# Workshop: Procurement of Packaging for Exports

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INFORMATION
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# Packaging Quality Assurance & Testing of Packaging For Exports

TFO CANADA

Experts in trade for developing countries
Experts en commerce au service des pays en développement
Expertos en comercio al servicio de los países en desarrollo

**Executing/Host Partner:**

IICA GUYANA

**Supporting Partners:**

Guyana Marketing Corporation

GMSA Guyana Manufacturing & Services Association Ltd.

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# Why Packaging Quality Assurance (QA) and Testing

The nature of the export distribution environment

Sources of damage related to distribution shocks

Sources of damage related to shipping vibrations

Determining optimum packaging expenditure

QA & testing of incoming pack materials

Filled package testing pre-shipment

# Export Distribution Hazards

Shock and vibration

Dynamic and static compression

Reduced atmospheric pressures

Elevated or reduced temperatures

Environmental factors: light, humidity, biological

Contamination

Pack piercing, snagging, puncturing, deformation

# Identifying Causes of Damage/Loss

| Effect | Packaging design requirement |
|---|---|
| mechanical shock | check supportable impact levels |
| deformation | determine safe compressive load |
| vibration | check for resonant frequencies |
| temperature | establish critical temperature limits |
| relative humidity | establish critical humidity limits |
| liquid water | ensure effective water barriers |
| abrasion | eliminate/isolate abrading effects |

# Sources of Impacts/Shocks

Accidental and deliberate drops during manual handling

Drops from chutes, conveyors and other machinery

Falls from pallet loads

Sudden stops on conveyers

Vehicles hitting potholes, curbs, railroad crossings

Railcar shunting

Packages rolled or tipped over

# Typical Nature of Package Drops

Maximum probable drop height is about 1 metre (40”)

Many drops are from lower heights, few from greater

Probable drop heights are lower for heavy, large and bulky packages

Unitized and otherwise restrained/secured loads reduce the risk of drops

# Shock Damage

Greatest damage to shipping containers arises from drops on edges or corners

Such damage leads to reduced pack performance

Corner and edge drops tend to transmit less shock to packed product itself

Most damage to packed products arises from flat drops

Product damage can occur without visible external evidence of package abuse

# Transport Vibrations

All modes of transport cause associated vibrations

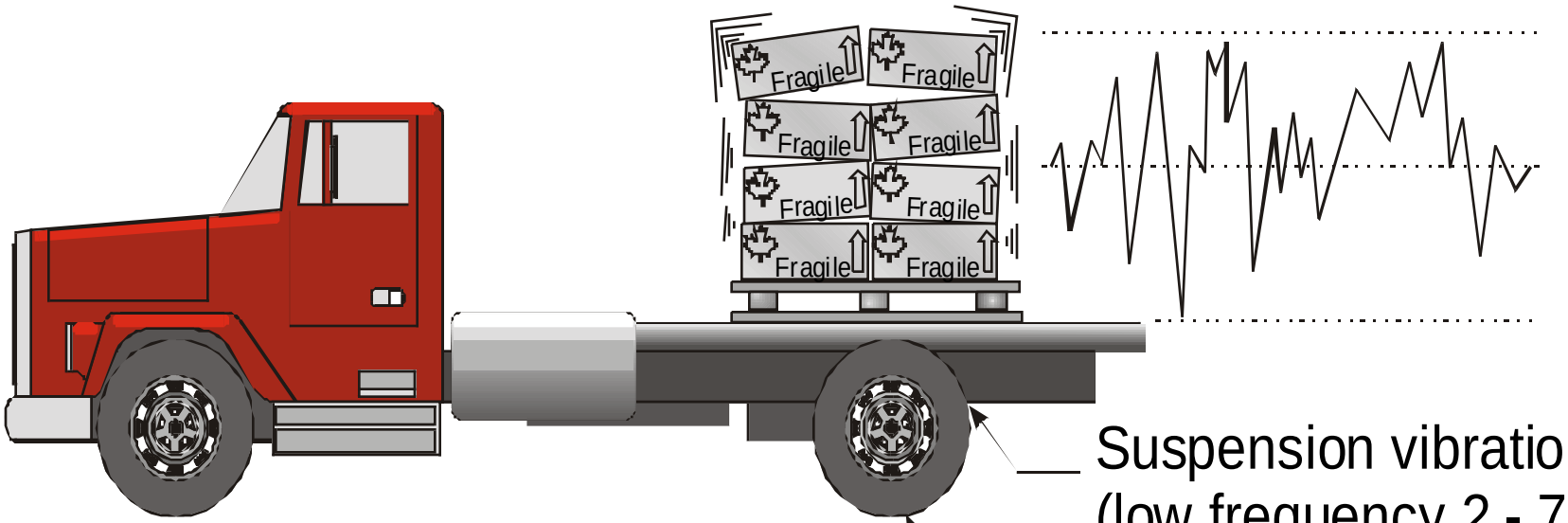
Generally, higher frequencies have lower amplitudes

