Corrugated Packaging 101

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The purpose of this paper is to help businesses (large and small) develop an appreciation for the science of corrugated material and understand the purpose behind different box designs. Both corrugated material and the boxes and trays that are formed from it are constructed for the specific packaging and shipping needs of businesses in various industries.

Once the science of corrugated material, the standards that govern the corrugated industry and the purpose box and tray construction has been explained, it will dispel the myth, "any old box will do."

The Challenge

Each business in each industry faces its own unique challenges when it comes to packaging and shipping its products, but they share the same goal: To get its products to market safely.

Proper packaging, which includes choosing the proper corrugated material and box (or tray) design, is an important factor in reducing the cost associated with losing products to damage.

What is Corrugated?

Corrugated material is comprised of two main components: a liner and a wavy, fluted material. The fluted material is inserted between two liners and gives the material its strength, similar to the way arches provide strength to a bridge. The liners and fluted material are then glued, pressed, cut and scored on a corrugator.

Basic Box Construction

All corrugated boxes and trays start out as flat sheets of corrugated material. If a box requires printing, it is transported to a press, which prints graphics directly on the flat sheet. Once printed, the box is fed through a flexo-folder gluer, which applies cross slots and cross scores to create the individual flaps, and applies cold glue on the manufacturer's joint (the end flap used to glue the box together), folds, and compresses the box.

Corrugated boxes are popular because of their strength and because they can be produced in high volumes very quickly and easily.

Standards of Corrugated Material

There are four basic standards used in constructing corrugated material:

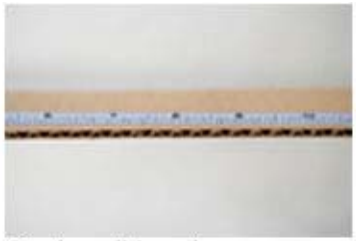
- Board styles
- Flutes
- Dimensions
- Edge crush test

Board Styles

There are four standard thicknesses of corrugated material:

- **Single face**: In which one piece of fluted material is glued to one piece of liner.
- **Single wall**: In which one piece of fluted material is glued between two pieces of liner.
- **Double wall**: In which two pieces of fluted material is glued between three pieces of liner.
- **Triple wall**: In which three pieces of fluted material is glued between four pieces of liner.

Single face board



Single wall board

Double wall board

Flutes

The wavy, fluted material, found between sheets of liner material, is commonly referred to as “Flutes”. The flutes themselves give the material its strength, allowing it to sustain a great deal of weight. It also provides a degree cushion to help protect the contents inside the box.

Flutes come in various standard sizes (A, B, C, E, and F). A-flute was the first type of corrugated to be developed, followed by B-flute, which is thinner. C-flute, the most common thickness used, lies between A and B. Both E-flute and F-flute (also known as fine flute) are respectively thinner than B-flute.

Dimensions

The dimensions of a corrugated box are always measured from the inside of the box and are expressed as length x width x height. The length is always the first dimension to be expressed and should always be the highest number of the three.

Edge Crush Test

Edge Crush Test (ECT) is the standard by which box strength is measured. It specifies the amount of force a piece of corrugated material can withstand before it fails. The ECT measurement is expressed in pounds per square inch and can often be found on the round printed label containing box specifications.

Strengthening Strategies

There are three main ways to add strength to a corrugated box.

1) Vertical fluting: boxes are constructed so the flutes always run vertically, giving it its stacking strength.
2) Thickness and board styles: boxes can be constructed using double or triple wall with a combination of different fluting, such as A-flute and C-flute between the liners.
3) Lugs and flanges: boxes can incorporate additional material in their design such as slotted lugs, re-enforced corner posts, and flanges inserted at each end to provide additional stacking strength.

Corrugated Box Construction

Depending on which industry the business is operating in and what type of products they produce will often command which type of box they will use.

Regular Slotted Cases

The most common box used in packaging is the Regular Slotted Case (RSC). This box features two major flaps, which run the length of the box, and two minor flaps at each end. The major flaps overlap the minor flaps when folded. The longer the box is, the less overlap exists among the flaps. The more square the box is, the more overlap exists. The overlap adds to the strength of the box, however the flaps of an RSC box can also be cut away to save on material.

