AN INTERDEPARTMENTAL CO-ORDINATION STUDY OF PACKAGING AND PHYSICAL DISTRIBUTION FUNCTIONS

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James W. Goff
Major professor

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ABSTRACT

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By

Margaret Lee Antokol

Packaging and physical distribution (transportation), both relatively newly recognized functions, can be focal points for economically beneficial intracompany co-operation and co-ordination. For years companies have been interdepartmentally competing and ignoring the total systems benefits from co-operation.

Talks with packaging and physical distribution personnel, empirical library reference research, and observations of on site company policies and procedures provided the major input for this work.

The purpose of this thesis is to provide an avenue of understanding between the problems faced by the packaging specialist and the physical distribution (transportation) specialist. Within the text, the interdependent functions of the two departments are explored and possible co-ordination routes are formulated.

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DEDICATION

To Stokely and Littlefellow who
stood by me through the entire project

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History of Shipping

Business logistics has been defined by Ronald H. Ballou as "the planning, organizing, and controlling of all move-store activities that facilitate product flow from the point of raw material acquisition to the point of final consumption, and of the attendent information flows, for the purpose of providing a sufficient level of customer service (and associated revenues) consistent with the cost incurred for overcoming the resistance of time and space in providing the service." [1]

This definition encompasses all phases of a business operation and lends itself particularly to those operations called physical distribution/transportation and packaging. The systems viewpoint has, unfortunately, not been universally accepted nor applied. Although the principle of comparative advantage, that is, the specialized production of commodities particularly suited for a specific area and the resultant trading of that area's surplus with the surplus of another specialized area [9] has been practiced for centuries, comparative advantage is glorified with the advent of the giant corporations and conglomerates. Because of high concentration in the industries, a systems concept of physical distribution, or business logistics, must be devised and implemented to assure an economical and systematic materials flow. A brief look at the development of transportation modes enables one to grasp the rapid state of flux in this industry.

Before 1817, the United States had no real transportation system. Loads were drawn by heavy, 4-6 horse team wagons, and the dependability or reliability of the method reflected:

1) road conditions
2) season of the year
3) possibility of backhaul
4) level of wages and prices (wide fluctuations)
5) competitive conditions

The U. S. Senate reported that the cost of shipping goods from Europe to America equalled the $9.00 cost for 30 miles of internal land transport! Land transport rates ranged from 30¢ - 70¢ per ton-mile. Other modes of transportation included ocean-going vessels and lake sailing ships. Goods were high priced and scarce because the country lacked adequate and efficient transportation networks. News did not travel quickly; consequently, new product information was slowly received.

With the advent of turnpikes, canals, and railroads during 1817 - 1860, United States industry surged forward. The average speed of 2 mph for heavy freight was increased to 10 - 15 mph with the opening of the canals and the subsequent appearance of steamboats. Prices for hauling freight by land and water dropped drastically from the 30¢ - 70¢ per ton-mile to 12¢ - 17¢ per ton-mile. By 1860 freight volume was moving five times that of post 1817. The railroad altered transportation patterns. Offering lower rates of

1.2¢ - 6.25¢ per ton-mile and speeds up to 20 mph, these railroads revolutionized domestic commerce.

The stagecoach populated the new turnpikes in areas where water transport was not available. Ships traveled from the South to New England via coastal water routes and the Great Lakes area,and the canal system from New York to Philadelphia grew in importance. The period witnessed a great growth surge with the settlement of the West as well as a dramatic numerical increase in population. Domestic trading flourished among the industrialized East, the agrarian West and the cotton-producing South. Manufacturing surged tremendously and transportation network improvements provided an impetus for this rapid growth. Physical distribution quickly became more than simply transportation.

The years after the Civil War again saw a growth in transportation methods. Motorized transport debuted with the automobile and truck, and became the new way to ship. Railroads held their own, but through increasing governmental regulations and competition of the motor carriers, they were beginning to feel the pangs of middle age. The impact of World War I brought the whole world closer together and availed people to more goods and services than ever before. Radio made its debut and subsequent advertising spread ideas and products and business had to keep pace with these new demands in any way it knew how.

Marketing and marketing concepts appeared around 1900 and,

until 1910, people found themselves in a discovery stage, with new ideas of the consumer and industry.

The main thrust of marketing was how to sell the product. From 1910 - 1920, the "period of conceptualization," the basic concepts of marketing were formed in an increasingly urbanized and industrialized country. 1920 - 1930 witnessed a "period of integration" where market functions were analyzed with marketing research and methodology procedures.

Although 1900 - 1930 were production-oriented decades with problems of capacity creation, work methods, and volume production, they also were periods of great prosperity and excitement. The intricacies and implications of what industry was doing had not yet been noticed, yet people eventually would rebel at the mass marketing, sales of shoddy goods, and the lack of responsibility on the part of the seller. This was still the era of caveat emptor!

Although sales were high and business generally profitable, the business world finally turned its attention to the processes other than production.[13] Borsodi sums up this thinking: "The day is gone when the recipe for fabulous profit was simply 'production; more production; and still more production.' The golden age of production is past. The age of distribution is upon us." [13]

This era saw sales emphasis begin to grow into a consumer-oriented industry. Confused thinking usually equated higher

sales with higher profits. No one investigated the possibility that the equation might be wrong. Unless corresponding physical distribution costs were the same for a higher production level -- higher sales could result in LOWER profits! With this realization of the diseconomies of scale, physical distribution became a recognized field.