Damage can be attributed to either relative movements or resonance conditions of the product/package

Most damage occurs in the 3 to 30 Hertz range

Vibrational testing usually covers frequencies from 3 Hz to 100 Hz

# Vehicle Vibration Sources




Suspension vibrations
(low frequency 2 - 7 Hz)

Structural vibrations
(higher level frequencies 50 Hz +)

Wheel vibrations
(mid-level frequencies)

# Relative Movement

Occurs when one object/pack moves relative to another

For example one bottle rubbing against another one

or a product rubbing against the inside of a box

Scuffing or abrasion is the typical resulting damage

Remedied by stopping relative movement, or

by isolating moving pack and product components

# Spring / Mass Relationships

## Vibrational Responses

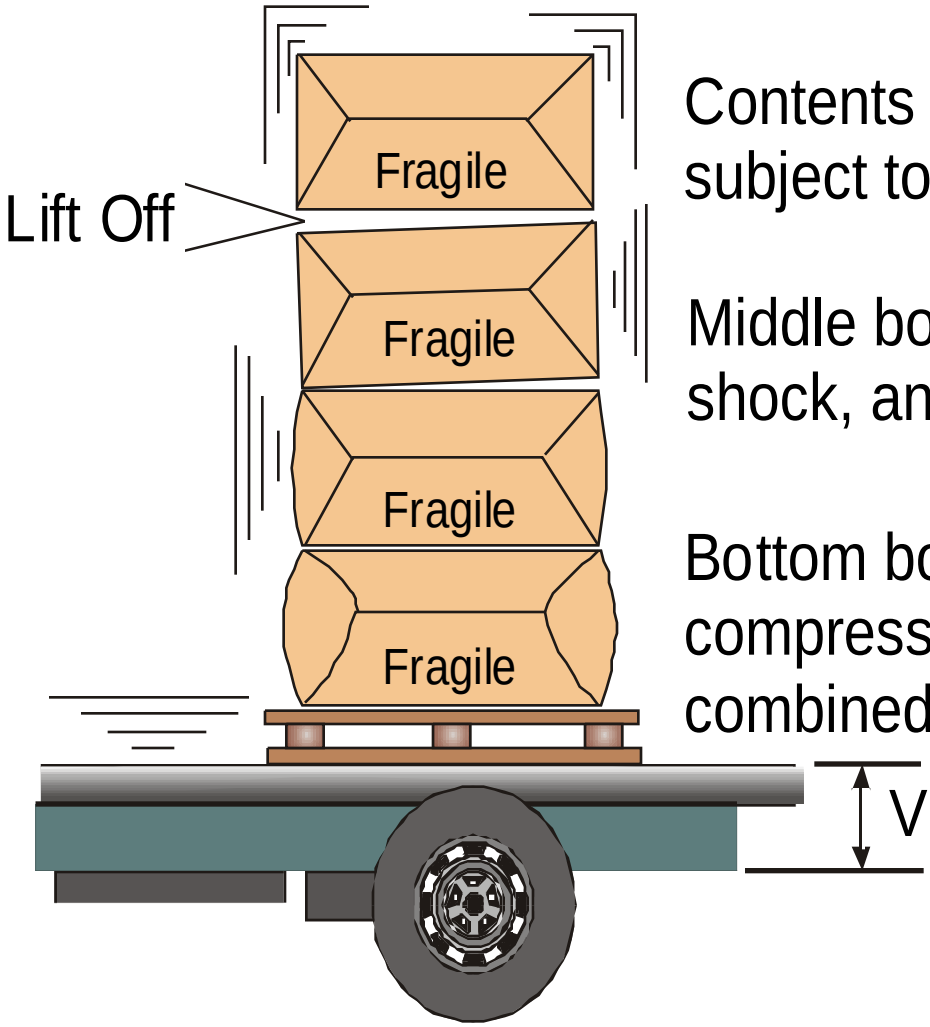
| If : | There is : |
|---|---|
| output = input | direct coupling |
| output > input | resonance |
| output < input | isolation |

