Co.

The carton board production machine at Ripasa Co was a Voigt machine working according to the cylinder concept with six cylinders. The drying section includes a Yankee cylinder and a filter for removing static electricity.

Close to the carton board machine there was a production control laboratory with normal testing equipment such as bursting strength tester, thickness instruments, Taber stiffness tester, tear strength tester, Bendtsen surface roughness tester and including a PCA score bend testing instrument for examination of creasability.

The production includes carton board in the range 200-450 g/m² and they base their production to a great extent on recycled fibres. Production speed was said to be grammage dependent and in the range of 100 m/min.

Within the Ripasa Co there are pulp producing mills. Because of this, I was told, they put a lot of interest in planting forest areas with suitable varieties of trees grown in their own nursery garden.

Visit to Cia. Suzano de Papel e Celulose

During the visit to Suzano Co on May 9, the production manager Marcos Silveira showed a film about the Suzano Co and gave some additional information. They base their production on eucalyptus fibres and have in this factory four production machines.

The one most interesting to me, was not running at the day of my visit. This one, a 4.5 m wide Voigt cartonboard machine producing board in the range 250-450 g/m² in three layers. The top layer was normally 80 g/m² and in the center they used recycled fibers in 60-70 g/m². This machine was said to be the biggest paperboard machine in the southern hemisphere.

The other machines were producing paper, to a great extent for xerographic and printing purposes. For these types of paper the eucalyptus pulp was said to have especially good properties.

In the Suzano Co they put a lot of interest in the curl phenomena of paper and informed me that they have developed production techniques for avoiding curl of the material.

The laboratory was equipped with most normal apparatus for paper testing and also a PIRA Carton Board Creasing instrument. In the conditioned part of the laboratory (23°, 65 % RH) they had e.g. a Taber Stiffness tester, two score bend testers (Twing Albert and PCA) and an IGT test instrument.

In the Suzano Co they informed us that they are aware of the environmental problems, and the company invests a lot of money and human resources in activities for decreasing pollution from their factories.

Fábrica de Papel Santa Therezinha S. A.

On May 11 the group from CETEA visited the Santa Therezinha Co., Penha plant in São Paulo city. In this factory the industrial manager Rui Goncalves talked about the company and showed the two Yankee machines in this factory (Voigt, 3 m wide). Production speed is grammage dependent and in the range of 600 m/min.

The production was in the grammage range 18-60 g/m², mostly silk paper, flor post, monoglized paper and MG special papers. These paper materials are used for labels, as sweets and food packaging material, as base paper in Al- and PE-foil laminating, and for air line ticket sets. The raw material is bleached or unbleached pulp of virgin fibres, to a great extent based on eucalytus, bought on the market.

The production capacity of the factory was 30000 metric tons a year and a lot of the production was said to be exported all over the world .

A philosophy for the Santa Therezinha Co, I was told, was to concentrate on producing high quality paper material within their production sector.

Backstopping Officer's Comments

The mission of the expert, Mr. Eriksson, was intended to assist the Food Packaging Technology Centre (CETEA) in developing its capability of technical assistance to the national paper and board packaging manufacturer and user industries.

In this connection the activities of the expert were carried out both at CETEA premises and at the plants of selected paper and board package manufacturers at the State of Sao Paulo.

The expert was very well qualified for the mission, with a strong experience in research, development and quality control of the manufacture, conversion and utilization of paper and board packaging materials. His specialized activities at the Swedish Packaging Research Institute, a high level institution in one of the more developed countries of the world in the specific sector of paper and board industries, gave him a particularly well suited background within the technical field of the mission.

A good working liaison was established between the expert and his mission counterparts, which contributed to the effective carry out of a wide and intensive programme of works.

Particularly useful activities were carried out by the expert in connection with examination of the related testing equipment, its appraisal, setting-up and calibration.

The training function of the mission was also given special importance. In addition to his direct tuition of the technical counterparts on testing instruments calibration and operation, as well as on the concerned testing methodologies and interpretation of the test results for appropriate conclusions and advice to the industries concerned, the expert carried out some seminars for participants from both the CETEA and the private industries. Ad hoc advice was also given during his visits to factories on raw materials, manufacturing processes and machinery, and on in-plant laboratory quality control.

Taking into consideration the intensive technical activities of CETEA, in co-operation with the Brazilian packaging industries, and the high importance of the paper and board packages within any country produce distribution system, the mission was of great importance for the project.

The conclusions and recommendations of the expert are pertinent and appropriate. Therefore, we endorse his recommendations for the further development of CETEA's capability of technical assistance to the national paper and board packaging manufacturer and user industries.