With the invention of the computer in the early 1940's, and its subsequent application to business logistics problems, modern physical distribution is more than merely producing and distributing goods. It involves a unique analysis of protective packaging, warehousing, inventory, various modes of transportation, order processing, plant and warehouse site location and customer service levels. All these things must now be considered BEFORE a product may be efficiently produced. Consumers are more demanding than ever before, and although the real cost of goods is less now than 50 years ago, the consumers consistently complain of high and unreasonable costs. The dynamics of distribution has expanded so greatly that it staggers the imagination. Production and distribution are not what they were even 25 years ago in terms of manpower, machinery output, and outlook.

History of Packaging

As with transportation and shipping, packaging as a discipline began around the turn of the 19th century. While man has always relied upon containers to hold and carry objects since the first skin bags, shells, and leaves, it has only been recently that the package was viewed as a separate entity, rather than as an accidental accessory, something that was haphazardly determined and the substance forced inside. With an inadequate and inefficient transport network, there was little need to protect or display products, for little trading of damageable articles occurred. Shipments consisted primarily of bulk items such as grains and minerals. As far back as 3000 B.C.E. packages were used as storage for valuable articles and not for transport and sale.

With high valued imports being brought into the colonies, the first protective packaging containers were European styles. However, as we became increasingly more independent, we developed types of our own.

The early packaging materials consisted of wood, glass, earthenware and/or textiles. Lumber was abundant and cheap, and became a staple in the packer's world. The early world history of packaging can be documented back to 3000 B.C.E. for use as alabaster make-up kits, and the Persians are purported to have used earthenware wine vessels to ship water to Egypt after Egypt's defeat. Leather bags and

glass bottles were used by the Romans prior to 1 C.E.

Labeling began with the Romans, as each person identified their product by names or initials molded in their glass container. Paper made from rag, silk, linen or hemp fibers was introduced in Canton, China in 105 C.E. and by the 10th century had replaced the parchment and papyrus used since 1500 B.C.E. Prior to 1800 C.E. wood boxes employing dowels or handmade nails were also used. With the advent of nailed shipping crates, packaging began to emerge as a new industry.

The first type of modern shipping container, and still in use today, is the nailed wooden box or crate. Because it was relatively cheap and wood was abundant, little attention was paid to designing boxes for maximum strength with minimum materials usage. In 1904 processes permitted the development of wire strapping and led to wirebound closures and in 1931 the invention of the Rock Fastener, or looped closure, simplified and speeded up closure procedures.[2]

As early as 1608 packaging was organized as an industry by Captain John Smith in Jamestown, Virginia, with the opening of the first glass bottle factory.[10] Later, Salem, Massachusettes produced industrial bottles for the exporting of New England rum and cider.

The first paper mill was established by Wm. Rittenhouse in 1690 in Germantown, Pa. and until the early 1800's the paper was handmade from textiles and rags. Coarse papers were

developed from wood fibre pulp, and from these, paper packaging evolved. With the emergence of corrugated and solid fibreboard in the late 1800's, a cheaper form of packaging products was developed. In 1903 the first experimental freight shipments using corrugated and fibreboard took place and by 1906 these materials were in general use. The use of these lightweight, sturdy, cheap boxes promoted a phenomenal growth pattern in the packaging industry, and also spurred shipments of goods through lower transport costs.

The folding carton, although not used as a shipping container, made its debut in the early 19th century primarily for 1/4, 1/2, and 1 lb. quantities of foodstuffs. These boxes were shaped by the store clerk on wooden forms and held together with tacks or strings. The folding carton as we know it, arrived around 1860, and was handmade in specialty shops. The first real packaging advancement was the development of the cracker box in 1894. The package protected the cracker from moisture and air and it preserved the crackers flavor and texture. The folding carton was rapidly adopted by industry and the variations, i.e. waxed paper liners, overpack with an outer wrapper, etc. were soon visible.

The set up box was used in Chinese manufacturing for packaging tea during the 16th century. The American set up box industry developed in Boston in 1839 out of necessity because long delivery delays of German set up boxes for the jewelry trade caused sales and delivery uncertainties.

In 1850 the invention of hand shears and paper cutters led to the mechanization of the set up box industry.[2]

Plastics have been packaging's most recent development. PVC (Polyvinylchloride) was manufactured in 1927, PE (Polyethylene) in 1942 and PP (Polypropylene) in 1957. Rigid, semi-rigid and flexible containers are formulated through various methods affording good protection, permeability barriers, style, and ease of operation. Yet, with all the conveniences plastics create, they are still virtually unrecognized by the National Motor Freight Classification Board.

Packaging Functions in a Physical Distribution Network

Very often, packaging is publicly viewed strictly in the consumer-oriented market, and consequently little attention is paid to the industrial package. Yet this industrial package is extremely important for, if poorly designed and awkwardly handled, the package itself could create ill-will among the middlemen in the distribution channel; thus, killing the product for the ultimate consumer. The focus of this section centers upon the expectations of a physical distribution manager and the packaging engineer.