RSC Variations

The RSC is a standard box construction with many variations, which include:

- Half Slotted Case (HSC)
- Centre Special-Slotted Container (CSSC)

An HSC is essentially an RSC with the top flaps removed. It is frequently used as a tray or inner box and is incorporated with an outer box, which forms the lid. The HSC is used commonly within the fruit industry since the lid can simply be removed to access the product inside without cutting, which can cause damage. Industries where products can be damaged by cutting quite often opt for the HSC type.

The CSSC derivative also referred to as an All Flaps Meet (AFM) box is an RSC in which both major and minor flaps meet at the centre of the box when folded. This style of box creates a flat floor, which prevents paper cuts or abrasions on products caused by

paper edges. This type of box also features an extra strong top and bottom provided by the full overlap.

RSC Applications
Small boxes used by industries such as the pharmaceutical industry feature bottom flaps that meet and are taped. The top flaps also meet and are taped, however these flaps may be cut back to save material. This style of flap is often referred to as “shy” or “econo” flaps.

Tray Form Boxes

The difference between a box and a tray is that a tray features a one-piece bottom. Trays are often used in the food and beverage industry to hold soft drink cans, pack meat, and stack fruits and vegetables. Trays are also often produced as lids for HSC boxes.

There are two types of trays: Glued Tray and Self-locking Tray.

Glued Trays
Glued Trays feature small flaps that are glued during the forming process. From a material perspective, Glued Trays are more economical than Self-locking Trays because they tend to have a lot less material in them.

Self-locking Trays
Self-locking Trays feature tabs, which can be folded and locked into recesses cut out of the tray. Self-locking Trays are a particularly useful tray because they can be formed by hand in small volumes or they can be formed automatically by tray formers in larger volumes.

Tray Applications
Trays are particularly useful in the food and beverage industry and are constructed in many different styles, including:

- Slotted tray
- Tray with top flaps
- Bag in box
- Display tray
- One-piece telescoping tray
- Multi-use box (MUB) tray

Bliss Boxes

Although it is technically a tray box, the Bliss box is unlike any other tray because it is made from three pieces of material, whereas a tray box is made from one piece of material. Like a tray, the body is made from a single piece of material, which forms the bottom, sides, and major flaps at the top. However, each end is made of a separate piece of material, featuring a minor flap. The bottom and sides feature overlapping flanges into which the end panels are glued and attached to the main body. This design provides much more strength than an RSC.

The Bliss Box design allows customers to get a lot more strength from the box and save money by using a lighter material for the body and a heavier material for the sides for stacking strength. Additional stacking strength is provided by having flutes run vertically.

Bliss Box Variations
Some Bliss Box designs feature end panels with no minor flap, which can help save on material if minor flaps are not needed. Another style of Bliss Box features a center divider made from two pieces of material on which the flaps can overlap, providing a bridge across the centre divider.

The body of a Bliss Box can sometimes contain perforations or a tear out which allows customers to display the contents of the box without opening it. Similarly, another style uses a Bliss inner box and an HSC outer box, containing major flaps. This allows the customer to remove the outer box, leaving the Bliss inner box to hold the product. This style of box is very popular within the fruit industry.

Bliss Box Applications
The Bliss box lends itself to many different uses. It is primary used in agriculture for packing fruits, vegetables, and meat as well as in the construction industry to hold heavier items. In fact, Bliss Boxes can be used in any industry that requires stacking strength.

Summary

No matter what industry a business finds itself in, if its goal is to get its product to market safely, it must become aware of the different packaging materials and methods available in order to avoid damage during shipping. Corrugated materials and box (or tray) construction itself will not ensure the safe delivery of products but it is an important part of the process.

Understanding what materials and designs are used in the construction of corrugated boxes and which materials and designs best suit a businesses needs is the first step in getting their products to market safely. It is also the first step in developing a strategy for forming boxes, packing them, and shipping them.