Damaging resonance may occur when output is greater than, and out of all proportion to, the input

# Examples of Resonance Damage

- Fatigue and fracture of metal cans and drums
- Food disintegration and otherwise altered food textures
- Separation and/or settling of granular products
- Substantially increased scuffing and abrasion problems
- Impacts between component parts or containers
- Pack closures or threaded fasteners Loosened/unscrewed
- Pallet patterns and dunnage systems disturbed
- Electrical circuit boards flexed and damaged

# Stack Resonance

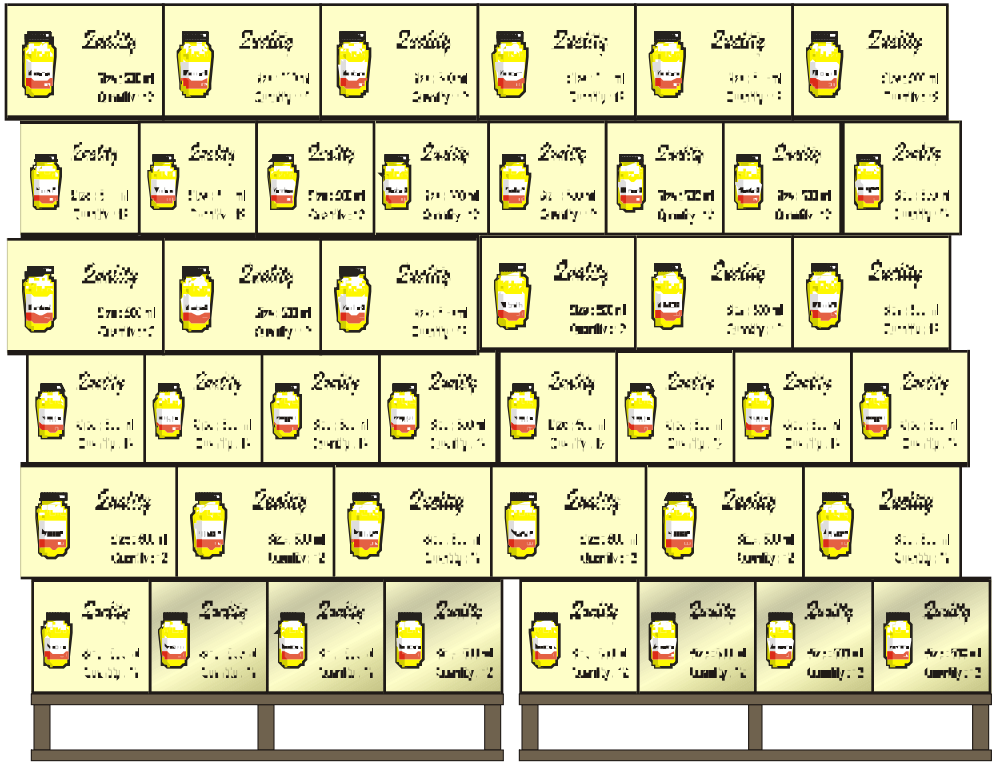



Contents of top box are subject to repetitive shock.