Dr. Harold Raphael suggests three package functions:

1) protection
2) utility-convenience, and
3) motivation-communication[12]

But, within the physical distribution network, the first two functions, protection and utility-convenience, far outweigh the motivational aspects of packaging. Packaging actually performs two tasks:

1) it preserves the product contained within, and
2) it facilitates shipment

Ideally, the package will do these at an optimum cost level. Distribution efficiency is the key to packaging and outlines four main ideas:

1) protects product
2) Convenient for handling and storing
3) easy to identify, and
4) provides a measure of security

Simple protection expands quickly into an entire series of desires from the packaging engineer, the traffic manager and the materials handling person. Considerations that must be included are: [4]

a) Does the package adequately shield the product from shock and vibration damage, multiple frequencies encountered in piggy-back operations, and impact/vibration/ compression damage encountered during carrier movement or handling operations?

b) Will the package thwart pilferage or reduce theft rate and loss?

c) Will the package contain the product during the entire channel route, thus affording protection to the environment as well as to the product?

d) Will the package require special handling equipment at any point throughout the channel?

e) Does the package suggest a change in carrier methods, modes?

f) Have carrier dimensions been considered?

g) Is the package appropriately labeled for ease in shipment, storage and handling?

h) Does the package conserve cube, reflect the lowest setting for damage claims, and obtain a most favorable freight rating?

i) Does the package have good stacking qualities, strength, dimension and surface properties?

j) Can the package be easily unitized?

k) Does the package consider quantity buying lots?

Many of these requests are conflicting. For example, optimum stacking strength and conservation of cube would require a square box -- a warehousing nightmare of tall stacks, one upon another, and all falling while being transported by

fork lift. Shrink or stretch wrap palletizing may be the solution, provided the carrier will accept the shipment, purchasing understands the need for new materials, and so forth. The optimum package/product requires much cooperation among departments and does not need any type of rivalry, be it to attain lowest departmental costs or the fastest service record.

By coordinating packaging and physical distribution areas, a lower economic total cost objective can be met. Packaging can greatly reduce damage claims, and it must be continually reviewed within the context of lengthening line hauls and channel additions. The packaging department itself requires scientifically initiated studies and analyses of environmental hazards within the physical distribution network, and the impact this environment will have upon the product. The packaging department must determine, or secure from engineering, the fragility level of the product at all facets.

Input from the distribution department can indicate mode of transport, special equipment available, classification rate and packaging dictated, if applicable, handling operations used, carrier dimensions, desired pallet configurations, height and width, etc. Although most warehousing and physical distribution persons prefer interlocking pallet configurations for column stability, packaging people prefer column stacking for package stability. Clearly,

compromises can be reached, possibly through computer analysis of packaging-distribution problems, or through discussions of the involved departmental objectives. If packaging, physical distribution and warehousing goals can be visualized and communicated, then optimal compromises can be formulated.

Governmental Regulations

Regulation of private industries is relatively recent in U. S. history. Although advisory commissions began their investigatory activities around 1830, these committees had no legal jurisdiction and served only in an advisory capacity to the state legislatures. The Granger movement was the prime force behind these commissions, and focused on the many abuses perpetrated by the railroads.

The Interstate Commerce Act of 1887, and the subsequent establishment of the Interstate Commerce Commission, recognized a need for regulation of the special problems created by the railroad transport dynasty. The highly intricate and specialized controversies arising from railroad activities were not meant to tie up the courtroom it was felt, and a commission decision would better protect private enterprises than would the decision of a single administrator. The ICC was also nourished by the belief that government intervention was necessary because the free enterprise system of competition in the field of transportation had broken down under the monopoly of the railroads.[6] Hence, the ICC was to take the place of the competitive function by establishing reasonable and just rates, prohibiting personal discrimination and requiring the publishing of such rates, prohibiting undue preference, prejudice, or pooling of freight loads, and calling for a short haul, long haul clause.

The ICC was given the power to administer the law with corresponding powers to investigate into the management of common carriers (railroads), require annual preparation of reports, as well as prescribe a uniform system of accounts for all railroads, and finally, to order the cessation of any violation and the giving out of penalties required by such violations. However, from its passage when Grover Cleveland initially departed from the idea of limited government, the ICC's authority grew. In 1891 Benjamin Harrison gave the ICC the power to require the testimony of witnesses arising from investigations into railroad activities, and in 1906 Teddy Roosevelt awarded the ICC the authority to prescribe maximum rates (ceilings). By 1910, when William H. Taft signed the Ash Pan Act, the railroads had lost their position as the single most prominent enterprise, and shared the spot with the communications industry. Taft and Congress deemed it 'necessary' to regulate the interstate and foreign operations of the telegraph, telephone and cable companies. These were assigned to fall under the jurisdiction of the ICC, the model for the future commissions.[5]

With the onset of World War I, the government took over control of the railroads. The Transportation Act of 1920 returned ownership of the railroads to private hands; yet, the changes that the government instituted in regulations when returning the railroads left virtually every aspect of the railroads operations under governmental control.

Although the need for the Interstate Commerce Act of 1887 was obvious because of the myriad abuses committed by the railroads in their dealings with customers, the transportation monopoly the railroads had no longer existed at the inception of the Motor Act of 1935, or the air regulation in 1938, or the water regulation in 1940. The Motor Act of 1935, bringing the trucking industry under the regulation of the ICC, did not occur because of abuses by the motor carriers of their customers, or potential customers. Rather, it stemmed from the theory that all competing forms of transport should be regulated to preserve the "inherent advantages" of each competing mode, and to further sound economic conditions within each industry. Amended in 1958, the Transport Act of 1940 dictated the fair and unbiased regulation of each and all modes of transportation, recognition of the "inherent advantages" of each mode, promotion of economical, safe and efficient service for each mode, as well as the promotion of a sound economical situation in the transportation industry. The Act also encouraged a system of fair wages and equitable working conditions. Underlying the Act was the intent that the ICC would develop, coordinate and preserve a national transportation system.[19]

