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# A Survey of Damage to Dry Groceries in Warehouses

Charles L. Goulston





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This report is published as part of a continuing research program to reduce the costs of marketing agricultural products from producer to consumer.

Research data for this report were gathered with the cooperation of 10 wholesale food firms. The author expresses appreciation to those firms for their invaluable contributions and to their management personnel for their knowledge and willingness to share it.

**Summary**

Mishandling and packaging deficiencies were the major causes of damage to dry groceries in a 1985 survey of warehousing operations by the Agricultural Marketing Service, U.S. Department of Agriculture. The 10 warehouses surveyed employed a variety of systems from conventional to fully automated. Recouping practices varied from almost nonexistent to extensive salvaging and repacking. Disposition of recouped merchandise ranged from selling at full price to donating the item to charity. Damage reduction efforts varied similarly from none to regularly scheduled employee meetings and incentive programs.

Few firms are fully aware of actual costs of damage, i.e., the many indirect costs over and above the value of the product lost. Many means are available to reduce damage; not all of them are economically feasible or applicable for any given firm. Suppliers must be willing to cooperate with their customers in resolving obvious packaging problems.

# A Survey of Damage to Dry Groceries in Warehouses

By Charles L. Goulston<sup>1</sup>

## Introduction

This report analyzes the findings of a 1985 survey of warehousing operations by the Agricultural Marketing Service (AMS), U.S. Department of Agriculture (USDA), to determine the cause of damage to dry groceries.

A USDA study in the early sixties<sup>2</sup> concluded that the cost of damage to dry grocery products<sup>3</sup> occurring in warehouses in the United States was over \$6 million a year. This figure did not include the cost of labor used to recoup damaged items nor any other indirect costs such as those discussed later. (Damage in institutional warehouses was not included.)

In a 1982 report by Michigan State University<sup>4</sup>, damage to dry grocery products was estimated at over \$15 million a year in the United States. This figure included damage during transportation from warehouses to retail stores in addition to that which occurred in warehouses. As with the earlier study, costs of recouping and other indirect costs were not included.

Based on the above studies and other available published material, it is apparent that the amount of damage to dry grocery products attributed to warehousing operations is substantial. In fact, if the cost of recouping damaged merchandise as well as the numerous indirect costs of damage are considered, the actual cost of damage to dry grocery products attributed solely to warehousing operations presently exceeds \$30 million annually.

A preliminary investigation of the problem by USDA revealed that the causes of retail store damage and the frequency of occurrence have not changed drastically in the last 10 or 15 years. The same can be said for damage resulting from rail and truck transportation. In contrast, many of the people interviewed perceived warehouse damage as a growing problem. Similar concerns were expressed by warehouse operators to their trade associations.

Following this preliminary investigation, the USDA conducted a survey of warehousing operations in 1985 with the following objectives:

- To identify causes of damage to dry groceries;
- To ascertain differences between operations, i.e., conventional vs. mechanized, and relate those differences to damage experienced;
- To determine the extent of damage and what, if anything, is being done to control it;
- To see how damaged goods are recouped and/or disposed of.

This report presents the findings of that survey.

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<sup>2</sup>Karitas, James J., Breakage and Damage in Grocery Warehouses and Retail Food Stores, MRR-652, U.S. Department of Agriculture, May 1964.

<sup>3</sup>"Dry groceries" generally refers to food items which do not require refrigeration and have a shelf life of over 2 weeks.

<sup>4</sup>Dry Grocery Losses in the U.S. Food Distribution System, Michigan State Univ., 1982.

## Methodology

All information was gathered by personally visiting each cooperating facility, observing its operation, and interviewing key warehouse personnel.

Dry groceries were the focus of the survey because they accounted for the major share of items handled and were the most frequently damaged.

In reporting the results of the survey every effort has been made to protect the anonymity of the participating firms without detracting from the usefulness of the findings.

## Description of Firms

A total of 10 wholesalers and chainstore operators cooperated with USDA in this study. Five firms were located in the Eastern United States, four in the Midwest, and one in the West. Although most of the cooperating firms operated more than one dry grocery warehouse, only one warehouse was surveyed for each firm. This permitted a greater variety of operations and policies to be examined.

In an attempt to look at a cross section of the industry, we surveyed facilities owned as follows: four by chain stores, three by member-owned cooperatives, and three by voluntary wholesalers. All the warehouses utilized conventional handling methods for some of their stock. (Conventional methods include the use of electric and manual pallet jacks as well as tow tractors and forklift trucks.) Five used conventional methods exclusively. One employed conventional methods except for the robots that were used to store and retrieve full pallets from backup storage. Three warehouses used mechanized order selection and assembly equipment, and one used a fully automated system.

Square footage allocated to dry groceries ranged from 200,000 to 800,000. Average inventory ranged from 400,000 to 1,900,000 cases<sup>5</sup>. The firms using mechanized systems reported that between 75 and 85 percent of all cases shipped were handled through that system; the remainder were handled conventionally. The firm using the fully automated system reported that about 38 percent of all cases shipped were handled in that manner, the remainder being handled conventionally.