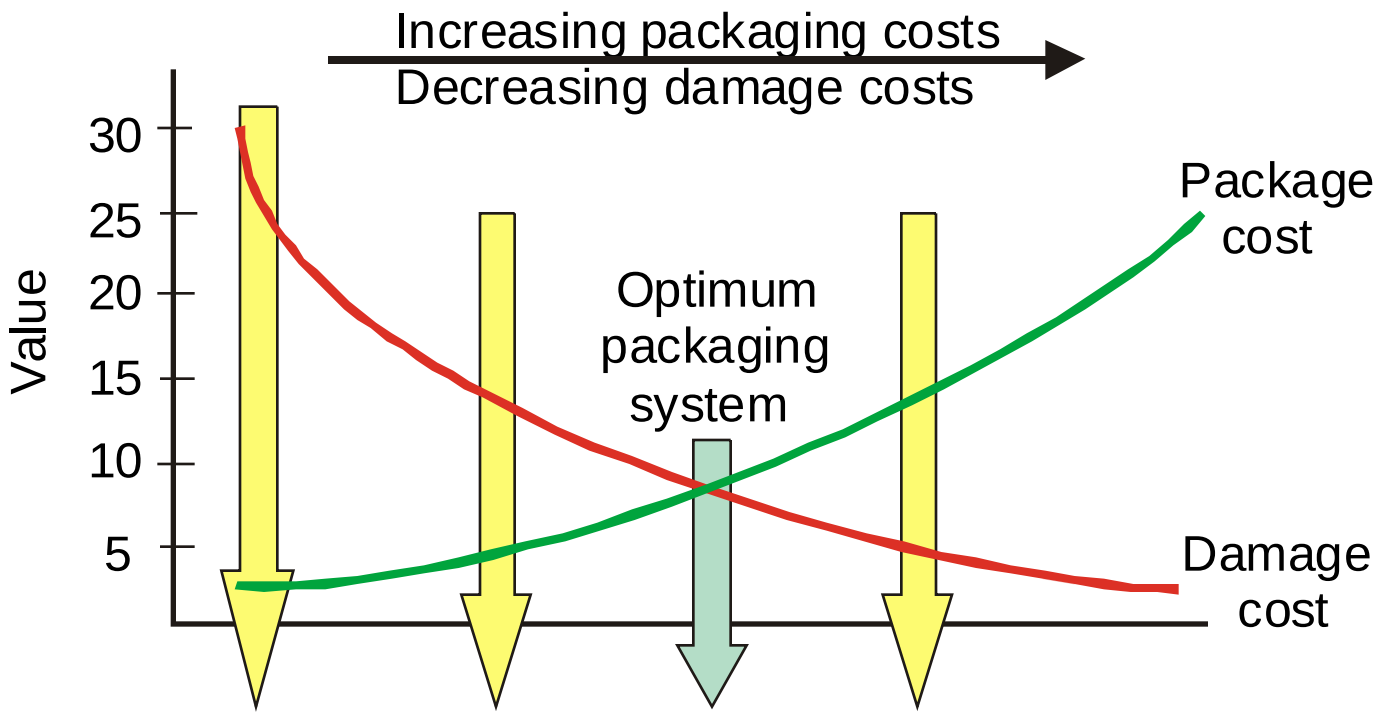
Middle boxes see dynamic compression, shock, and vibration forces combined.

Bottom box experiences repeated cyclic compressive forces greater than the combined mass of boxes above it.

