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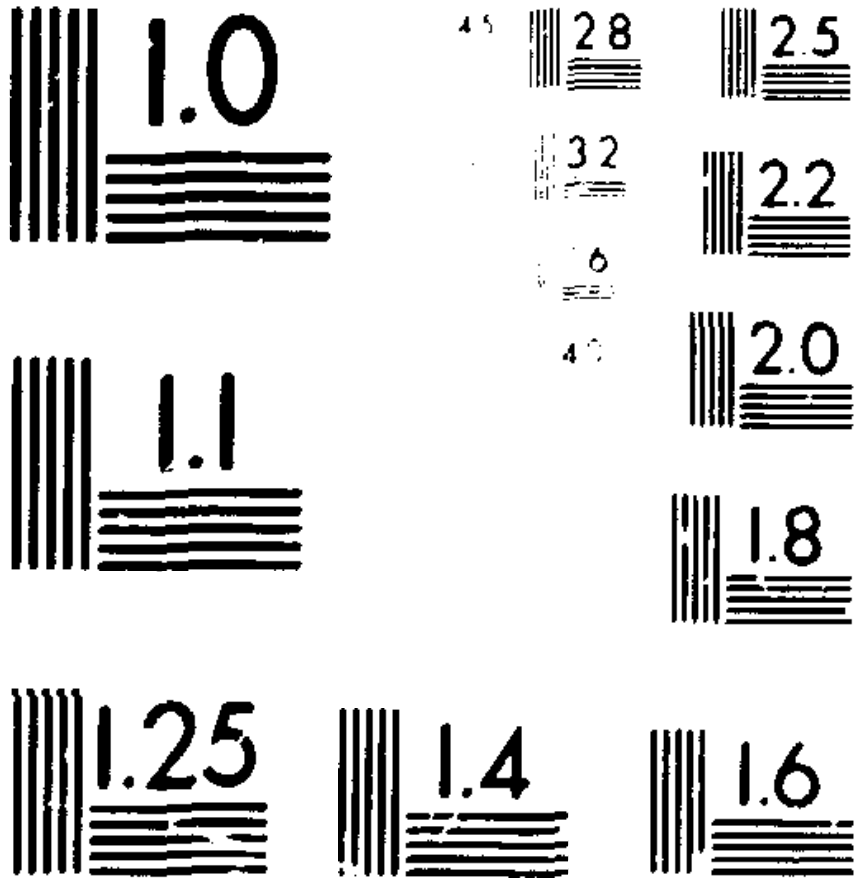

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DP/ID/SER.A/514
22 May 1984
ENGLISH

CONSOLIDATION OF THE PACKAGING CENTRE AND ESTABLISHMENT OF A PLASTICS CENTRE AT THE JAMAICA BUREAU OF STANDARDS

DP/JAM/82/004
JAMAICA

Technical report: Transit Pack Testing*

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

Based on the work of Frank A. Paine
Expert in Transit Pack Testing

United Nations Industrial Development Organization
Vienna

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V.84-86509

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SUMMARY

Mr. F. A. Paine, UNIDO Consultant on Transit Package Testing spent the period October 17 - December 17, 1983 in Kingston, Jamaica at the Bureau of Standards where the Packaging Centre is in a period of consolidation.

While four out of the original team of five senior members of the staff are still in office, the Transit Packaging Section has new personnel. The mission was largely devoted to the training of these three new people, Messrs. Campbell, Powell and Parris in the following:

1. Basic packaging concepts.
2. Setting up the test equipment correctly and explaining the methods of using it.
3. Outlining the relation between tests on filled packages and tests on empty containers and materials.
4. Developing suitable schedules for testing packages for transport within and for export from Jamaica.
5. Divising a one year development programme which would not only utilise the skills and knowledge of the section but also improve the overall standards of Jamaican packaging.

In addition to these, the consultant assisted Mr. John Salisbury, the Project Manager inputting the basic methods of test and the explanation of their uses as well as how to interpret the results, on to video taped programmes for the long term training needs of the Packaging Centre and other sections of the Jamaican industry. To our knowledge, this is the first time this has been done in the packaging field and opens tremendous possibilities for the future. In effect, it can provide first-hand instruction from the original consultant to staff of a packaging organisation over a long period, and by judicious updating, give training possibilities previously not available without the return of the consultant.

Visits, with transit packaging personnel for training purposes, were also made to several industrial companies to assist in packaging problems and a seminar of five (5) morning sessions covering export problems, principally in the fields of furnitute and fresh produce packaging was arranged.

This was attended by 34 people from 20 or so different firms with the assistance of Mr. Salisbury and 7 or 8 industrial representatives from the fields of packaging, transport, fruits and vegetables and furniture.

Recommendations are made in the report.

A. INTRODUCTION

Appreciating the role of research and testing in the development of good packaging, the Government of Jamaica formulated a project which was implemented by the Jamaica Bureau of Standards and UNIDO between March 1979 and March 1981 for the establishment of a Packaging Centre. This project formulated guidelines for development action in the reports of a number of visiting consultants, among them the author of this report. These covered the following fields:

Paper and board
Plastics
Metal containers
Fruit and vegetable packing
Glass containers
Transit pack testing
techno economic investigations and laboratory test techniques.

Implementation of these recommendations, the introduction of the techniques into industry and the application of laboratory test data to the improvement of industries effectiveness are underway, but help is required in consolidating these activities.

In particular, since the staff within the Centre changes over the years, a more permanent way of training new intake and also industrial trainees is required and to this end the project involves the production of a series of videos which can be updated from time to time and which record the methods of testing in detail and give guidance on the interpretation of the results.

B. JOB DESCRIPTION

DP/JAM/82/004/11-05/31.7.E

POST TITLE: Expert in Transit Pack Testing

DURATION: Two months

DATE REQUIRED: As soon as possible

DUTY STATION: Kingston

PURPOSE OF PROJECT: To advise and assist in consolidating the Packaging Centre at the Jamaica Bureau of Standards.

DUTIES: The activities of the expert will be agreed upon in co-operation with the national counterpart personnel and the UNIDO Project Manager. The expert will be assigned to the Packaging Centre of the Jamaica Bureau of Standards and will specifically be expected to:

1. Advise on the methods and use of the transit packaging equipment, i.e. the vibration table (Gaynes mechanical type 1250), drop tester, laboratory box compression tester (MacKlow Smith, U.K.), inclined plane. Specify the test methods to be used and the interpretation of the results obtained.

2. Present a series of six 1-hour talks on transit pack testing for Centre staff and industrial personnel, focussing on ways the results obtained in the laboratory can be related to the problems of the export industry.

3. Assist the Project Manager in preparing the script for a series of video training films that will record the points made by the expert during the mission (note that no experience in film-making is required).

4. Assist Packaging Centre staff in preparing testing schedules for the problems at present being investigated.

5. Recommend a one-year basic development programme designed to improve the skills of the Centre staff in transit pack testing.

The expert will be expected to prepare a final report setting out the findings of the mission and recommendations to the Government on further action which might be taken.

QUALIFICATIONS: Packaging Technologist with good knowledge of laboratory transit package testing techniques and the needs of good export packaging. Science degree preferred, experience in developing countries helpful.

LANGUAGE: English.

C. PROGRAMME

The consultant arrived in Kingston, Jamaica on 17th October, 1983 and reported for duty the next day. After a routine visit to the UNDP office to arrange details of DSA and etc., he met the staff of the Packaging Centre and discussed with Mrs. Marguerite Domville, Head of the Centre details of the mission and a programme for the first part was drawn up. Briefly this covered the period October 17 to November 14, 1983 and was devoted mainly to the training of the transit packaging section, none of whom had more than a few weeks experience in the use of the principal test equipment

- Drop tester
- Inclined plane tester
- Vibration tester
- Compression tester; and
- Stacking tests.

This was supplemented by the six formal talks on packaging and by a few visits to key companies in the packaging making sector.

From November 14 - 17, 1983 the consultant was absent from the Bureau due to a previously arranged visit to the USA (Chicago and East Lansing, Michigan) and advantage was taken to this to obtain information on certain American test procedures which were not available in Kingston.

The remainder of the programme fell into three parts:

November 18 - 27 : Work on the writing of standard test procedures and the scripts and preliminaries for the video series on testing. Also development of the standard sequences for testing packages for home and export transport and their relation to a possible certification scheme.

November - December 2

: This was the week of the seminar and the mornings were fully occupied with this while the afternoons were concerned with script preparation for the video series.

December 3 - 17 : Work on question and answer sessions, filming for the videos and completing the suggested programme for the next years developments in transit testing.

As will be seen from the detailed timetable there was some overlap. Also a number of problems from local industries were discussed and used to illustrate the test procedures. On two occasions the consultant took part in discussions between Mrs. Domville and a Mr. Donald Redden of the World Bank who was engaged in a study of problems in the export area in which packaging plays an important role.

The consultant left Jamaica on 17th December and produced this report between that date and his debriefing in Vienna on the 6th January, 1984.

D. OBSERVATIONS AND RECOMMENDATIONS

These are mainly reported in relation to the five areas specifically referred to in the Job Description:

"1. Advice on methods and use of the transit package test equipment."

The equipment in the laboratory was not set up in accordance with ISO standards and the first task was to remedy this.

The VIBRATION TABLE was operating in the out of synchronous phase and was placed into the recommended ISO harmonic type of synchronous movement by removing the table top and adjusting the belt drive.

Recommendation

Although stacking loads can be applied using weighted packs and the high fences supplied with the equipment, it is recommended that a loading system similar to that developed at PIRA in the U.K. be installed. This can be built in Jamaica and information will be sent to the Bureau by the consultant as soon as possible.

The INCLINED PLANE TESTER was incorrect, in that -

(a) the friction between package and dolly was far too great due to the presence of a layer of grease on the top metal surface of the dolly. This was removed and the top cleaned.

(b) the dolly impacted the bumper at the same time as the package placed level with its leading edge. To move nearer to the standard set by ISO, the bottom board of the bumper was cut away to allow the dolly to pass beneath it thus causing the package to make the first impact. ISO recommend about 4 inches of travel beneath the bumper - there is only 1½ inches in the new arrangement but it seems satisfactory.

(c) the inclined plane tester had not been calibrated in terms of impact speed in relation to distance up the track. This was done by timing the dolly over the last 20 inches of travel and a graph

is now situated on the top left hand corner of the bumper.

Recommendations

1. Means of preventing rusting of the top of the dolly without causing undue friction between it and package must be found. It is suggested that a varnish film pigmented with aluminium powder might do this. The possible friction effects should be ascertained beforehand however.

2. The calibration of the tester is accurate enough for the present but should be checked at least annually and preferably using a timing device able to measure over a shorter distance than the last 20" of travel.

The DROP TESTER

(a) This appears to have release difficulties which have been traced to the wrong voltage applied to the solenoid release device. At present it has to be operated by hand.

(b) No rails are placed around the area of swing of the flaps of the table and this is dangerous to personnel.

Recommendations

1. The correct voltage should be made available to ensure that the release mechanism can always be used.

2. Guard rails or other means of preventing access to the danger area of the swinging flaps of the table should be installed.

The STACKING TEST has been supplied with special concrete blocks for loading but only one spreader board is available and this is small.

Recommendation

A spreader plate preferably made of metal and 24-30 inches square should be provided for several stacks.

Specify the test methods and the interpretation of results.

The methods to be used for each of the test equipment have been written (ANNEX 3) and have been explained both in formal and informal talks. They are also available in video film form* where their interpretation is discussed. These videos were produced for -

the drop test;
the inclined plane test;
the vibration test;
the stacking test; and
the compression test.

The basic policy for the video films is reported under paragraph 3 of this section of the report.

*Note - The consultant worked under the guidance of Mr. John Salisbury in the video area and Mr. Salisbury is far better qualified to give detailed information on this aspect of the work. The basic filming only was completed during the mission and this will need editing and arranging and this will take some time.

In addition to the videos related to the transit packaging test equipment, a video on the development of multi test schedules was also produced as well as two or three on materials tests.