Unfortunately, this intent has not been realized because each agency within the ICC and CAB must protect its own mode, thus conflicting with a national transport goal. Economist Dr. Milton Freidman remarked that the regulators typically become instruments of the industries they were

supposed to regulate.[30]

One of the more interesting cases that illustrates the conflicting goals theory and the hypothesis of instrumentality is the Geraci case. A private carrier hauling fruits and vegetables northward, contracted with an alcoholic beverage company to haul his product southward, thus avoiding the wasteful empty backhaul in both companies. Although no other trucking firm objected to this arrangement, a complaint was lodged by a competing railroad that hauled part of the beverage firm's product. The ICC ruled in favor of the railroad, stating that private forms are not to mix with contract forms in view of the 'public interest.' This case decision was strengthened by the action taken in the Veon Case, where the ICC maintains that the empty backhaul of private carriers is one of the "inherent disadvantages" of the carrier. Furthermore, the ICC has proposed a strict enforcement of forbidding private carriers from engaging in interstate trucking. This is also done in the spirit of promoting and protecting the public interest![28] Similarly, a Ralph Nadar study has reported an annual addition of two billion dollars to the freight bill because of the ICC's rate-making policies; again, made in the public interest.[19]

There are four legally defined categories within each of the five basic modes of transportation (air, pipeline, motor, rail and water). The common carrier exists to serve the public and is required to provide service to everyone

without discrimination. All rates quoted by the common carrier must be published and adhered to. Entry into or exit out of business of common carriers must be approved by the Interstate Commerce Commission, upon the basis of public interest and need, and all carriers are required to comply with national safety regulations. Changes in rates must also be cleared by the ICC, and the ICC has the power to suspend rates.

The Reed-Bulwinkle Act gave the ICC immunity to anti-trust laws in collusion or price fixing agreements.

Contract carriers may choose their customers, but are still required to publish rates, although these rates may be altered in actual contract. The permits to operate a contract carrier are less restrictive than those for a common carrier.

Exempt carriers, primarily haulers of agricultural products are exactly that -- largely exempt from any regulation.

Private carriers also have no economic governmental regulation, but they must be supplemental to the owner's primary source of business.

The choice of transport mode many times depends on operating characteristics; factors other than price. In a comparative analysis between modes, the following was shown: [29]

1) availability - truck
2) frequency - truck

3) capability - barges (water)

4) dependability - pipeline

5) speed - depends upon total outlook

Measured output of the ICC regulated carriers vs. non-regulated carriers shows that in cargo ton-miles, the non-regulated trucks outcarry their regulated sisters by 82,000 millions of miles. Subsequent revenues and expenditures are 4,890 millions of dollars greater.[27]

Similarly, packaging requirements for transport modes had gone through its own history of regulations. Until the Pridham Court case of 1914, wooden boxes were the only legitimate way to ship packaged goods. The new variation of wooden boxes, called corrugated and fibreboard packaging, was berated by the lumber industry as flimsy, and unsupportive and that the corrugated board could never do as good a job as wooden boxes. The railroads charged higher west-east rates for these corrugated boxes originating from California. On the basis of rate discrimination, Mr. Pridham was awarded by the courts equal rates and thereby opened the door to the reign of corrugated packaging, and the demise of the wooden box.[10]

Within the trucking industry, certain items must be packaged using explicit specifications dictated in the National Motor Freight Classification, the daughter of the Uniform Freight Classification. With the enactment of the Motor Carrier Act in 1935, the motor carriers were subjected to

the same rate publication requirements as the railroads. The National Motor Freight Classification is an adaptation of the Uniform Freight Classification, and is the most widely used throughout the United States. The establishment of such a classification was primarily to meet the competitive railroads and to fulfill the Motor Act requirements. Until December 31, 1971, there were two versions of the NMFC, but Series A now has general application.

Within the body of the NMFC are various rules governing forms, ratings, weights, shipping procedures and packaging requirements. Specifically Items 200-297, 680, 685, 687 and 689 deal with package and container specifications.[14] For the packaging engineer, a knowledge of the items and the penalties of non-adherence should be a part of his/her standard vernacular. In many cases, a package will be explicitly specified with the Index to Articles of the NMFC. Without adherence to the specified package, a company may find itself with increased transport charges, denial of damage claim by the carrier, or possibly an outright refusal to accept the shipment. There are, however, legal procedures for the use of a newly developed package outlined in Item 689, Test or Experimental Shipments.

Problems within the packaging industry today are similar to the prejudice and ignorance faced by the infant corrugated industry in 1903. This time, however, the classification and packaging specifications are more rigidly entrenched

because the ICC exists and subsequently upholds the National Motor Freight Classification. Although headway has been made, thinking has not changed and packaging is still viewed as a "slap-together" operation, that is, after careful research by many other departments, the final product may be merely shoved into an untested (but adhering to NMFC) package and shipped. Results: damage -- and everyone is astonished when the product fails. The crux of the problem is the failure of government, industry and the private sector to recognize the packaging functions and packaging economics.

The National Motor Freight Tariff Association of the National Classification Committee has provided industry with approximately 10,000 commodity descriptions and also described the type of outer container acceptable for shipping. Item 689, test shipments exists to determine "the merits of shipping containers or loading or bracing methods, not specifically provided for in the classification." This archaic rule has not been changed in over 30 years. The basic provisions of Item 689 are:[32]

a) The packager must request a test permit from the chairman of the board, send a sample or form of the proposed package, and provide a complete description of the proposal.

b) The test permit will not be issued unless the board determines there is sufficient* merit in the proposal.