# Pallet Load Skewing



# Determining Optimum Packaging Cost




| | | | | |
|---|---|---|---|---|
| Package cost | 3.00 | 5.00 | 8.00 | 13.00 |
| Damage cost | 25.00 | 13.00 | 8.00 | 5.00 |
| Total cost | 28.00 | 18.00 | 16.00 | 18.00 |

# Recommended Quality Assurance Practice and Procedures

- Keep records of pack specs. agreed with suppliers
- Keep examples of previously supplied, acceptable packs, for reference & comparison
- Employ basic measuring methods to check pack dimensions/weights/compressive strength, etc.
- Maintain close relations with pack suppliers, exchanging & comparing QA findings
- Have access to specialist QA & test services with regard to particular pack materials & problems

# Incoming Packaging QA Procedures

- Have simple, easily applied acceptance criteria, for each type of packaging us
- Apply regular but random QA tests on all incoming packs & packaging materials
- Sample on a per pallet/ per shipment basis, so source of variations/defects can be traced
- Test immediately on receipt, to achieve rapid solution of problems and avoid delays and other impacts on packing operations

*NB. All shipments can be expected to include a proportion of defects*

# Classification of Incoming Pack Defects

**Quality defects may be classified by the purchaser, according to chosen criteria, as follows:**

- **Class A:** Critical defects such that the packaging cannot be used for its intended purpose
- **Class B:** Major defects; packaging deviates from specn., but can be used if packer provides extra inputs, eg., labour or materials
- **Class C:** Appearance of packaging is somewhat impaired, technical functions are not affected

# Sampling Incoming Packaging

- Acceptable Quality Levels (AQL) should be established, fixing percentages of A, B & C defects permissible within a shipment
- Systematic but random sampling should be carried out, based on shipment quantities
- Sample sizes for a normal inspection can range from 10% for lot sizes up to 1,000 packs, to 1% for lots over 100,000
- Lot acceptance or rejection levels should be based on permissible levels of A, B & C defects pre-agreed with supplier

# Tests on incoming packs & materials

- QA & testing methods are specific to pack types – glass, metal, paper, plastic, etc.
- Other than for visual inspection & dimension checks, pack tests require special equipment
- For this reason testing often contracted to a specialised third party, eg Standards Bureau
- Or a trusted supplier may perform tests and provide data to customer
- Tests on incoming packs are especially necessary for mechanised/automated packing operations

# Specific tests of paper/board packaging

## Strength tests:

- Bursting strength (Mullen; tests drop resistance)
- Edge crush (tests rigidity, stacking strength)
- Flat crush (tests compression resistance)
- Puncture (tests resistance to puncturing/shocks)

## Other tests:

- Adhesion tests (adhesion of paper plies and of liners to fluting)
- Moisture resistance (Cobb; water absorption test)

# Specific tests on plastics packaging

- Tensile test & stretch/elongation test
- Tear test, machine & cross direction (Elmendorf test)
- Moisture vapour transmission test
- Gas permeability tests (oxygen, CO2, odours)
- Resistance to product, solvents, oils and greases
- Heat and cold (re filling temperatures, etc.); climatic and ageing tests
- Heat sealing strength tests

# Specific tests on rigid packaging (bottles, cans, etc.)

- Pressure testing
- Leakage testing
- Closure/seal testing (including closing torque/ease of opening)
- Compression testing
- Drop testing
- Climatic (temperature & humidity) testing/accelerated ageing

# Printing inspection and testing

- Print rub/scuff resistance/adhesion tests
- Resistance to product constituents/solvents
- Registration accuracy/uniformity
- Print definition/clarity/legibility
- Colorimetric accuracy/consistency of tones and shades (compared to reference colour samples)
- Resistance to fading (accelerated ageing test)

# Tests on filled/closed packages

- Compression/top load tests (empty & filled packages)
- Leakage/seal/closure failure tests
- Simulated transit tests with filled packages: drop test; vibration test; inclined plane impact test; revolving drum test; humidity and temperature resistance tests
- Accelerated aging tests

# Reasons for Pre-shipment Testing

Testing by actual product shipment:

- is subject to uncontrolled variables
- is not directly observable
- is not repeatable,
- can be time consuming and costly
- does not provide quantified results or guidance

All probable hazards can be simulated under controlled pre-shipment test conditions

# Basic ISTA Preshipment Test

**International Safe Transit Association**

Test sequence (Initial Procedures)