"2. Present six 1-hour talks on transport package testing with particular reference to problems of export."

The titles and outlines of the six talks are given in ANNEX 2.

Additionally, the five half-day seminars (see ANNEX 5) covered export problems in the fields of fruits and vegetables and furniture.

Recommendation

Blackout facilities in the board room of the Bureau which is used extensively for seminars should be provided as the present curtains are completely useless and do not permit slides to be seen properly; many are not visible at all. POOR PRESENTATIONS NEVER GIVE GOOD RECALL AMONG THE PEOPLE ATTENDING SEMINARS.

"3. Scripts for the series of video training films"

As can be seen from the policy statement attached as ANNEX 8, the basic input from the consultant was to write scripts as required and produce (with assistance from the Packaging Centre staff) questions and answers which would bring out points of significance which are difficult to include in a general statement or which the staff have found difficulty in appreciating. As already reported, this was done for the basic tests.

Recommendation

The video technique for training opens up a most exciting prospect and should be developed for other areas. Three points are particularly worth noting:

(a) The trainees are able to follow visually what is otherwise only available in the printed form hence a much better understanding achieved.

(b) When the expert has gone, exactly what he said can be referred to easily.

(c) The video film is specific to the actual equipment and the Jamaican situation and not a generalised version.

"4. Assist Package Centre staff to prepare test schedules for current problems."

As it happened, it was rather the other way round - the staff assisted the consultant to prepare 3 schedules - general ones for home and export packaging a specific schedule for testing multi wall paper sacks.

Recommendation

All these schedules must be tried out and modified if necessary. If the development programme cannot be related to the certification scheme for any reason then at least one package (selected in relation to a manufacturer who will co-operate by providing data on package performance and packages for test in exchange for information that can lead to better or less expensive packaging) should be studied by one of the schedules every month.

"5. Recommendations for a one year development programme."

This has been detailed in ANNEX 6. It is again stressed that the best training in packaging testing in this consolidation period is to use the equipment available to tackle actual problems and learn by doing. Other forms of training should be kept to an absolute minimum.

ANNEX 1

Detailed timetable

Date		Activities
October 17	.....	Arrived in Kingston.
" 18	.....	(a) Visited UNDP Office, cleared details of DSA, bank, etc. (b) Reported to Packaging Centre, renewed acquaintance with members of staff from previous mission, met new staff, and in particular, Messrs Campbell, Powell and Parris.
" 19	.....	Took part in a discussion with Mr. Redden of the World Bank and Mrs. Domville on improvement of Jamaican exports in fruit and vegetable. Agreed that grading of produce and minimum standards for packaging would go a long way in achieving success.
" 20	.....	(a) Visit to Jamaica Packaging Industries (JPI) to see Mr. B. Currie and a representative from Estate Industries to discuss packaging of Tia Maria liqueur. Opportunity to see the plant with the Transit Packaging Section was taken. (b) Discussed problems of packaging ceramic ware holding gourmet preserves with representative of Things Jamaican.
" 21	.....	(a) Produced a programme outline of the six talks requested and agreed same with Mrs. Domville. (b) Discussed seminar to be held by JBS to be given mainly be consultant and J. Salisbury.
" 22 & 23	.....	Developed and planned details of talks and seminar programme.
" 24	.....	(a) Short meeting with Dr. A. S. Henry, Director of the Bureau of Standards. (b) Discussion with transit staff on getting the testing equipment into proper working order.
" 25	.....	Visit to Reliable Packaging Co. to discuss problem and to see sack making plant with transit staff - first training talk and discussions.

Date		Activities
October 26	.....	With Mr. Grant, got the tensile tester in shape to do paper tests of sack kraft from Reliable Packaging. Arranged for the programme to be written up.
" 27	.....	Made tests on paper from sacks and drop tests on the sacks themselves.
" 28	.....	Visit to D & G Wines Ltd to see bag in box packaging. Second training talk.
" 28 & 29	.....	Detailed planning of seminar presentation and video film preparation with Project Manager.
" 31	.....	(a) Visited Agricultural Marketing Co. (b) Finalised seminar programme (c) Arranged visit to Grace Kennedy farm with Miss M. Tenn.
November 1	.....	(a) Third talk on testing. (b) Visit to West Indies Pulp & Paper Corrugated.
" 2	.....	Preparation for seminar
" 3	.....	Fourth talk on testing.
" 4	.....	Visit to West Indies Pulp & Paper carton factory.
" 7	.....	Visit to Cariframe furniture.
" 8	.....	(a) Visit to cheese plant at Mile Gully (b) Fifth talk on testing.
" 9	.....	(a) Second discussion with Donald Redden and Mrs. Domville on export and packaging. (b) Discussed relation between tensile tests on paper and strength of sacks made from it.
" 10	.....	(a) Sixth talk on testing. (b) Discussions with Mr. Lowe of Reliable Packaging on sack problem.
" 11	.....	(a) Final preparations for seminar demonstrations of test equipment. (b) Interviewed for television news shown in the evening spot.

Date		Activities
November 14 - 17	.....	Visit to Chicago and Michigan State University School of Packaging in USA - private arrangement.
" 18 - 25	.....	(a) Returned to Kingston. (b) Video work. (c) Scripts for talks on drop test, compression, etc. (d) Daily sessions of filming both general sequences and question sessions. (e) Meeting with Messrs. Roche and Joyce of Coates Brothers re problem of Flexo printing at W. I. Synthetics.
" 27	.....	Visit and discussions at the Grace Kennedy farm with Miss M. Tenn.
November 28 to December 2	.....	SEMINAR WEEK - Export Packaging. (a) Met Resident Representative, Dr. McSweeney at the opening session of the seminar. (b) Several question and answer sessions for video films prepared.
December 5 - 9	.....	(a) Video shooting almost entirely. (b) Held discussions on flexo problem with Mr. Mahfood of West Indies Synthetics.
" 10 - 11	.....	Discussions on one year development programme.
" 12 - 16	.....	(a) Completed test procedures. (b) Discussed the Certification Programme and associated work needed. (c) Collected last information for report form of which was agreed with Project Manager.
" 17	.....	Left Kingston.
" 18	.....	Arrived home in U.K.
January 5 & 6	.....	Vienna debriefing.

ANNEX 2

Series of talks on packaging testing for transit packs with particular reference to corrugated cases

1. Introduction - What do we need to know to design successful packaging?

2. Testing - The first and second correlations:
   - actual performance versus field trials;
   - field trials versus laboratory transport schedules.

3. Testing - The third and fourth correlations:
   - laboratory transport schedules versus individual tests on empty containers or dummy contents;
   - individual empty container test versus material properties.

4. Quality measurement in the corrugator plant.

5. Quality checking for the CFC user.

6. Writing specifications.

OUTLINE OF EACH TALK

1. Introductory talk

This was an expanded version of the first talk given in the seminar (see ANNEX 5) and the notes given for that should be sufficient outline.

2. & 3. Correlations

In these two talks the relationships between actual performance of a package in use in the field on the one hand and laboratory test procedures were outlined, and in particular, the reliability of field performance predicted from laboratory measurements was discussed. Reference was made to papers given at a PIRA Symposium in 1969 and subsequent studies and photocopies of some of these and relevant ISO, ASTM, National Safe Handling Committee, BSI and other documents supplied.

4. Quality control and the corrugated case maker

The difficulties of controlling the product from the corrugator other than by visual examination and measurement of total board caliper was stressed and the value of measurements of properties such as edge crush,

flat crush, bursting strength, etc in assisting the long term improvement in incoming raw materials and in predicting the performance of cases made from them was examined.

5. Quality control and the case user

The main point here was the realisation by the user that quality cannot be inspected into a batch of anything however long and painstaking the procedure. That co-operation and trust in working out the requirements is more important than a slavish adherence to statistical sampling.

6. Specification writing

A good specification is a means of communicating the agreed needs of a user to his supplier(s) - it should be in three parts:

(a) A straightforward statement on what the material, package or other product will be required to do.

(b) A statement which outlines the procedures to be adopted if a consignment does not meet specification.

(c) The details of the significant test methods and or visual examination that should be carried out to see whether the batch is correct.

Again, the importance of co-operation between user and supplier was stressed.

ANNEX 3

Standard test methods

Detailed test methods were prepared for the following tests:

1. Vertical impact test
2. Horizontal impact test
3. Vibration test
4. Compression test
5. Bursting strength
6. Puncture test
7. Flat crush
8. Edge crush.

VERTICAL IMPACT TEST

Standard method using the Gaynes No. 125 Release Trap Door Tester

1.0. SCOPE

The method describes the procedure for carrying out vertical impact test using the Release Trap Door Tester.

2.0. EQUIPMENT

2.1. The Gaynes No. 125 Release Trap Door Tester fitted with two flaps which can be secured in a horizontal plane with a slight gap between the flaps.

2.2. The catches which hold the trap door in position can be withdrawn by a mechanism operated through a foot pedal connected by a cable to a solenoid.

2.3. The flap assembly can be raised manually by increments of three inches from a minimum of nine inches on a column to the desired drop height. A device centered on that column permits the top edge or corner of any package to be held in the desired attitude of fall when drops other than falls flat onto a face are required.

2.4. Two sizes of flap are available; the second set being used when low drop heights are needed below the height at which the standard flaps would hit the floor.

3.0. NUMBER OF PACKAGES REQUIRED

It is desirable to have 5 filled packages available and 5 empty unused packages. The test can be made on less; even on one filled and one empty.

4.0 PROCEDURE

4.1. Condition the packages for 48 hours before testing.

4.2. Fill an unused package with undamaged actual or dummy contents. Close and seal it to simulate the actual system used in practice while still permitting opening and reclosure without significant damage, thus allowing examination of the contents during the test.

4.3. Insert the plug controlling the release mechanism.

4.4. Depress the foot pedal, swing the flaps into the horizontal plane and release the foot pedal. Check that the table flaps are solidly in position.

4.5. Set the table to the desired drop height and check this as necessary using a ruler or a standard measuring stick.

4.6. Check that the area around the tester is clear of any material and personnel.

4.7. Position the pack on the flaps in the desired attitude.

4.8. Check once again that the danger area around the equipment is clear of material or personnel.

4.9. Actuate the release mechanism by depressing the foot pedal.

4.10. Examine the pack for damage and record this. Repeat the drop procedures 4.4. to 4.9. as required.

5.0. TEST REPORT

The test report should include the following:

5.1. A full description of the package.

5.2. The gross weight of the package and the net weight of the contents.

5.3. The number of packs tested and the result of each test.

5.4. The temperature, time and relative humidity of the conditioning period.

5.5. Any other relevant information.

HORIZONTAL IMPACT TEST

Standard method using the Gaynes Inclined Plane Tester

1.0. SCOPE

The method describes the procedure for carrying out horizontal impact tests on filled shipping containers using the Gaynes Inclined Plane Tester.

2.0. EQUIPMENT

2.1. The inclined plane tester consists of a two rail steel track inclined 10 degrees to the horizontal with a rolling carriage or dolly and a rigid bumper. It is made by Gaynes Engineering and is their Model 1000 c.

2.2. The track is graduated in inches and has been calibrated to convert distance up the incline into speed in metres per second.

2.3. The friction between the dolly surface and the package placed on it is such that during movement the package remains stationary relative to the dolly but at impact it can slide freely.

2.4. The bumper or impact surface consists of a number of heavy timbers arranged in a plane at right angles to the track. The timber at the base of the bumper is cut away so that the leading edge of the dolly passes below so that the package impacts the bumper and not the dolly.

3.0. NUMBER OF PACKAGES REQUIRED

It is desirable to have five (5) filled packages available and five (5) empty unused packages, but tests can be made or less; even with one filled and one empty.

4.0. PROCEDURE

4.1. Condition the packages for 48 hours before testing.

4.2. Fill an unused package with undamaged actual or dummy contents. Close and seal it to simulate the actual system used in practice while still permitting opening and reclosure without significant damage thus allowing examination of the contents during the test.