* Sufficient has never been defined.

c) The tender and acceptance by the carrier of the test shipment is to be without prejudice to any defense of the carriers as to the inadequacy or form in event of loss and/or damage to the property.

d) The originating carrier must have in his possession a copy of the test permit.

e) The delivering carrier must notify the National Classification Board and the originating carrier of any loss and/or damage.

f) Each package must be labeled with the test permit number.

The basic provisions of Item 689 provide enough nuisance and bother to deter most companies from shipping under 689 and/or developing better industrial packaging/shipping methods. Furthermore, if the companies developed a new shipping method, there has been no legal precedent for acceptance for test permit issuance. Unfortunately, the issuing of test shipment permits is done in a seemingly random and haphazard manner.

To further complicate matters, the National Classification Board requires the results of antiquated, outmoded, and impossible pre-testing methods to substantiate the validity of a changed package! For example, in a personal letter, dated October 10, 1973, to Mr. Dennis Young, Chief Engineer of Lansmont Corporation, Robert Leonard of the NMFC stated the following:

"RE: Shrink film (Packaging)

In view of the fact that the National Classification Board is now considering the issuance of Test Shipment

Permits allowing for the shipment of canned commodities in shrink wrapped trays, we offer the following as guidelines to a preshipment laboratory/test justification.

Package 500 of the NMFC has been the predecessor of shrink wrap packaging and has been restricted to truckload or mixed truckload quantities only. Today consideration is being given to less than truckload shipments utilizing the same shrink package but with variations.

First of all, before a Permit will be issued, the Board must be satisfied that the proposed package will perform at the same level or above that of the package being replaced (control package). A testing procedure similar to the suggested procedure below must be performed to simulate as closely as possible the actual LTL environment. Tests must be performed with both the control package and the proposed under identical conditions with a comparative evaluation made.

Due to the differing environments of TL versus LTL, the provisions of Package 500, having end openings when overwrapped and shrink with film, will not be sufficient. Contamination and pilferage alone will necessitate a fully enclosed package.

If utilizing polyethylene film, a mil thickness of 3 mil will be acceptable providing can is capped with a molded snap on plastic over-cap. Due to the die-cutting effect of the metal top chimes, polyethylene film of 4 mil thickness should be considered - and may be required following test results. Polyvinyl Chloride film if not using plastic over-cap should be of 2 mil thickness or with plastic over-cap, 1.5 mil.

Trays must be of complying corrugated fibreboard with a minimum flange height of 1.5 inches as solid fibreboard or chipboard pads or trays will not be permitted for LTL shipments.

Procedure

For test purposes - 12 cases of control package
- 12 cases of proposed package

Vibration Test:

Six (6) of the twelve (12) cases of each must be subjected to vibration before being subjected to further testing. The vibration test consists of two (2) phases:

(A) Single cases of product must be vibrated for 30 minutes and then rotated 90' and vibrated in the opposite plane for an additional 30 minutes.

(B) Two (2) cases must be double tiered and vibrated again for 30 minutes then rotated 90' and vibrated an additional 30 minutes in the opposite plane.

Vibration test conducted on a synchronous motion vibrator calculated to achieve 1.5 G's of force.

Impact Test:

Two (2) cases of each must be subjected to 250 vertical impacts of 8 inches at a frequency of 30 impacts per minute. This test conducted with both single packages and double tiered packages to determine if can chime will have a die-cutting effect on film.

Incline Impact (Conbur):

Four (4) cases of each must be impacted twice on one side and twice on one end from a distance of 4½ feet on the incline plane in the following configurations:

1. Single cases
2. Two (2) cases, one atop the other
3. Four (4) cases in a two high two wide configuration.

Drop Test:

Six (6) cases of each submitted to ten 18 inch free fall drops from a split table drop tester onto a metal clad concrete floor. Drop sequence conducted as follows:

1. One drop on flat bottom.
2. One drop on flat top.

3. & 4. One drop on each flat side panel.

5. & 6. One drop on each flat end panel.

7. One drop at a 45' angle on bottom corner, at manufacturers' joint on control package.

8. One drop at a 45' angle on top edge along side panel.

9. One drop at a 45' angle on top edge along end panel.

10. One drop at a 45' angle on a top corner.

A performance evaluation should be based on the average performance of the control package (present package) compared to the same product and unit container in the proposed packages (shrink package). There will undoubtedly be damage in testing as in many areas the laboratory test will exceed the limits of normal transportation handling. The primary purpose, however, is to evaluate the proposed with that which is considered acceptable today, the control package. Favorable laboratory testing results will then justify actual shipping conditions authorized under the Test Shipment Permit program. Successful shipping experience will warrant publication of the new package to the National Motor Freight Classification.

One additional comment - expressing strength qualities of film by stating mil thickness is not reliable today with the many resins available. When submitting test results when applying for a Test Shipment Permit, also specify film material properties by use of ASTM testing methods, dart drop, tensile strength, percent

elongation, puncture and propagation of tear, percentage of shrink, MD and TD. This information is usually available from film supplier.

If we can be any further assistance, please advise."