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<sup>5</sup>The term "case," as used in this report, refers to the secondary container in which the consumer, or retail, packages are packed and shipped.

## Findings

### Causes of Damage

Considerable time was devoted in each firm to determining the causes of damage within the warehouse. Most of the causes mentioned in previous articles and earlier studies still exist.

Mishandling, also referred to as human error, is the first major cause of damage. Examples include:

1. Cases that are damaged by falling from the pallet load to the floor. This type of damage can occur during order selection or when the full pallet is bumped into the rack as it is being positioned in a slot or removed from the slot. (See figure 1.)

2. Cases that are damaged as a result of being "speared" by the tines of a forklift truck or being bumped by another part of the truck or pallet transporter.

3. Cases that are dropped by selector. This can be attributed to employee carelessness or excessive use of glue between cases, a problem that is discussed later. (See figure 2.)

4. Cases that are crushed by the weight of other cases. This often occurs when one full pallet is placed directly on top of another full pallet. (See figure 3.)



Figure 1.—Cases that have fallen from the upper rack because they were bumped during positioning in slot.





Figure 2.—Cases that have fallen from the pallet during selection.

In addition, there are numerous other examples of mishandling damage. It is important to note that mishandling is usually only a contributing factor to damage. In most instances of damage, at least one other factor may be implicated such as packaging, pallet condition, pallet stacking patterns, or narrow aisles. For example, many cases that fall from pallets as a result of bumping into the rack have been stacked so that they overhang the outer edges of the pallet. Cases dropped by the selector often have improperly glued flaps or a plastic shrink-type overwrap which cannot handle the strain. Damage caused by the tines of a forklift truck can be attributed to a deteriorating pallet, as well as to narrow or overcrowded aisles. Therefore, it is usually difficult to assign one particular cause to a damaged case.

Nearly every person interviewed cited packaging as the biggest single cause of damage. One or two felt that mishandling was the primary cause and ranked packaging second. As a group, the mechanized operators complained more about packaging than the conventional operators.

Packaging problems, in this report, refer to a broad category that includes the arrangement in which cases are stacked on



Figure 3.—Cases that have been crushed due to excessive stacking.

a pallet, pallet quality, the material of which a case is constructed plus the physical attributes of the case and its contents, e.g., the weight of the contents, the dimensions of the case, the size and count of the packages inside, the amount of empty space and supporting members (dividers) inside the case, and the manner in which the case has been sealed. Virtually all of these factors were mentioned as causes of damage by at least one person.

Packaging deficiencies appeared on many different brands of products. Nevertheless, a disproportionate share could be found on products with regional and private brand labels, possibly because manufacturers of these products had greater incentives to cut packaging costs.

The following are examples of packaging-related damage commonly seen and/or reported by the firms surveyed:

- Cases were crushed in several instances. This can be attributed to one or more packaging shortcomings including excessive air space inside the case, lack of adequate dividers or supports, and case material inadequate to support the weight of cases piled on the pallet. Not surprisingly, this type of damage increased manyfold when a second pallet was stacked directly on a pallet of the same type. (See figure 3.) The problem of crushed cases was especially noticeable with cases of plastic bottles containing liquids such as bleach and soft drinks.
- Some cases of canned food consisted of thin corrugated trays overwrapped with shrink-wrap. This resulted in a flimsy package that could not withstand the handling found in some warehouses.
- Excessive use of glue between cases to help stabilize the load made selection difficult and sometimes caused cases to fall because they were inadvertently attached to other cases.
- Cases overhanging their pallets were seen in nearly every warehouse. In most instances, the problem was that the size of the cases was incompatible with the pallet. In a few instances, the cases were simply placed carelessly on the pallet either by the shipper or by the receiving personnel in the warehouse. This often resulted in the breakdown of overhanging cases due to the pallet edge biting into the case. (See figure 4.)

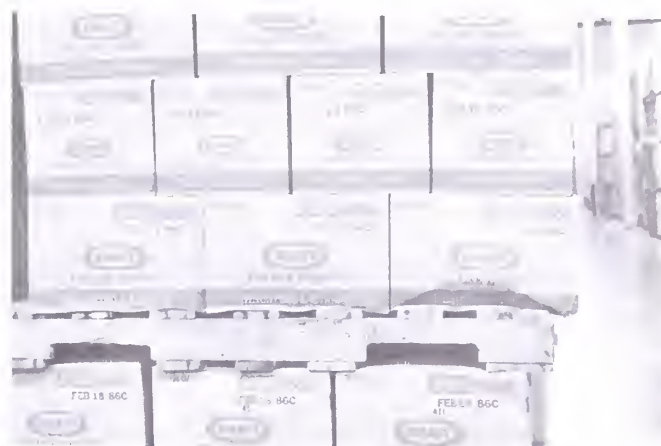


Figure 4.—Case damage caused by excessive overhang.