4.3. Place the package on the dolly in the attitude that the impact is desired (face blows flat and vertical edge blows with the diagonal between opposite edges and parallel with the slope are the usual attitudes).

See that the leading part of the package is level with the edge of the dolly.

4.4. Set the release block at the distance up the incline to give the required impact speed. This is found from the calibration curve placed at the side of the bumper.

4.5. Start the motor and cut in the lever which actuates the device to connect the dolly to the lifting chain. The dolly and the package will now travel up the incline until the release mechanism is operated by the release block. The dolly and package then run down and impact the bumper. Prevent a second impact by catching the dolly on the rebound.

4.6. Repeat the procedure for other impacts as required, examining the package whenever necessary and recording the data using an instant photographic camera, if at all possible.

5.0. TEST REPORT

A test report should include the following:

5.1. A full description of the package.

5.2. The gross weight of the package and the net weight of the contents.

5.3. The number of packages tested and the result of each test.

5.4. The temperature, the time and the relative humidity during the conditioning period.

5.5. Any other relevant information.

VIBRATION TEST

Standard method for using the LAB Vibration Table

1.0. SCOPE

The method describes the procedure for carrying out vibration tests using the LAB Vibration Table in the mode providing the standard motion commonly described as a circular harmonic motion in which the eccentric drives on both shafts are in phase.

2.0. EQUIPMENT

2.1. LAB Vibration Transportation Simulator

2.2. High and low fences for restricting movement

2.3. Equipment for measuring the frequency of the vibratory motion and for automatically timing and shutting down the motor.

2.4. Means of loading the package during test.

3.0. NUMBER OF PACKAGES REQUIRED

It is desirable to have 5 filled packages available and 5 empty unused packages. The test can be made on less; even one filled and one empty.

4.0. PROCEDURE

4.1. Condition the packages for 48 hours before testing.

4.2. Fill an unused package with undamaged actual or dummy contents, close and seal it to simulate the actual system used in practice while still permitting opening and reclosure without significant damage, thus allowing examination of the contents during the test.

4.3. Switch on the machine and adjust the speed until it just produces a frequency shown on the dial of just over 200 cycles per second. Switch off.

4.4. Secure the low fence across the end of the table, place the package under test on the platform against the fence with its longer base dimension in the direction of motion.

4.5. Switch on the machine and adjust the speed until the package is just leaving the deck of the table once in each cycle. This is achieved by placing a length of paper about 2 feet long under the package leaving a few inches protruding from the side. The speed of motion is then increased until it is just possible to withdraw the paper by applying a light tension to the protruding end. Note the frequency at this point and operate the speed control to reduce this frequency by between 10 and 20 cycles per second. Switch off.

4.6. Where necessary, load the package to the desired level and place fences, etc in position to stabilize the assembly so that it will not fall over during testing. Check for this by running the equipment for a very short period.

4.7. Set the timing device for the appropriate time of test and switch on. Both the red button on the timing device and the green button on the machine must be depressed to switch on this time.

4.8. When the timer cuts out, turn the package through 90 degrees and repeat the vibration procedure for the same time.

4.9. Examine the pack and the contents, recording damage data photographically, if at all possible.

5.0. TEST REPORT

The test report should include the following:

5.1. A full description of the package.

5.2. The gross weight of the package and the net weight of the contents.

5.3. The number of packages tested and result for each test.

5.4. The temperature, time and relative humidity of conditioning.

5.5. Any other relevant information.

STANDARD TEST PROCEDURE FOR COMPRESSION TEST ON EMPTY CORRUGATED CASES

1.0. SCOPE

This method describes the procedure for determining the ability of empty corrugated cases to resist external compressive loads applied to the opposite faces at top and bottom of the case.

2.0. EQUIPMENT

2.1. The MacKlow Smith Compression Tester, type T445, maximum loading 14kN, motor driven, platen type applying the load through a uniform movement of the lower platen at 10 ± 3 mm per minute.

2.2. A recording device, accurate to ± 2% of the load and a platen displacement of ± 1 mm.

2.3. The compression equipment is fitted with a floating head which may in fact be fixed wherever necessary. For compression testing on empty corrugated cases it is immaterial whether it is fixed or floating, but in other instances, it may be critical.

3.0. TEST SPECIMENS

Not less than 3 and preferably 10 specimens of a specific size and type of case, closed in an appropriate manner with adhesive tape are required.

4.0. PROCEDURE

4.1. Condition the empty cases and any fittings to be used in the test for 24 hours, make up each case closing it with adhesive tape.

4.2. Switch on the equipment at least 30 minutes before commencing to allow it to warm up.

4.3. Center the empty case standing on its base on the lower platen so as to avoid off central loading.

4.4. Check that the speed control knob is off its zero position but still near zero and that the machine is switched to variable speed.

4.5. Switch to the up position, increase the speed and raise the bottom platen so that there is a slight gap between the top of the test case and the bottom of the top platen. Switch off.

4.6. Move the speed switch over to pre-set speed and switch to the up position until an initial load of 0.22 kN has been applied. Switch off.

4.7. Alternative procedure 1

To be used where only the maximum load sustained by the case is required. Move the maximum pointer, (the red hand) to near zero.

4.8. Switch to the up position and continue compression until case failure, which is indicated by a substantial fall in load leaving the red hand at the maximum reached. Record this value on the dial.

4.7. Alternative procedure 2

Where only the load at a specific deformation is required, move the maximum pointer, the red hand, to near the zero.

4.8. Return the deformation indicator to zero.

4.9. Simultaneously switch to the up position at the same time as the deformation recorder is switched on. Watch the deformation recorder and the moment the maximum deformation has been reached, switch off and note the load indicated by the red hand at this point.

4.7. Alternative procedure 3

This is the usual method employed. Return the maximum red hand pointer to near the zero.

4.8. Simultaneously switch to the up position and put the chart movement recorder on.

4.9. Continue to compress the case until failure occurs then switch through off to the down position. The chart recorder will now have reproduced a curve of load against the compression. Record on the chart the details of the case identity and scales at this point

For every one of these procedures one will repeat the operation using a different specimen until they have all been tested.

5.0. TEST REPORT

The test report should include the number of replicates tested, a full description of the case and material used, conditioning details, and for alternatives 1 and 2, the individual results obtained, the mean and the standard deviation and for alternative 3, all of the graphs for each individual test with the analysis deduced from them.
Any other information about the mode of failure should be included.

STANDARD TEST METHOD FOR THE DETERMINATION OF THE BURSTING STRENGTH OF CORRUGATED FIBRE BOARD

1.0. SCOPE

1.1. The method describes the procedure for determining the resistance to bursting of corrugated board.

1.2. It is applicable to single wall board, i.e. board consisting of two liners and one fluting medium. Triple wall board cannot be tested by the method and testing double wall board is of doubtful accuracy. Both these materials are best tested by the puncture test.

2.0. APPARATUS

2.1. Mullen Bursting Tester, Model A

2.2. Sharp knife for cutting specimens at least 6 inches square.

3.0. CONDITIONING

All specimens should be conditioned for 24 hours before testing.

4.0. PROCEDURE

4.1. Check that the rubber diaphragm is correctly placed. Select the appropriate pressure gauge and switch on the instrument.

4.2. Place the first specimen squarely on the diaphragm plate under the tripod.

4.3. Spin the wheel controlling the position of the upper tripod plate clockwise, allowing it to stop when it reaches the surface of the specimen. Rotate the wheel one quarter of a turn more to obtain a firm clamping pressure.

4.4. Set the red hand of the gauge to zero or to a point on the scale below that at which the burst will occur.

4.5. Release the safety latch which is adjacent to the shift lever and move the shift lever to the left to start the motor. Hold the lever in this position until the sample bursts and immediately this occurs, throw the lever into reverse until the pressure returns to zero and allow it to return to the starting position.

4.6. Record the maximum bursting pressure indicated by the red hand. Return this hand to zero or to a point where it will be contacted by the advancing black hand in the next test.

4.7. Repeat this procedure with the remaining specimens and record the average bursting pressure and the standard deviation.

NOTES

1. When testing corrugated cases for compression strength, it should be recognised that the inner flaps at the top and bottom of the case are useful areas to use for bursting tests after the case has been used for compression testing.

2. Normally, two bursts - one upward and one down can be obtained on each of the four flaps from a case. This gives eight results per case. At least two cases and preferably three, should be tested which gives sixteen or twenty-four results.

3. Any burst which gives a double pop should be ignored and samples with creases in the liner should be rejected.

5.0. TEST REPORT

The report should give the full description of the sample, the individual test results indicating the side up at each particular occasion, the average value and the standard deviation.

THE PUNCTURE TEST

Standard method for determining the puncture resistance of corrugated fibre board

1.0. SCOPE

The method describes the procedure for the determining the puncture resistance of single wall and double wall corrugated board using the TMI Beach Puncture Tester.

2.0. EQUIPMENT

2.1. The equipment consist of a pendulum from which projects an arm in the form of a 90 degrees arc which ends in a triangular pyramidal shaped point which punctures the specimen.

2.2. The pendulum can be raised to a "cocked" position before releasing by a latch.

2.3. A "lazy" pointer system records the energy taken out of the system by the specimen being punctured.

2.4. Specimens are secured in position by clamping plates.

2.5. Four scales with different total loadings are provided.

3.0. NUMBER OF SPECIMENS REQUIRED

Sufficient material shall be available to make at least two tests and preferably five with the corrugations in the direction of the pendulum and the same number at right angles to this while allowing the punctures to be performed through both surfaces of the board, i.e. there will be at least eight results and preferably twenty; four through one surface, two of which will have the corrugations parallel and two at right angles to the direction of swing of the pendulum and four through the other surface with exactly the same arrangements.

4.0. PROCEDURE

4.1. Check the zero of scale 1.

4.2. Check the pointer friction.

4.3. Check that the loose collar is fixed on the puncture pointer correctly.

4.4. Add the appropriate weights for the experimental scale required.

4.5. Open the clamping plates and insert a specimen.

4.6. Set the lazy pointer about 1 inch above the expected reading.

4.7. Raise the pendulum and latch it. Place loose collar in position.

4.8. Stand clear of the apparatus and release the pendulum.

4.9. Read the test value on the appropriate scale.

4.10. Repeat the above procedure for all the remaining specimens making sure that the corrugations and the surfaces are correct to give the right sort of average.

5.0. TEST REPORT

The test report should include:

5.1. Full description of material tested.

5.2. The results for each of the tests carried out and the average results for each of the four variables in position.

5.3. A grand average overall of all results.

5.4. The time, temperature and relative humidity during the conditioning period.

5.5. Any other relevant information.

STANDARD METHOD FOR THE DETERMINATION OF THE FLAT CRUSH RESISTANCE OF CORRUGATED BOARD

1.0. SCOPE

This method outlines the procedure for the determination of the resistance of the flutes in corrugated board to crushing forces applied perpendicular to the surface of the board.

1.2. The method applied to single face and single wall board.

2.0. APPARATUS

2.1. Flat Crush Tester, a motor driven platen type compression tester fitted with a dial gauge micrometer to measure the beam deflection in kilograms.

2.2. The apparatus used for cutting test specimens consists of a sharp knife and a template 10 cm x 10 cm.

3.0. CONDITIONING

3.1. Test pieces should be conditioned for 24 hours

3.2. Cut ten test pieces which are free from converting marks, printing and other damage.

4.0. PROCEDURE

4.1. Place a specimen with the flutes facing the front between the upper and lower platens of the compression tester.

4.2. Ensure that the pointer on the dial micrometer scale is at zero and move the red hand to near zero.

4.3. Start the motor by moving the lever to the forward position and watch both the dial micrometer and the moving platens.

4.4. Apply the load to the specimen until the side walls of the corrugations collapse.

Note: Immediately there is a plateau or a collapse the motor should be thrown into reverse rapidly or damage will occur to the beam of the instrument. When the plates are fully separated again, return the lever to zero, remove the specimen and repeat the procedure.

4.5. Convert the number of revolutions into actual kilogram readings and calculate the mean of the results giving also a standard deviation.