Now, examine the feasibility of the tests that are requested. For instance, the impact test requires an 8 inch drop every 2 seconds. If the can rims (chime) will indeed cut through the film, a realistic test, such as vibration on a side or upside down will give more accurate, practical results. The Conbur test, although still a favorite with industry, is not an accurate gauge of railroad humping. Through the use of more sophisticated shock testing equipment, the Conbur test has been shown to be inaccurate and inadequate. Also, the comparison of two packages (existing and proposed) fails to acknowledge differences in a) freight weight, b) economic cost of packaging materials, c) handling, loading, and stacking characteristics, d) socio-economic factors, such as choice of materials in an energy short environment. The most obvious fault of these requests is that although an existing package may meet the specified requirements, this does not guarantee that the existing package does an adequate job, nor does it allow for the correction of bad (inefficient and inaccurate) testing procedures designated by rules and items as old as the packages themselves. Not only this, but there is no defined failure status. If a good, newly developed package is forced to withstand tests

that do not, in fact, simulate the physical environment, how can the results be valid for that environment? Yet this is the accepted governmentally regulated way of determining a good package!

A sample survey conducted at the American Management Association Packaging Show held in New York City, April 22-25, 1974, revealed various company attitudes.

Several years ago, General Electric invested $25,000 developing a new shipping package. The damage rate differential was approximately 5% -- a significant economic cost saver. The NMFCB reviewed the package and decided it had not warranted a test shipment permit. General Electric even though it had gone through all the steps necessary to prove the package, better than the regulation package, was denied the test permit on arbitrary grounds! As a result, General Electric prefers to adopt and modify existing approved industrial packages.

Chesebrough-Pond's attitude is similar, and they also prefer to use already classified packages.

The attitudes of material suppliers are slightly different, and somewhat disturbing. Goodyear, while supplying films and other materials, prefers to stay out of the classification problem completely, letting the customer worry about meeting the regulatory requirements.

National Testing Lab's also lets the customer carry the legal burden.

In a letter from David Lansdale, Director of Packaging at Scott Paper Co. he states that Scott Paper has "not applied for any classification exception since about 1950." He further says that they have done preliminary work, but have never followed through, largely, because they find a package that is already classified.

Throughout the world, great advancements in the packaging and transportation fields have been reported and implemented. The standardized pallet in Europe has made inter-country shipping move quickly and efficiently. In Sweden the shippers (packages) of grocery products also become the shelves, combining the advantages of packaging and physical distribution by eliminating 'make work' by allowing one container to be used at every point in the physical distribution channel. Although the U.S. has seen channel development such as the systems developed by Coca Cola, Pepsi, and L'Eggs, all private carriage, packaging and transportation have made little headway as a combined discipline here. Although there are several combined effect-causes for this, the main roadblock has been the Uniform Freight Classification and the National Motor Freight Classification Board.

Item 689, Test Shipment Regulation of the National Motor Freight Classification has been a detriment or deterrent to the United States Society because:

a) the existence of Item 689 has stopped real industrial packaging/transportation development

b) Item 689 promotes unnecessary and extensive wastage through the stoppage of innovation by allowing the continuing acceptance and use of packages that do not adequately perform the packaging functions, use excessive materials (usually corrugated board), and could easily be replaced by lighter, more efficient materials.

By discouraging innovative practices Item 689 costs the American consumer money (in excessive packaging and damage), time (in minutes and hours spent in claiming damage loss, returning the product and so forth), and valuable leisure hours (cost of frustration). Item 689 has caused ill feelings between packagers and shippers, government and industry, traffic department and packaging engineering department and the public sector of our society.

Packaging as a Modal Influence

With the establishment of the Consolidated Freight Classification and the subsequent National Motor Freight Classification, the packaging industry has been literally 'boxed in' by regulations. I have previously mentioned the National Motor Freight Classification and some of the complications it creates, but let's look further into the NMFC. The main purpose of this manual is to provide companies with the applicable rate structure for their particular products. Patterned after the railroad's own Classification, the NMFC was designed to 1) offer a competitive structure with the railroads and 2) to fulfill the requirements of the National Motor Carrier Act of 1935. There are other types of classifications, for example: the Coordinated Motor Freight Classification for shipments in the New England area. The rate is assigned by density, and when fragility or threat of pilferage is high, the rate increases significantly. The official express classification belongs to the REA (Railway Express Agency) and is somewhat simpler than the other classifications. REA has simple to follow rules that govern rates, ratings, packaging, refrigeration labeling, shipping of perishables, etc.[14]

The relationship of the package to the mode of shipping is often misunderstood. For example, if a company decided to manufacture and ship cigarettes -- here is what that shipping department must contend with.[32]

Item	ARTICLES	LTL	TL	MW
47760	CIGARETTES AND CIGARS GROUP: Articles consist of Cigars, Cigarettes, Snuff or Manufactured Tobacco, as described in items subject to this grouping.			
47770	Cigarettes, tobacco, with paper wrappers, see Notes, items 47772, 47774 and 47778 in boxes 25 united inches or more, length, width and depth added, see Note, item 47776, or Packages 895 or 1109	85	55	36.2
47772	NOTE - Wooden boxes must be so constructed, strapped or sealed as to prevent opening and pilferage of contents from boxes without breaking seals or mutilating container. Fibre boxes must be so closed and secured as to prevent pilferage of contents without mutilating container.			
47774	NOTE - When on same bill of lading, plastic cigarette cases may be included with shipments consisting of or including cigarettes, whether enclosed in the same or separate containers; the weight of the plastic cigarette cases not to exceed 10 percent of the weight of the cigarettes.			
47776	NOTE - Also applies when inner containers consist of ornamental boxes.			
47778	NOTE - TL shipments will also be accepted in lift vans. Shipper to load and consignee to unload. Bills of lading and shipping orders must be so endorsed and freight bill must show that loading was by shipper and unloading by consignee.			
47790	Cigars, tobacco, see Note, item 47772, in boxes 30 united inches or more, length, width and depth added, see Note, item 47792, or in Package 795	85	55	24.2