1. Weigh the package
2. Conduct repetitive shock test (vibration)
3. Conduct drop test

# ISTA Drop Test Procedures

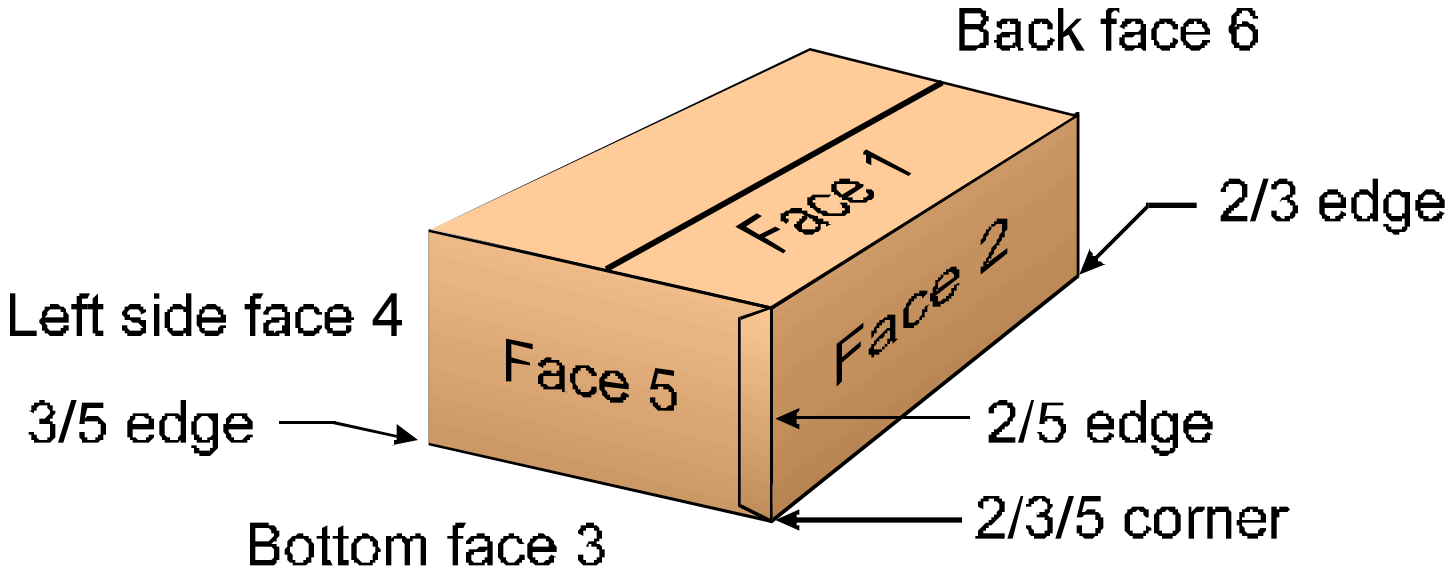
| | |
|---|---|
| Up to 21 lb. | 30 inches |
| 21 through 41 lb. | 24 inches |
| 41 through 61 lb. | 18 inches |
| 61 through 100 lb. | 12 inches or incline impact test |

1. First drop is on 2/3/5 corner
2. Drop on shortest edge radiating from 2/3/5 corner
3. Drop on next shortest edge radiating from that corner
4. Drop on last edge radiating from 2/3/5 corner
5. Drop once on each of the smallest faces
6. Drop once on each medium face and each large face

# Box Nomenclature for Testing

From the manufacturer's joint end, number the six faces clockwise with the top as No.1.

Edges and corners are identified by the faces that meet there



# Testing Equipment Demonstration

**Possible bench top tests on paper board:**

**Mullen burst test:** records resistance to pressure of a circular area of board, standard test of board strength and drop resistance, quoted in psi or kpa.

**Edge crush test: records** compression resistance, of a board sample, standard test of stacking strength in lbs/inch or N/cm.

**Elmendorf tear test:** records tearing resistance of paper or plastic film, measures travel of pendulum after it has torn through a sample of the material