5.0. TEST REPORT

5.1. The report should contain the following:

The average of the results in kilograms per square centimetre; the total number of specimens tested; the individual results and the average and the standard deviation. Any other information likely to assist in evaluating results should also be recorded.

STANDARD TEST METHOD FOR THE DETERMINATION OF THE EDGE CRUSH RESISTANCE OF CORRUCATED FIBRE BOARD

1.0. SCOPE

This method outlines the procedure for the determination of the resistance of corrugated board to a crushing force applied perpendicular to the edge of the board in the direction of the flutes.

1.2. The method is applicable to single wall and double wall board.

2.0. APPARATUS

2.1. Edge crush tester

A motor driven platen type compression tester produced by TMI, fitted with a dial gauge micrometer to measure the deflection of a steel beam in kilograms. The speed of the driven platen is such that the force applied increases at 11±2 Kgf/s.

2.2. A fine tooth saw or a sharp cutting knife for cutting samples.

2.3. A template 25.0 ± 0.1 x 100.0 ± 0.1 mm.

2.4. Specimen holder TMI No. 17-9-6, 3/4" deep.

3.0. PREPARATION OF TEST SPECIMENS

Cut 10 - 15 rectangular pieces with the flutes perpendicular to the long edge using the template described in 2.3. and condition for 24 hours.

3.1. Select at least 10 test pieces free from converting machine marks, printing and damage from crushing, etc and use those for testing.

4.0 PROCEDURE

4.1. Adjust the specimen holder for the type of board to be used by unscrewing the end block completely. Place a test specimen between the blocks and screw the two blocks together again. When this done, the test specimens should just slip between the two blocks and be equal distance at both ends.

4.2. Place this assembly on the platen centrally so that it lies across the machine.

4.3. Check the zero on the dial gauge and return the red hand to near zero.

4.4. Push the lever to forward and smoothly compress the specimen. Immediately any sign of a plateau or failure occurs, return the lever into the reverse position and then back to off.

4.5. Record the reading and repeat the process with the remaining specimens.

5.0 TEST RESULTS

The test results should record the edge crush resistance of each specimen and provide an average and a standard deviation for the total results. The edge crush resistance in kilograms per metre is given by the formula:

$$R = 10f$$

where f is the maximum load in kilograms sustained by the average specimen.

ANNEX 4

Suggested standard transport tests for packages for home and export use in Jamaica

Scope

For parallelepipedal (rectangular) packages up to about 30 kg (65 lbs) weight, no dimension greater than 0.6 m (24 ins) to carry cans, glass bottles or jars, plastic containers, cartons, etc or individual items such as hardware, smaller domestic appliances, etc.

Required

At least three new unused and filled packages. (Normally, if the manufacturer supplies five filled and closed packages and five empty containers plus fittings, the needs are met).

Procedure

1. Weigh one filled package and classify as follows:

0 - 5 kg	.....A
5 - 10 kg	.....B
10 - 20 kg	C
20 - 30 kg	.....D

Note: Borderline cases to be treated with common sense.

2. Condition all packages in the transit lab for 24 hours. If and when conditioning can be controlled then 27°C; 70% R.H. could be suitable.

3. First stacking test. Determine the required load from the formulae:

Domestic packs - $W(2.5-h)/h$ where W is the weight of a package and h is its height in metres,

or $W(96-h)/h$ h now in inches.

Export packs - $W(144-h)/h$ h in inches

Stack to stand for 24 hours.

4. First drop test:

Case to be dropped five times as follows to impact

(a) base

(b) a longer base edge

(c) a shorter base edge

(d) the base corner opposite to that containing (b) and (c)

(e) top.

Note: Impacts other than the flat drops (a) and (e) to be made with the diagonal between the edge of corner immediately above that impacted and the opposite top edge or corner in a horizontal position (see diagram). The drop height to be determined by reference to Table 1.

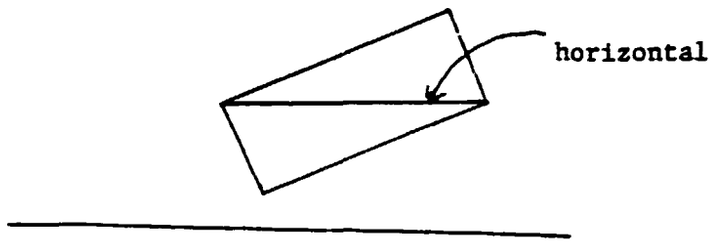

Table 1 (Drop height)

Case classification	Domestic		Export	
	metres	inches	metres	inches
A	0.5	21	0.8	30
B	0.4	18	0.6	24
C	0.3	12	0.5	21
D	"	"	"	"

5. First impact on inclined plane tester.

Domestic - one impact on to each side face and vertical edge in turn at an impact speed of 1.5 m/sec. - 8 impacts

Export - as domestic but speed of 2.2 m/sec.

6. Vibration test.

Domestic 10 mins. in each direction under a load determined from the formula:

$W(60-h)/h$ h in inches

Export 20 mins. in each direction under a load determined from the formula:

$W(100-h)/h$

7. Second stacking test.

Loading as in the first stacking test but to stand for 3 days.

8. Second drop test.

Five drops as in the first drop test but the opposite edges and and corner to be used, i.e. the ones at the base not used in the first drop test. Drop height this time from Table 2.

Table 2 (Drop height)

Classification	Domestic		Export	
	metres	inches	metres	inches
A	0.8	30	1.0	39
B	0.6	24	0.8	30
C	0.5	21	0.6	24
D	0.5	21	0.5	21

9. Second inclined plane impact test.

As the first set but at impact speeds of:

Domestic - 2.2 m/sec

Export - 2.7 m/sec

10. Inspection.

The first inspection unless damage has been noted shall be after the vibration test. At this point, it is anticipated that no serious damage, i.e. no damage sufficient to cause complaint, should have occurred.

A second examination is required after the second horizontal impact series 9. Here some damage should have been experienced but not to such an extent that more than 5 to 10% of the value of the contents is lost.

If at any time breakage or spillage of the contents occurs the test should be stopped and an inspection made. Whether the test should be continued after replacing the damaged goods will depend on circumstances. In any event, the remaining filled packages shall complete their testing.

Note 1

No climatic test is included above. If this is needed it should be placed between (5) and (6).

For domestic packs, a five minute shower test followed by 24 hours at ambient conditions.

For export packs, two shower periods of 5 minutes separated by

one hour at ambient conditions, and after the second shower the pack to remain at ambient conditions for the remainder of the 24 hours.

Note 2

If the packs are to be palletised or despatched in freight containers, the drop height in the first drop test only may be performed at 12 inches for the domestic packs and 21 inches for the export packs for all weights of pack.

IMPORTANT NOTE

It should be remembered that the intensity of testing in each test may require adjustment and must be finalised only after the procedures given in the one year development programme have been carried out.

ANNEX 5

Programme, participants and notes for 5-day seminar on export packaging with particular emphasis on furniture and fruits and vegetables

PERFORMANCE PACKAGING -
FOR TODAY'S AND TOMORROW'S
PACKAGING NEEDS

SEMINAR

ON

"TRANSIT PACKAGING

WITH

EMPHASIS ON EXPORT"

NOVEMBER 28 TO DECEMBER 2,1983

THE JAMAICA BUREAU OF STANDARDS
6 WINCHESTER ROAD
KINGSTON 10

DATE: 28th November, 1983

TIME: 9.00 - 12.00

TITLE: Corrugated boxes. Some factors that affect performance under transit conditions.

SESSION I. - F. Paine - What is Packaging? How to design successful Packages?

DEFINITION

Packaging is:

A means of ensuring safe delivery
in sound condition
to the ultimate user
at minimum overall cost

Designing successful packages

Four sets of facts needed:

(a) Facts about the product - How can it be damaged or deteriorated?

(b) Facts about the journey - What happens to the package between the end of the production line and the user?

(c) Facts about the market - Who sells what to whom?

(d) Facts about packaging materials, methods and costs.

Functions of a shipping container

(a) To contain

(b) To protect

(c) To be compatible

(d) To communicate and inform

(e) To permit access, without damage, on arrival.

Table 1.1—PRODUCT ASSESSMENT

1. PYSICAL FORM	2. GENERAL NATURE
Gas	Corrosive
Mobile liquid	Toxic
Viscous liquid	Volatile
Paste	Odorous
Liquid + solids	Perishable
Powder (free flowing?)	Sticky
Granules	Corrodible
Tablets	Fragile
Capsules	Abrasive
Solid block	Easily marked

3. HOW CAN IT BE DAMAGED?

By mechanical shock?	— Fragility factor
By vibration?	— Frequency range
By abrasion?	— Surface finish
By crushing?	— Safe load
By temperature changes?	— Safe range
By moisture and r.h. changes?	— Critical values
By oxygen?	— How?
By odours?	— Which?
By light?	— Fading
By spoilage?	— Chemical changes
By incompatibility with materials?	— Which ones?
By rodents, or insects?	— Specific

Table 1.2—HOW CAN THE PACKAGE BE UNSATISFACTORY?

Admits dirt
Leaks
Not siftproof
Not compatible with product
  (a) transfers odours or flavours to product
  (b) causes corrosion of product
  (c) reacts chemically
  (d) loses strength in contact with product
Easily pilfered
Stains easily

Table 1.3—PRINCIPAL DISTRIBUTION HAZARDS

MECHANICAL HAZARDS	CLIMATIC HAZARDS
Drops	**Liquid water**
Position	Rain
Height	Sea spray
Type of floor	Condensation
Impacts	**Inclement humidities**
With other packages	Causing loss or gain of moisture
Identical	Corrosion
Of similar material	Physical changes
Of different material	
With vehicle walls, docks etc	**Unsatisfactory temperatures**
	Causing melting
Vibration	Emulsion breaking
With or without stacking loads	Embrittlement
	Deterioration
Crushing forces	
In stacks, nets, slings	

All hazards may have an effect on the product and also they may have an effect on the package. Both can be unsatisfactory.

Table 1.8 Marketing considerations

(1) The product

What is the competition?
- (*a*) Packages used?
- (*b*) Quantities sold?
- (*c*) Price bracket?

What are the selling points of
- (*a*) Competitive products
- (*b*) Our product

(2) The retail service

Self-service?
Department store?
Mail order?
Doorstep?
How do competitors retail?

(3) The customer

Age
Sex
Income group
Social level
Location (home, local, regional, national or export)

(4) The package

(*a*) *Primary package*
Size, shape, weight
Standard, gift, seasonal
Bag, envelope, pouch, sachet
Rigid or folding box, card pack (blister, skin, etc.)
Metal container
Glass container
Collapsible tube (metal or plastics)
Plastics container (blown, injection or thermo-form)
Moulded pulp container
Composite tube

(*b*) *Transport package*
Size, weight, shape, number of units
Wooden case or crate
Fibreboard case or drum
Sack (paper, textile, plastic)
Metal drum
Glass carboy
Plastics
Bale

(5) Convenience and use

(*a*) *Primary package*
Inspection before purchase?
Easy opening?
Reclosure?
Measured dose?
Dispensing aid?
For storage out of sight?
or for use where attractiveness important?
Easy grip?
Special function? e.g. spray, cook-in-pack, squeeze use, etc.
Disposal?

(*b*) *Transport package*
Weight?
Shape?
Display conversion?
Disposal?
Returnable?
After use?
Pallet movement?
Containerized transport?
Hand holds?
Fork truck?
Slinging?

SESSION II - B. Currie

How corrugated fibreboard cases (CFC's) are made?

The various styles and their uses.

Nature of corrugated board - A, B, C, E, flute, etc.

The corrugator -

(a) Single face unit

(b) The double backer

(c) Processing the blanks

(i) the printer slotter
(ii) die cutting
(iii) the manufacturer's joint.

(d) Closing CFC's - adhesives
taping
stitching and stapling.

Styles of case and their use - The International Code.

Internal fittings.

SESSION III - F. Paine

The hazards of transport and the behaviour of CFC's on journeys.