Item	ARTICLES	LTL	TL	MW
47792	NOTE - Will apply only on shipments in wooden boxes, or when cigars are in inner containers or humidors, fibre boxes may be used, providing they meet the following specifications: When gross weight of box and contents does not exceed 110 pounds, in fibreboard boxes testing not less than 275 pounds; when gross weight does not exceed 120 pounds in fibreboard boxes testing not less than 350 pounds; and when the gross weight does not exceed 165 pounds in corrugated fibreboard boxes not exceeding 77 united inches, with facings not less than .030 of an inch thick, testing not less than 500 pounds, provided flaps are glued throughout the entire area of contact and box is bound with four metal straps, two each way, crossing on top and bottom.			
47800	Kits, cigarette making, NOI, see Note, item 47802, in inner containers, in boxes	100	55	24.2
47802	NOTE - Provisions apply only on kits consisting of tobacco; cigarette paper or collapsed paper cigarette tubes; filters; and fibreboard boxes, folded flat; with or without cigarette making machines.			

SPECIFICATIONS FOR NUMBERED PACKAGES

Package 795 - In solid fibreboard inner containers having Mullen test of not less than 300 pounds enclosed in outer corrugated fibreboard box testing not less than 200 pounds, except that gross weight may be increased to not exceeding 100 pounds and flaps of box must be glued and taped.

Package 895 - In fibre boxes made of single-wall corrugated fibreboard facings of which are fibreboard weighing not less than 33 pounds per 1,000 square feet, combined board testing not less than 175 pounds, dimension limit 57 united inches, gross weight not exceeding 42 pounds.

Package 1109 - In fibre boxes complying with all requirements of item 222 for boxes testing not less than 175 pounds, except that weight may be increased to not exceed 50 pounds and dimensions must not exceed 53 united inches.

Any other type of packaging and the common carrier may, at his option, refuse to accept the shipment. Any other type of packaging and the insurance company may refuse liability claims. As one wades through the amazing number of package specifications there seems to be a preponderance of package specifications utilizing only corrugated board and kraft paper. In many cases the use of this board is excessive and wasteful. A prime example of this is the "F" packages for furniture. Damage rates using these packages have been found to exceed 50%, yet these packages still remain on the books. In a study done at Michigan State University School of Packaging, kitchen cabinets packaged by shrink wrap were found to have significantly lower damage rates (less than 10%).[31] Yet the "F" packages are still mandatory.

Packaging can and does influence the choice of transport mode. As in the above furniture case, the usage of common carriers was discontinued and a private fleet was the economic solution. In other cases contract carriers are the answer. Basically, the common carrier stands to lose much from the antiquated packaging specifications dictated by the National Motor Freight Classification Board.

Packaging can influence choice of mode both by affecting commodity ratings and the rates applied. That is, ratings

for an assembled product may be significantly higher than for a 2-part stacked package of the same item. If, by conforming with Item 222 of the NMFC the subsequent cube is large, or the packaging expense too great, another mode that circumvents the classification will be found. If the damage rate is too high, another mode will be used. The common carriers falling under this regulation will soon find themselves burdened with small volume shipments and short hauls and other low profit items because those companies wishing to avoid the problems created by the NMFC will revert to contract and private carriage and, these companies, from economic considerations, will be high volume, long haul companies. I am not implying that the decline of common carriers in the United States is solely caused by packaging regulations, on the contrary. Packaging is just one of the many problems facing the common carrier today. It is also one of the easiest to alleviate, by reorganizing the packaging regulations called for in the NMFC, or abolishing them completely.

Co-operative Interaction

While interviewing with many companies this past year, I asked extensively about the interaction of the transportation/shipping departments and packaging departments. In several companies the reply was "oh, we don't have any communication" or "we just don't talk"! Other companies have recognized the need for interaction and are initiating programs designed to bring the departments closer together. But, they are not quite sure how to do it. Coordination of a packaging/transportations/shipping operation involves the interaction of many marketing, cost accounting, warehousing and inventory procedures.

There is no simple way to take the departments, merge them, and expect instant solutions. For example: one young company, approximately 1500 employees, has a severe problem of multiple plant and office locations in various parts of the same city. The shipping manager has been with the company since its birth and has always packaged items his "own way." This generally means finding a box and stuffing it with foam or air cap until the product doesn't rattle and then sending it off, usually via air because of the delicate nature of the products. Packaging documentation for shipping purposes has been inadequate forcing the 'pack as you can' situation. Part of the shipping operation has been moved to a plant 20 miles from town, and most of the shipping warehousing has also been relocated. Another division of the company, however, retains its own shipping, warehousing and inventory

procedures. The packaging department of this company is about 5 1/2 years old and consists of 3 people. Until recently many segments within the company were not aware there was a packaging department, and even if they were aware, they were not sure of the packaging department's function. Now, as the company begins to feel the pinch of rising costs and materials shortages, the packaging department has suddenly become a focal point for problem solutions. The biggest task coordinates the packaging and shipping operation.

Utilizing all the various skills that can be brought into play in this type of an organizational structure, one begins to realize the importance of a total systems concept as stated earlier, not just in packaging or transportation, but in all company operations.

One of the most important things a company can do is recognize the potential of each department and make that potential known throughout the company.