Actual hazard depend on the distribution system.
Great variety of distribution system of varying complexity (see figs. overleaf).
All can be regarded as combinations of a number of simpler elements.

Elements are:

(a) Movement from one point to another by a single mode, including the loading and unloading operation at each end; and

(b) storage.

The principal factors affecting the choice of transport modes are:

1. How fast do we need delivery?

2. What quantity must be carried in one journey?

3. What are the boundaries, both natural and man-made, of the service? (e.g. road transport must end at a sea port unless a ferry is available).

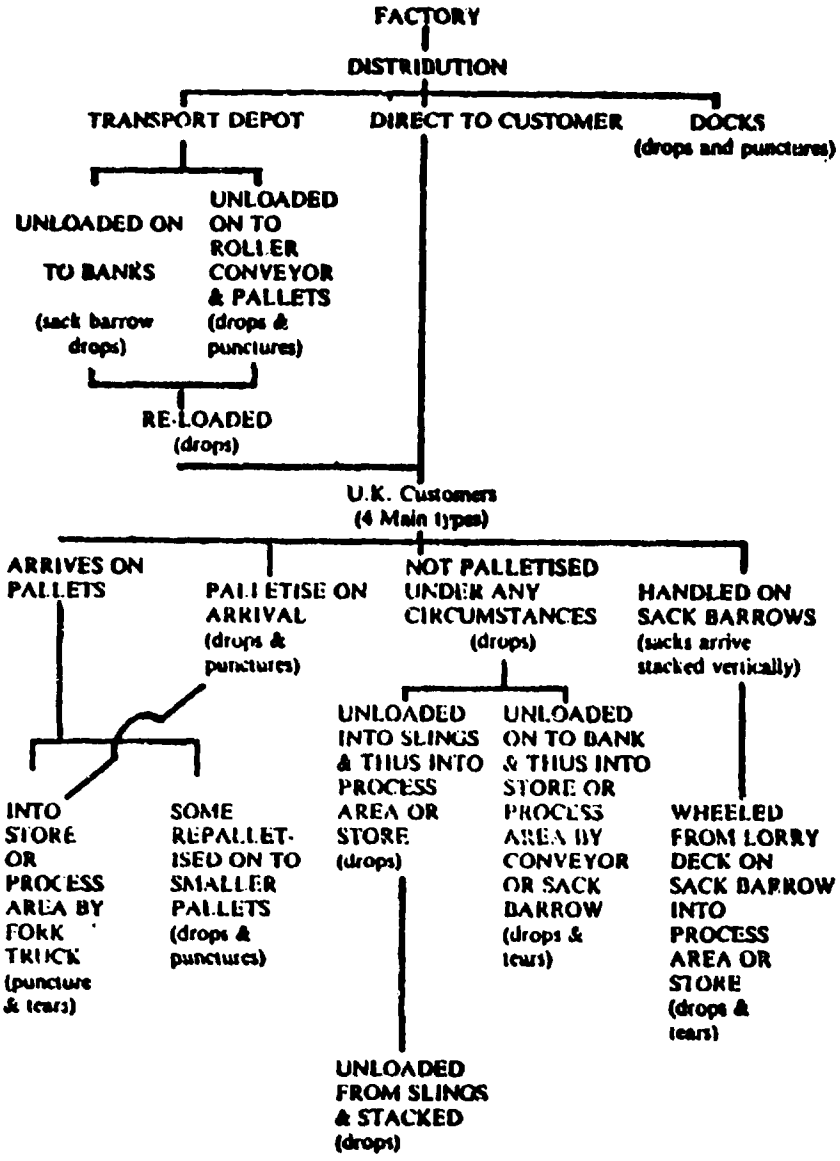

Figure 4.2.1—DISTRIBUTION AND HANDLING OF 50 kg SACKS FROM FACTORY TO CUSTOMERS

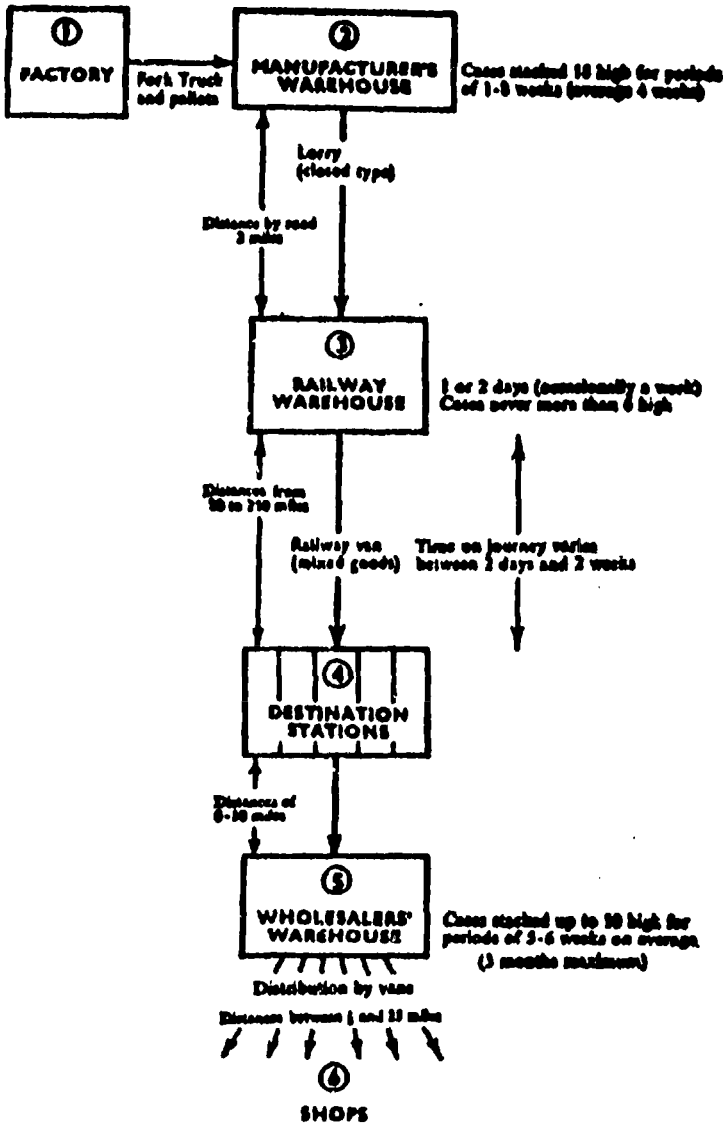

Figure 4.2.2—A SPECIMEN DISTRIBUTION SYSTEM FOR CASES

The principal modes of transport are:

Three classes - (i) Inland transport - road
rail
inland waterway

(ii) Sea transport

(iii) Air transport.

Inland transport

Road

Pros

Cons

Rail

Pros

Cons

Rivers, etc.

Pros

Cons

Sea transport

Limitations

Air transport

Lim Limitations

Advantages

Assessing the hazards of the journey (see figs. on preceding page)

(a) Sacks - drops and impacts
stacking hazards
climate.

(b) Cases - pilferage
insects and rodents.

Table 15.2 Testing conditions in various standards (see ISO 2233 and BS 4826 pt. 2)

	°C	%r.h.
Extreme cold	−50	40
Very cold	−18	40
Cold and dry	−10	40
Hot and dry	+65	40
Normal temperature (UK)	+20	65
Normal temperature (USA)	+23	50
Wet temperate	+20	85
Warm and moist	+38	85
Wet tropical	+38	95

Table 15.3 Methods of test and factors requiring quantification

Method of test	*Relevant International Standard*	*Factors requiring quantification*
Conditioning	ISO 2233	Temperature, relative humidity, time, pre-drying conditions (if any).
Stacking test	ISO 2234	Load, duration of time under load, attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, number of replicate packages.
Stack test using compression tester	ISO 2874	Load applied, duration of time under load, attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, number of replicate packages.
Compression test	ISO 2872	Maximum load (where applicable), attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, upper platen rigidly mounted or free to tilt, number of replicate packages.
Vertical impact by dropping	ISO 2248	Drop height, attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, number of replicate packages, number of impacts.
Horizontal impact tests (inclined plane test)	ISO 2244	Horizontal velocity, attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, profiles of impacting surfaces and use (if any) of an interposed hazard, number of replicate packages.
Rolling test	ISO 2876	Atmospheric temperature and relative humidity, number of replicate packages.
Vibration test	ISO 2247	Duration of test, attitude(s) of the package(s),[1] atmospheric temperature and relative humidity, load (if any) superimposed on the package(s), number of replicate packages.
Low pressure test	ISO 2873	Pressure, duration of time at reduced pressure, temperature within test chamber, number of replicate packages.
Water spray test	ISO 2875	Duration of time under spray, attitude(s) of the package(s),[1] number of replicate packages.

[1] See ISO 2206.

DATE: 29th November, 1983

TIME: 9.00-1200

TITLE: The transit package test equipment in the Bureau and its application to transit problems.

SESSION 1 - J. Salisbury

The main types of package test equipment

A short historical introduction

Drop testers

Horizontal impact tests

Stacking tests and the compression tester

Vibration and compression during transport

Climate conditioning and storage tests.

SESSION II - F. Paine

Evaluating and testing filled transport packages.

Methods of evaluation

(a) Visual examination and estimates

(b) Non-reproducible, ad hoc tests

(c) Responsible (usually laboratory) testing - ISO methods

(d) Field trials

(e) Observation of performance in actual use

Four approaches:

1. Compare the unknown package with one; the performance of which is known.

2. Assess the performance by simulating the hazards of the transport system to be used.

3. Investigate the strengths and weaknesses of the current package to improve performance or reduce costs.

4. Using tests on empty packages and/or material for quality control purposes.

The place and value of:

The bursting (Mullen) test

The puncture test

The box compression test

The tensile test for paper sacks

The bending stiffness of corrugated

The edge crush test on corrugated

The flat crush test on corrugated.

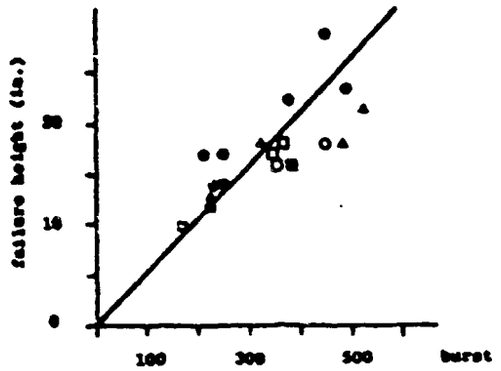

Figure 5.2 Drop *v.* burst. ○, solid kraft; ●, B-flute kraft; ■, solid test; □, B-flute test; ▲, A-flute test.

Table 5.2 Factors affecting stacking performance

Contents factors	(i) Number, arrangement, weight and dimensions
	(ii) Nature, strength and deformability
	(iii) Interaction with case
Distribution factors	(iv) Stacking method, pattern, type of pallet, etc.
	(v) Stacking height and loading
	(vi) Stack duration
	(vii) Climatic conditions
	(viii) Handling damage before stacking
	(ix) Case attitude in stack
Case factors	(x) Size, shape and style
	(xi) Materials used, construction and tolerances
	(xii) Fittings?
	(xiii) Printing effects, cut-outs etc.
	(xiv) Closure method
Other factors	(xv) Relevant statutory regulations. Company specifications, carrier's conditions of acceptance, etc.

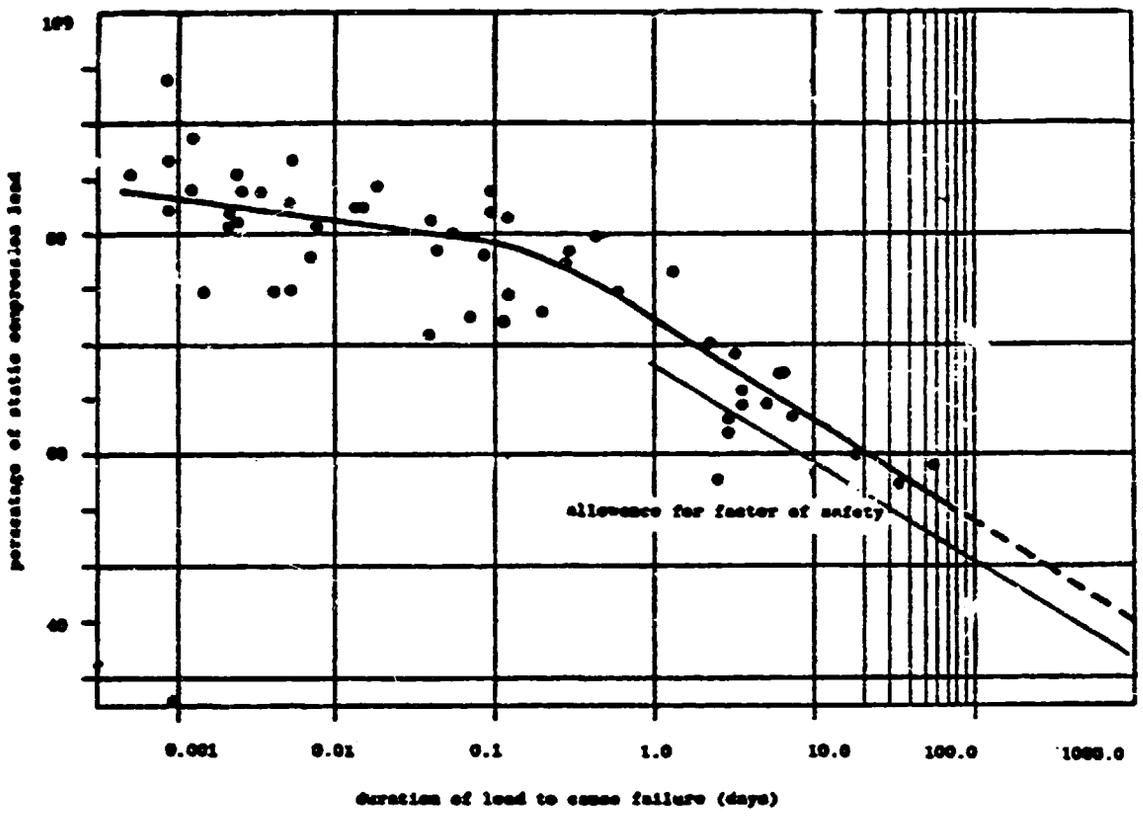

Figure 5.3 Duration of load to cause failure in stacked fibreboard cases (redrawn from Kellicut and Landt, 1955[5]).

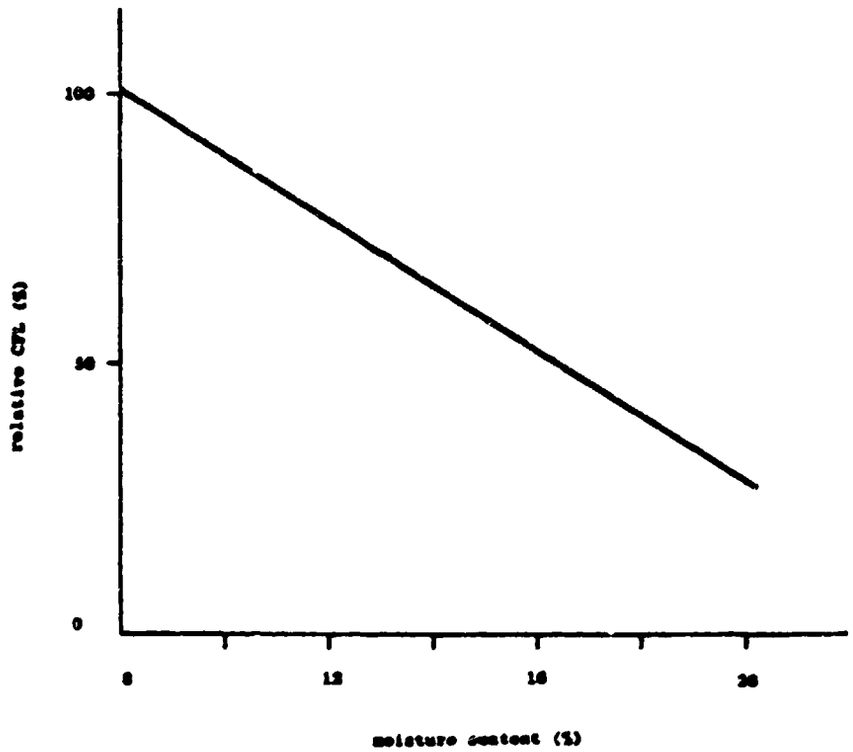

Figure 5.4 Effect of moisture content on case failing load (CFL) relative to that obtained after preconditioning at 23°C and 50% r.h.

Pallet details	Full deck reversible	Perimeter deck (lower deck 40 % of top area)	2-way with 3 1000 × 75 mm bearers
Max. loading (kg/cm²)	0.28	0.51	1.09
Where located	lowest cases	top cases, pallet 3	top cases pallet 3
Distribution	even	uneven	uneven

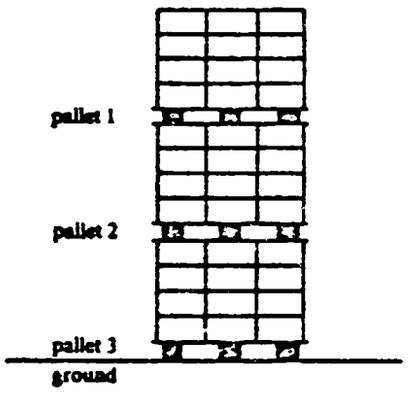

Figure 5.5 Variation in stack loading with type of pallet. Case details: 500 × 400 × 300 mm. g. wt. 50 kg. Pallet details: 6 cases per layer, 4 layers per pallet 1000 × 1200 mm, pallets weighing 30 kg. Stack details: 3 pallets high.

SESSION III - F. Paine

Typical example of problem solving.

DATE: 30th November, 1983

TIME: 9.00 - 12.00

TITLE: Furniture packaging for export; the main problems and ways of reducing them.

SESSION I - F. Paine

What is furniture? - classification

(a) Tables and chairs - for kitchen
- dining room
- office.

(b) Carcase furniture - cupboards and wardrobes
- chests and tallboys
- desks and bureaux.

(c) Upholstered furniture for lounge, bedroom, office.

(d) Specialised furniture, e.g. hospital beds, dental chairs, etc.

Material used - Solid timber
Veneers
Steel framed
Wicker
Bamboo
plus textiles, metal springs, expanded plastics and rubber cushioning, etc.

SESSION II - J. Salisbury

How can furniture be damaged or deteriorated?

Can we prevent or reduce such damage?

Impact damage	-	breakage, indentation, bruising
Vibration damage	-	scuffing, rubbing, chafing, loosening of screws, etc.
Crush damage	-	distortion, breakage, indentation, etc.
Climatic damage	-	water staining, mould growth, corrosion, etc.

Use of pads, covers, wrappers, cases, crates, etc.

SESSION III - F. Paine

The cost and volume problems in export markets.

Packaging is "A means of ....."

Knock down designs - are they a practical solution?

Will freight container loads reduce problems and/or costs?

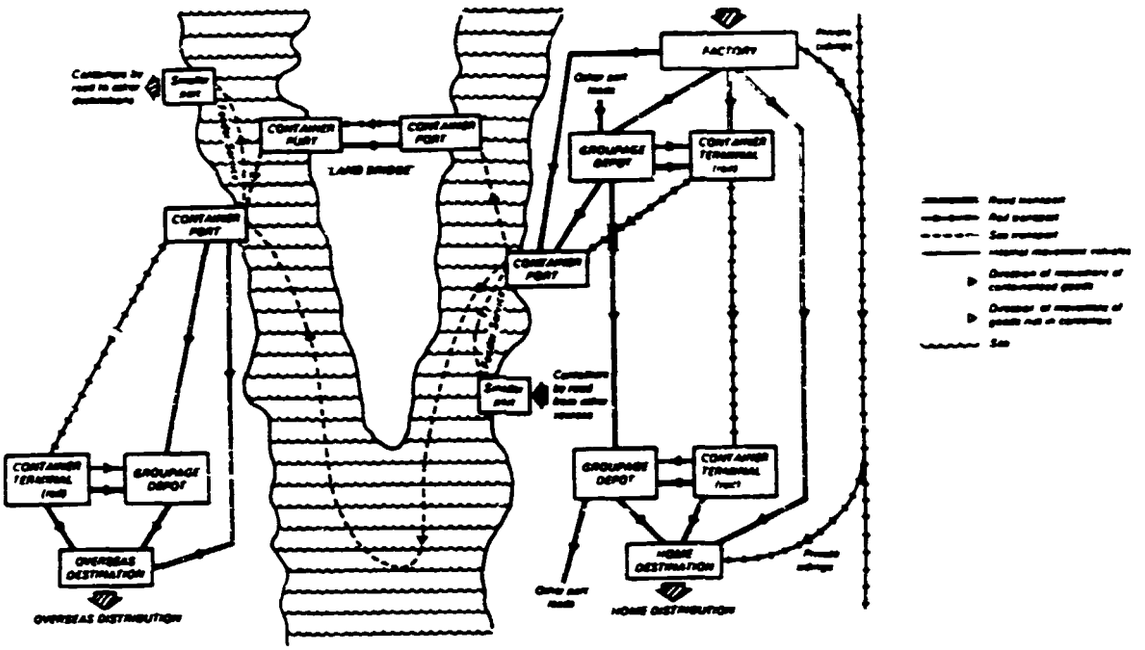

Fig. 41 Flow diagram showing movement of goods by container.

DATE: 1st December, 1983

TIME: 9.00 - 12.00

TITLE: Fruit and vegetable packaging for export.
The main problems and ways of reducing them.

SESSION I - F. Paine

The nature of fresh fruits and vegetables - Deterioration indices.

General nature

Fresh fruits and vegetables are -
(i) bulky
(ii) easily damaged mechanically
(iii) easily lose water
(iv) are living and must be kept alive.

Means that they are sensitive to their environment;
their metabolism is temperature dependent;
they are affected by oxygen and carbon dioxide levels;
they are sensitive to other volatiles such as ethylene.

They are also very variable - between plants, seasons, soil and climatic areas. Genetically variable and cultivation practices will affect both quality and behaviour.

The growing process, respiration and ripening (see figures on page 21)

Fruits and many vegetables such as tomatoes and cucumbers are harvested after growth is complete.

Vegetables which are leaves, buds or stems are harvested before maturity.

Respiration rate varies from product to product.

Increased CO_2 and decrease in O_2 lowers rate of respiration but too much CO_2 or too little oxygen will damage the tissues.

Tropical products are more tolerant to increased CO_2 and decreased O_2 so control asmospheric storage more effective than with temperate.

Any packaging should aid in minimising deterioration without upsetting the life process. Best done by reducing rate of respiration.

Importance of ethylene gas in ripening

Effects of temperature (see Table on page 22)

Composition of the atmosphere

Effects of humidity

Importance of careful handling and grading

Biological spoilage and packaging

Deterioration indices for vegetables and fruits (see Table on page 23).