A packaging department can and will

1. initiate new product/package designs
2. initiate new package/shipper designs
3. revise old packaging for

    a. economics

        1. material cost too high
        2. materials unavailable
        3. damage loss too high
        4. optimum material usage, maximum strength

b. esthetics

1. more compatible with company image
2. marketing push for old product

c. shipping

1. conservation of cube
2. warehousing/inventory facilitation
3. decrease in-transit damage
4. facilitate intracompany shipments

d. inventory control

1. stacking
2. picking order
3. stock rotation
4. handling procedures
5. quantity or unitized lots

4. keep up to date on the latest changes in the packaging world

a. materials

1. what suppliers can provide
2. availability of packaging materials
3. substitution of materials
4. where and how to procure needed materials
5. availability of new materials

b. machinery

1. locate new machinery designs that aid in the packing operation

2. learn who provides the machines at the lowest cost

3. determine the proper machinery for the company and in what phase of manufacture can they be utilized

c. design concepts

5. keep accurate watch on governmental packaging legislation

6. aid in product design

a. in the initial product design, packaging can often play a significant role in product formation by applying the packaging dynamics

of shock and vibration engineering to the product itself rather than relying solely on the container for protection concepts

b. packaging can be utilized as a strikingly effective marketing tool, as exemplified by the L'eggs pantyhose example

7. overall economics

a. materials pricing

b. quantity pricing

c. redesign of package; eliminate costly undesirable features

d. promote sales through appearance

The company's use of their packaging department greatly depends upon the level of managerial authority and status alloted to the department. In the young company mentioned above, the packaging department is treated much like an ancillary function, and is not utilized to its full potential.

Packaging is viewed as an end result, not as a continuing process. Testing for material verification for packaging specifications is crude, at best. Production is not willing to give up products to serve as test subjects. Although the developed packages from the department are good, with the addition of adequate equipment and company respect, they could be more than excellent.

Inter-departmental communication lines depend largely on the respect/status level of the participants. Much time is spent on creative thinking and innovating ideas, yet

without the channels to disperse the information and obtain accurate and intelligent feedback, all creative resources are lost. Communication flow should be a two-way system, much as in the distributions network channel system of information. Persons at the top of the status chain should not stifle new innovations and redesign. Similarly, all links in the chain must recognize each other as being a vital and significant section, none of which rank in greater or lesser importance. A smooth, efficiently run organization has no need for petty status/power politics.

A transportation department can and will:

1. provide accurate ratings and rate assessments on products
2. provide routings and services of the best transport mode at the least cost
3. integrate an inventory control system
    a. keep adequate supplies of properly specified shipping containers
    b. order only those supplies designated by engineering for packaging
    c. keep smoothly running finished goods inventory
4. organize and operate warehousing system
    a. facility location analysis for warehousing and storage facilities
    b. rent or own decisions for warehousing
    c. order picking systems within a warehouse structure
5. aid in production scheduling
    a. provide mode of transport best suited for

customers need, i.e. immediate, car load, regularly scheduled orders, etc.

b. assist in developing transport schedules to meet production time, thus eliminating the need for valuable storage space or eliminating unnecessary shipment delays

6. aid packaging in development of ideal shipping package

   a. provide packaging with governmental regulations regarding the particular product

   b. provide ratings information to help determine the optimum packing configuration

   c. provide details of storage environment

7. machinery

   a. determine what types of materials handling equipment can be utilized

   b. coordinate machinery with packing line for greater uniformity and accuracy in packing

8. economics

   a. report all damage claims or returned damaged products to packaging for further study and inspection

   b. report any suggestions that result in unitized pallet configurations or would aid in shipping units to packaging for possible redesign

   c. coordinate an optimum pallet configuration computer analysis for maximum stacking strength and space utilization

There are many areas where transportation/shipping and packaging overlap. In this climate of materials shortages compounded by skyrocketing materials prices, soaring transportation costs, and fuel scarcities, there exists a psychological need for similarly affected departments to band together to meet the onslaught. Initial steps that can be

undertaken to coordinate the packaging/transportation department and assuage some of the environmental indignities are:

1. Schedule a formal meeting of the packaging and transportation departments. This must be called by high level management. Attendees should include representatives from marketing/sales, production/purchasing, inventory control, quality control, manufacturing, accounting, computer analysis, and general management. Discussion topics should include:

    a. problems occuring in transit, i.e. damage, theft, losses, etc.

    b. materials shortages; procurement problems

    c. production scheduling

        1. when does the packaging function begin

        2. when does transport function begin

    d. shipping scheduling problems

    e. customer service responsibilities

        1. mode of transport

        2. bulk or individual shipment

        3. package appeal, graphics, labeling

2. If not already done, set up a series of shipping carton documentation

    a. Obsolete any and all packaging not specifically approved by the packaging department.

    b. Have shipping notify packaging of any items that have not been used in a 3-6 month period for a review status. Purchasing and inventory control (if separate) would be notified if package is obsolete.

    c. Review product line to determine the proper packaging and validate that procedure by actual packing observation.

3. Make certain that the level of managerial status is equal in both packaging and transportation departments and in a position of decision making authority.

4. Alert other departments of the proposed cooperative venture.

5. Encourage each department to aid the other and to ask for help whenever any difficulties arise.

A solid working relationship is desperately needed between packaging and transportation departments all over the country. It is only when these two functions learn that their interdependence is an asset, not a liability, and begin to accept and help one another, that we can ever hope to undo the excessive red tape in Washington and be able to manage efficiently and economically the myriad of packaging/transportation problems.

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