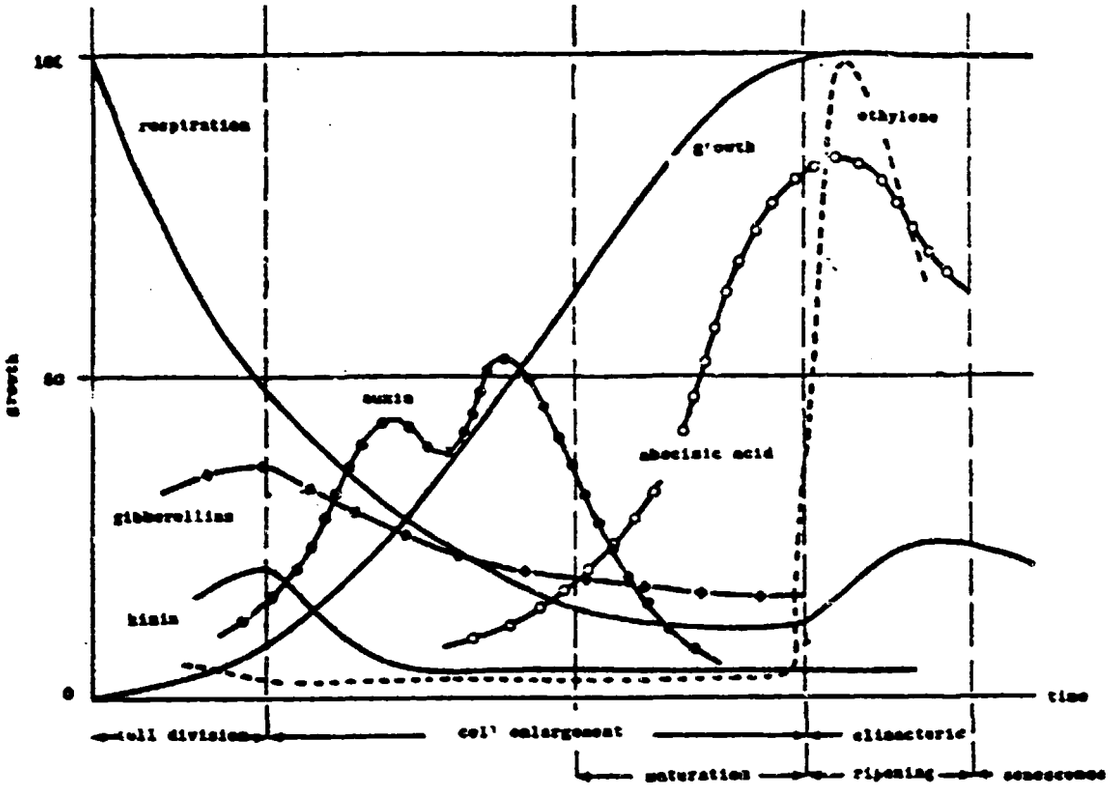

Figure 6.2 Processes controlling maturation and ripening of fruit.

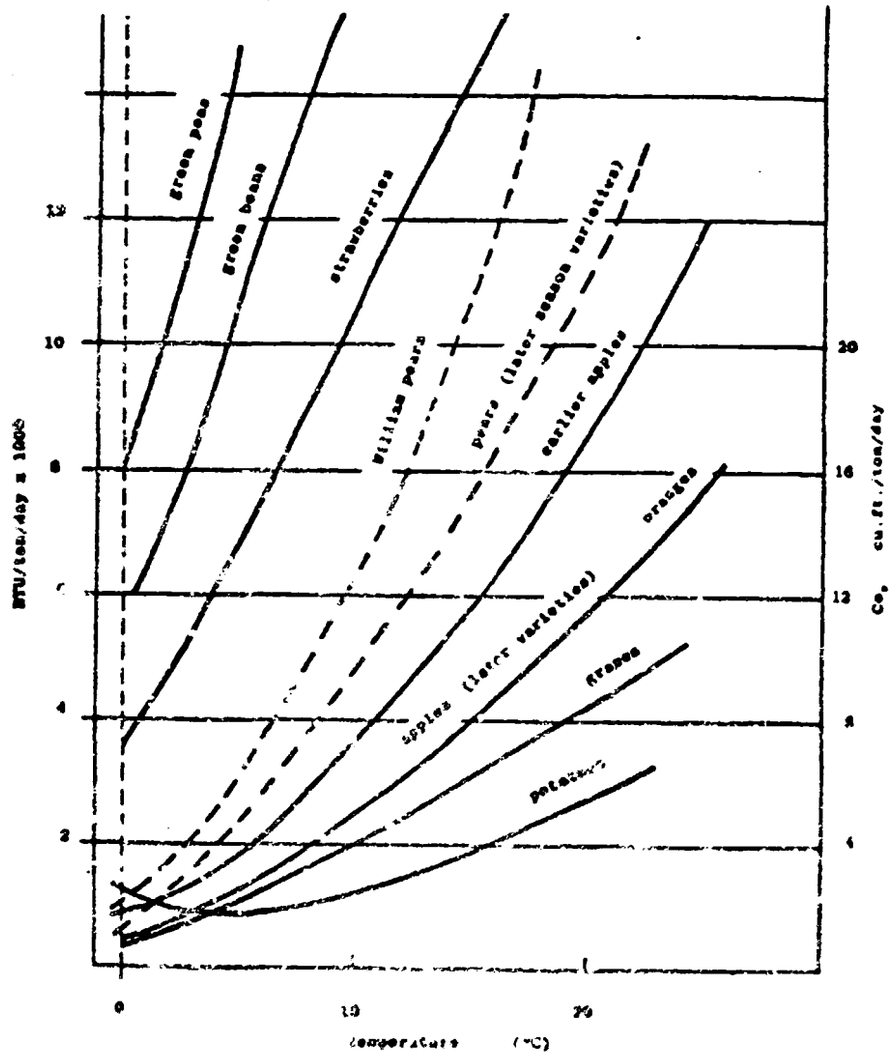

Figure 6.3 Effect of temperature on the production of heat and carbon dioxide by fruits and vegetables.

Table

Life of typical temperature zone fruits and vegetables at the optimum keeping temperatures

BEST STORAGE TEMPERATURE °C	FRUIT OR VEGETABLE	APPROXIMATE KEEPING TIME (WEEKS)
-1.0	Nuts	up to 50
	Pears	8-28 depending on variety
	Parsnips (topped)	up to 20
-1.0 to +3.0	Apples	8-28 depending on variety
-0.5	Cherries	1-4
	Plums	3-7
	Quinces	8-16
	Garden peas	1-3
	Beetroot	up to 20
	Carrots	up to 20
	Swedes	16-24
	† Onions (later varieties)	up to 28
0.0	Asparagus	2-4
	Broccoli	1-3
	Brussel sprouts	2-4
	Cauliflower	2-4
	Lettuce	under 1
	Rhubarb	2-3
	Spinach	1-2
	Cabbage	3-6
	Cabbage (later varieties)	6-10
	Celery	6-10
	† Early onions	6-10
7.0	Green beans	1-2
	Cucumbers	2-4
	Tomatoes	1-3
	Potatoes	16-24
10-12	† Marrows	6-12

† Note:- require humidity below 70% rh

Table

Life of tropical fruits and vegetables at optimum keeping temperatures

BEST STORAGE TEMPERATURE °C	FRUIT OR VEGETABLE	APPROXIMATE KEEPING TIME (WEEKS)
-0.5	Grapes	4-6
	Apricots	2
	Figs	2-3
0.0	Chinese leaves	1-2
	Sweet peppers	4-6
	Coconuts	8-12
5.0	Melons	2-3
	Avocado pears	3-6
5.0 to 7.0	Mandarins	3-6
	Oranges	7-12
7.0	Mangoes	2-3
	Avocardoes (Fuerto)	3-5
	Passion fruit	3-5
10.0	Paw-paws	2-3
	Pineapples	4-5
10.0 to 12.0	Grapefruit	up to 16
12.0	Bananas	1½-3
	Sweet potatoes	16-24

Table 7.2 Approximate order of importance of specific deterioration indices for classes of food. 1 = most important, 7 = least important.

Foods	*Index of deterioration*	*Microbial changes*	*Inherent changes*	*Moisture changes*	*Oxidation changes*	*Taint etc.*	*Light*	*Physical damage*
Baked goods								
Bread, biscuits, cakes, etc.		4	4	1	2	4	4	2
Meat and meat products								
Raw, cooked and cured meats		1	2	4	2	6	4	6
Sausages		2	2	4	1	5	5	7
Poultry		1	2	5	2	4	6	6
Animal fats		—	—	—	1	2	—	—
Fish and fish products								
Wet, smoked and cured		1	3	4	2	—	—	—
Fish cakes		1	3	1	3	—	—	5
Shellfish (cooked)		1	4	1	1	—	—	—
Vegetables and fruits								
Brassicas		—	—	1	2	—	—	3
Legumes		—	—	1	2	—	—	3
Potatoes		2	—	1	—	—	3	4
Root crops		1	—	—	—	—	—	2
Top fruits		1	—	2	—	—	3	—
Soft fruits		1	—	—	—	2	—	3
Salads		2	—	1	—	—	—	—
Cereals and cereal products								
Grains (e.g. rice)		—	—	1	—	—	—	—
Flour		—	—	1	2	—	—	—
Breakfast cereals		—	—	1	4	3	—	2
Confectionery								
Hard and soft boiled sweets		—	—	1	—	—	—	—
Chocolates		5	-	1	2	3	—	4
Jams		1	—	1	—	—	—	—
Jellies		1	—	1	—	—	—	—

SESSION II - F. Paine

The hazard of export distribution

(a) Sea transport

(b) Air transport.

(i) Problems with sea transport

(ii) Problems with air transport.

SESSION III - F. Paine & J. Salisbury

Typical packages and current use. Their strengths and problem areas.

Bananas

Citrus

Avocadoes

Cucumber

Tomatoes

Winter vegetables

DATE: 2nd December, 1983

TIME: 9.00 - 12.00

TITLE: (1) Unit load preparation and container stowage

(2) Regulations concerning transit packaging and how they affect exporters.

SESSION I - F. Paine - Unitizing methods and container stowage.

What is a unit load?

Film wraps

Pallet stabilizing adhesives

Strapping, materials and methods

Container stowage

Table 5.5 Comparison of unit load methods

Method	*Load stability*	*Benefits*	*Limitations*
Strapping			
Automatic	Excellent	Handles cases in columns	Cannot be used if layers have gaps
Semi-automatic		Reduces case cost	Not restackable
Manual			
Shrink wrap			
Automatic	Excellent	Reduces case cost	Cannot be used if layers have gaps
Semi-automatic	Excellent	Cleanliness	Takes up much floor space
Hand gun	Good	Handles uneven loads	Not restackable
		Handles cases in columns	High cost per pallet
			High labour cost
Stretch wrap	Excellent	Reduces case cost	Cannot be used if layers have gaps
		Cleanliness	Takes up much space
		Handles uneven loads	Not restackable
		Handles cases in columns	High cost per pallet
Wet adhesive			
Automatic	Good	Low cost per pallet	Will not handle cases in columns
Manual	Good	Unitized load	Possible fibre tear when
		Restackable	dismantled
Hot melt	Good	Lowest cost per pallet	Will not handle cases in columns
		Unitized load	Requires conveyor system
		Restackable	
		Gap filling	
Tape	Fair	Lower equipment cost	Not restackable
		Portability	Marginal stability
Cord	Fair	Lower equipment cost	High labour cost
		Portability	Not restackable
			Marginal stability

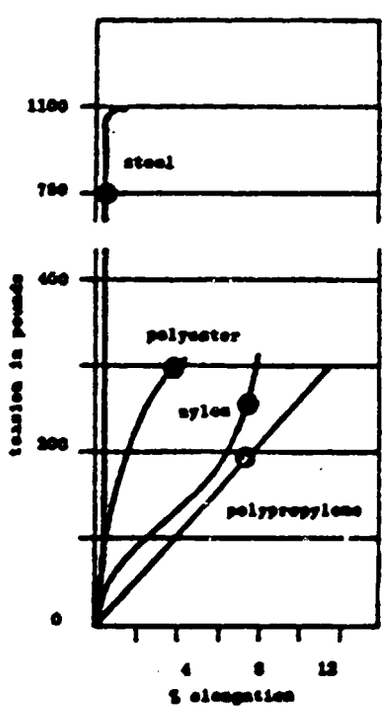

Figure 5.8 Tension/elongation curves for different types of strapping (courtesy Signode). ● = maximum normal working range.

SESSION II - Sealand Ltd - Talk on container stuffing

SESSION III - F. Paine - National and international regulations and their effect on exporters.

The influence of the EEC on migration problems

Current UK/EEC?/World?? thinking on food packaging health safety

Environmental problems

Beverage container legislation

"Excessive or unnecessary" packaging

Codes of 'good packaging' practices

PANELS FOR SEMINAR

November 28, 1983 - Corrugated box

1. Mr. J. Salisbury - Chairman
2. Mr. F. Paine
3. Mr. Currie - J.P.I.
4. Mrs. M. Domville
5. Mr. Nicholas - West Indies Pulp Products

November 29, 1983 - Transit Pack Testing

1. Mr. J. Salisbury - Chairman
2. Mr. F. Paine
3. Mrs. M. Domville

November 30, 1983 - Furniture Packaging

1. Mr. J. Salisbury - Chairman
2. Mr. L. Davis
3. Mr. F. Paine
4. Mrs. M. Domville
5. Mr. Ferron - Morgan's Furniture

December 1, 1983 - Fresh Fruits and Vegetables Packaging

1. Mr. J. Salisbury - Chairman
2. Mr. Coote - JETCo
3. Mr. F. Paine
4. Mrs. M. Domville
5. Mr. Maloney

December 2, 1983 - Container Stuffing

1. Mr. J. Salisbury - Chairman
2. Sealand Representative
3. Mr. F. Paine
4. Mrs. M. Domville

ATTENDANCE AT THE EXPORT PACKAGING SEMINARS

This series of seminars was arranged in five sessions; each of which could be registered for separately.

A total of 34 people attended excluding staff from the Bureau.
The individual seminars were attended as follows:

Day 1	-	19 participants
Day 2	-	12 "
Day 3	-	14 "
Day 4	-	15 "
Day 5	-	15 "

Between 6 and 8 staff mostly from the Packaging Centre attended.

The names and organisations of the participants were:

Keith Walters	-	Jamaica Frozen Foods	-	1,2.4,5
Z Budhan	-	Min. of Agriculture	-	1,2,3,4,5
Janet Neita	-	T. Geddes Grant	-	1
Michael Wong	-	Grace Kennedy	-	1,2,3
Brian Wilson	-	NIDCo	-	1,3
Coltan Allison	-	Jamaica Frozen Foods	-	1,2,4,5
Vanette Rose	-	JNEC	-	1
Michael Johnston	-	Adolph Levy	-	1,2,3,4,5
Stewart Hanson	-	T. Geddes Grant	-	1,3,4
Dereck Fairclough	-	Scientific Research Council	-	1,2,3,4,5
Ransford Williams	-	Sunblest Export Traders	-	1,2.3,4,5
Carlton Stewart	-	Coates Brothers	-	1
Henry Campbell	-	Metal Box Ltd	-	1,4,5
Eulalee Russel	-	West Indies Synthetics	-	1,2
Lovina Henry	-	" " "	-	1,2,5
Robert Wong	-	National Industries Co.	-	1
Patrick Duncan	-	Grace Kennedy	-	1,2,5
Alvin Harris	-	Jamaica Citrus Co.	-	1
James Levy	-	Adolph Levy	-	1,2,3,4,5
Alice Collie	-	Grace Kennedy	-	2,4

Names and organisations of the participants cont'd.

Elvin Nash	-	Cariframe Ltd	- 3
Donald James	-	" "	- 3
Peter Colman	-	Modern Furnishing	- 3
Leason Wallace	-	T. Geddes Grant	- 3
Canville McIntosh	-	JNIP	- 3
Christine Young	-	Ranger Foods Ltd	- 3,4,5
Fanny Andrade	-	North Clarendon Processing Co.	- 4
Michael Ramsay	-	W. I. Synthetics	- 4
Beverly Jackson	-	JNIP	- 4
Janice Holung	-	JETCo	- 4
Joy Hall	-	JNEC	- 5
Ali Rookwood	-	JETCo	- 5
Keith Wilson	-	National Industries	- 5
Richard West	-	" "	- 5

ANNEX 6

Suggested one year development programme for staff at the Packaging Centre

The principal need is for the equipment to be used. Only in this way will people get to understand its value and be able to interpret the results. The best form of training that the Bureau staff can have is to work on problems within Jamaica and use the facilities available to solve them. It was with some surprise that I found on my return to Kingston that some of the equipment installed in 1981 had not been very extensively used.

Three major projects which will not only ensure that the equipment is used but should also improve Jamaican packaging and see that the Packaging Centre serves Jamaican industry in the best way are described.

The first is related to the ISO Scheme for Accreditation of Laboratories and possible certification methods for packaging. The ISO scheme, as the consultant understands it, envisages a master laboratory for a particular area in each developing country which is accredited to ISO standards and which then acts as a training centre and the accreditation authority for laboratories in individual firms who become qualified to certificate particular products. The central laboratory checks the laboratory's capability from time to time by using duplicate samples and carrying out the tests themselves.

If the central laboratory is also to be a certification authority it must accredit that section of its own staff as if it were an independent laboratory.

Currently, Jamaica needs a certification scheme for transit packaging but only in the sense that it will help industry by improving the packaging without complicated paper restrictions. Industry should therefore be consulted at all stages.

The other projects are designed to provide baselines as to the present standards for cartons and flexibles in the country by measurement of packaging in use now. This data will then permit sensible standards to be set for these areas.

Project 1

Programme to improve the standard of corrugated fibreboard packaging for the export of Jamaican products

1. Establish the key product areas to be studied, i.e. ascertain:

   (a) the major products exported
   - fresh fruit and vegetable
   - canned goods
   - bottled foods
   - cartoned goods, etc

   (b) the quantities of each exported
   - bananas
   - citrus
   - yams, etc

   (c) the value of these exports

   (d) a breakdown of the current costs for packaging materials, packaging labour costs and transport.

   This largely desk research should establish priorities.

2. For each important product find out whether complaints of damage, poor quality or uneconomic operations exist, and where they do, try to establish if this is due to poor packaging, bad grading or other causes.

   In this area the new schedules worked out recently for export packages will provide guidance and assistance (see ANNEX 4). Each of the packages selected should be submitted to the schedules.

3. When the packaging is inadequate an analysis of the results of the tests should permit improvement and these can be checked by further tests. If the packaging is satisfactory the test may indicate where cost reduction may be possible without loss of performance.

4. We can now divide the packaging into two groups:

   (a) packages satisfactory both in use and in testing;
   (b) packages unsatisfactory in use but improved up to standard by testing.

5. Specifications can now be written for the packages. This should be done in co-operation with both the user and the suppliers of the package concerned and should do no more than give:

   (a) the type, composition and weight of the board;

   (b) the dimensions, style and tolerances for the case and fittings;

   (c) key board qualities, e.g. burst, puncture, edge crush, flat crush and Cobb test.

6. It should now be possible to provide certification, once a supplier has established that he can make to the agreed specification he can be empowered to use the Certification Mark of the Bureau on the packages concerned. This will be specific always to the product and sometimes even for the destination of the product, e.g. wording such as:

   APPROVED FOR EXPORT OF BANANAS

   OR

   APPROVED FOR EXPORT OF BANANAS TO CANADA.

7. Once allowed to use the Certification Mark the supplier has the responsibility to maintain that standard.

   The JBS role will be that of monitoring production. This may take place in two ways:

   (a) Users of the packages who feel that a delivery of packages is not up to standard may ask the Bureau to sample and check that delivery.

   (b) Periodically, without warning, the Packaging Centre will take samples for test from any point of the distribution chain.

   In either instance, if the result is satisfactory a report will go to both user and supplier. Where the user requested the check he will receive the charges for the testing. Where the Packaging Centre carried out the check the costs will be defrayed by the supplier. If the results are unsatisfactory both parties will again be informed.

   The user company must then decide, on commercial grounds, whether to accept the cases and use them or to reject them. THE BUREAU SHOULD HAVE NO AUTHORITY TO STOP THEIR USE.

The supplier of the cases will receive the charge for the testing and a warning that the next two deliveries will be checked also. If both deliveries do not reach the required standard, the right to use the certificate will be withdrawn. If the second delivery at least reaches standard no further action will take place, save to send the charges for the testing to the supplier.

To prevent undue testing by the Bureau it should be agreed that the supplier will only be called upon to pay for a limited number of random checks, say 3, in any one year unless he fails to meet the standard.

Note:

When obtaining specimens under this project or whenever the standard schedules for home or domestic transport are concerned, the following numbers and tests should be attempted:

5 filled and 15 empty cases and fittings (if any).

For the transport test, 3 new filled cases will be made up using undamaged contents from the 5 filled cases.

The remaining cases will be used as follows:

5 for compression tests - graphs essential.

These same cases can then be used to provide specimens for other tests, e.g. the inner flaps can be used for burst or puncture and other areas for board composition and weight.

3 new cases can be used for edge and flat crush tests, etc.
2 new cases for total weight of the case and its dimensions.

The remainder are for replacements and for record purposes.

Other projects for materials testing staff to ensure:
(a) practice in the use of equipment; (b) background data on Jamaica usage

1. Folding boxboard cartons.

   Samples of cartons in use for all kinds of product should be purchased from stores in Kingston and examined:

   (a) for general performance, by observations in use;

   (b) for specific properties, e.g.

   (i) weight and thickness
   (ii) stiffness Taber
   (iii) creasing quality - PIRA Creaser
   (iv) dimensions, i.e. panel size and crease widths
   (v) rub resistance of print
   (vi) strength of adhesive joints
   (vii) water drop or Cobb test on both surfaces
   (viii) other significant properties.

2. Similar projects can be instituted for:

   flexible packaging
   glass and cans
   paper sacks, etc.

ANNEX 7

Staff of the Packaging Centre of the Jamaica Bureau of Standards

Dr. A. S. Henry - Director, Bureau of Standards

Mrs. Marguerite Domville - Head of the Packaging Centre

Staff

Miss Yvonne Allen

Miss Ingrid Bennett

Mrs. Winsome Russell

Mr. Elvis Grant

Mr. David Reid

Mr. Lionel Campbell

Mr. James Powell

Mr. Silvan Parris

Miss Beverley Thomas - Secretarial.

ANNEX 8

Other contacts made

1. West Indies Synthetics Ltd - Mr. Joseph Mahfood
   Twickenham Park Director
   P. O. Box 69
   Spanish Town
   Tel: 984-3081

2. Mr. Donald R. Redden
   World Bank
   1818 H St., N.W.
   Washington, D.C. 20433
   U.S.A.
   Tel (202) 477-1234

3. Mr. Bernard G. C. Currie - Commercial Manager
   Jamaica Packaging Industries
   214 Marcus Garvey Drive
   P. O. Box 10
   Kingston 11
   Tel: 92-37031-3

4. Mr. Alan T. R. Roche
   Coates Brothers (Caribbean) Ltd
   P. O. Box 445
   P.O.S. Trinidad
   Tel: 62-34414/62-37792
   Executive Caribbean Area Director

5. Mr. A. W. Joyce - Technical Manager
   Coates Brothers (Ja.) Ltd
   Nanse Pen Close
   P. O. Box 317
   Kingston 11
   Tel: 923-6028

6. Mr. Derek Lowe - General Manager
   Reliable Packaging Ltd
   P. O. Box 96
   179 Spanish Town Road
   Kingston 11
   Tel: 92-38922

ANNEX 9

Video Film Making - Basic Policy

The films are concerned with recording the main points stressed by a visiting consultant. The users are considered to be graduate scientists who are likely to have to use the test methods described.

Each film will have sections that will focus on:

1. Introduction

   (a) Historical points

   (b) The principle of the test procedures being examined

   (c) The meaning of the test, its relationship to what happens in real life.

   (d) Question and answer session

   At this point questions (some prepared, some spontaneous) will be put to the consultant by the staff members of the Packaging Centre.

2. The method itself

   (a) What test methods are available? Do they differ significantly? Are they completely applicable to our equipment?

   (b) Demonstration of the method being used.

   (c) Essential points to watch for if the test is to be carried out satisfactorily. Common mistakes.

   (d) Question and answer session

   As before.

3. Evaluation and presentation of the results

   How to evaluate the results, what is significant, what is normally ignored.