- Excessive tape around top layers of loaded pallets and pallets covered with shrink-wrap indirectly caused some damage because both materials interfered with the selection process, resulting in dropped or fallen cases. Furthermore, removal and disposal of the shrink-wrap was a nuisance.
- Condensation of moisture inside the warehouse caused some cases to collapse and some flaps to come unglued. (This problem is compounded when the cases overhang the pallet.)
- Bagged products such as dog food, charcoal, flour, and sugar were particularly susceptible to damage due to the minimal protection and stability provided by the outer bag as well as the retail package. Damage was often caused by nails or splinters protruding from the pallet or items falling from the pallet during transport or positioning.
- Pallets stacked in register resulted in excessive damage because of their lack of stability. Even some that were overwrapped with shrink-wrap tended to collapse or shift as the shrink-wrap was being removed. Assembling the pallet cubes with an interlocking pattern, would alleviate the problem. However, some manufacturers seem to find stacking cases on pallets in register more advantageous for them. (Stacking in register cannot be avoided if the length and width of the case are equal.)

- A few people complained about a decline in the quality of incoming pallets. This refers to cheaply constructed pallets, protruding nails, and missing or broken components. These factors all contribute to increased product damage.
- Only two or three firms felt that hidden damage was a serious problem. Hidden damage, in this case, refers to pallet loads that appear undamaged to the casual observer. But as cases are selected from the pallet, one or more damaged cases appear on the inside of the cube. Damage of this type was obviously not caused in the warehouse; the problem must be resolved between the wholesaler and the supplier.



Figure 5.—A pallet load of mixed cases being manually secured with shrink-wrap.



Figure 6.—A pallet load of mixed cases being shrink-wrapped by a robotic device.

- The multiplicity of case sizes, shapes, and weights makes it very difficult to assemble a stable, strong pallet load of mixed products to be shipped to retail customers. Consequently, full pallets occasionally tip over, resulting in several damaged cases. All the firms surveyed attempt to prevent this from happening by wrapping tape around the top layers of cases or by wrapping shrink-wrap around the top layers or around the entire pallet. (See figures 5 and 6.) Despite these efforts, some damage still occurs between the time the pallet load is assembled and the time it is wrapped.

## Recouping Operations

The policies and practices for recouping or salvaging damaged merchandise cover a wide spectrum. The same applies to disposing of damaged and recouped merchandise. Of necessity, independent wholesalers, for instance, cannot follow the same practices as chain store operators. Several firms mentioned that their labor costs prohibited any extensive recouping operations.

All firms surveyed expended some effort, in varying degrees, to separate unsalable damaged product from salable undamaged or slightly damaged product within the damaged case. Once separated, the unsalable product was disposed of and the remainder was handled in several different ways. In some firms, a credit slip was placed in the partial case to allow for any missing units, the case was taped shut, and it was shipped to the store as if it were a full case. Two other firms operated the same way, only without using credit slips. Those firms gave their stores flat credit allowances on all shipments from the warehouse to cover such partial cases or other minor damage. Generally, the chain store firms had the most flexibility in that they could establish policies for shipping *and* accepting damaged goods.

Some firms expended considerable effort cleaning off units which became soiled by spillage from other damaged units. One firm consolidated partially damaged cases until it collected enough salable units to make a complete case, then sealed the case and shipped it. Four firms accumulated assorted salable units from damaged cases, placed them in larger cases, such as banana boxes or tote boxes, and shipped them to particular stores or randomly selected stores. One such firm, a chain, did not charge the stores for the mixed cases, but two other firms billed the stores a fixed amount per case.

Several firms had particular outlets for slightly damaged units, either a retail store owned by the firm or a salvage buyer who paid a fixed price per master container of mixed items or a fixed percentage of book value. At least one firm contributed all usable damage to a local charity.

There are numerous variations and exceptions to the practices described above, depending on the degree of damage and the product involved. For instance, one firm sold all damaged name-brand merchandise to a salvage outlet but donated all private-label items to charity. Another firm operated a retail outlet for all salable damaged goods.

All the firms had personnel responsible for retaping cases whose flaps had come open. Usually this was done at or near the selection slot; one firm had such cases sent to the salvage department for retaping.

The number of employees reported to be working in the recouping operation varied from 1 to 30. These figures are not too meaningful because some of the recouping operations also handled damaged and undamaged cases returned from retail stores.

The recouping facility varied from one or two tables and pallets in a corner of the warehouse to a separate room with tables, shelves, and a sink. The firms doing the most extensive recouping and/or consolidating utilized about 1,000 square feet. One or two firms whose recouping operations included handling returns from stores utilized more space.

## Vendor Credits

Cooperators were asked about their policy for requesting credit for damaged merchandise from vendors. The responses varied widely. It appears that some vendor credit policies are the result of confidential negotiations between the vendor and the customer.

Nevertheless, some firms indicated that the only vendor credits they received were for damage directly attributable to faulty packaging. In those instances, the amount of credit ranged from partial to full cost. Several firms mentioned that certain vendors or manufacturers were very liberal in granting credits for damage regardless of where the fault lay. Although this study did not include damage occurring in retail stores, most firms indicated that nearly all vendors gave credit for items damaged in the stores.

## Damage Reduction

All cooperators were asked what, if anything, they were doing to reduce or prevent damage. Four of the firms felt that their damage experience was normal or better than normal for their type and volume of business. Therefore, they were doing nothing to reduce damage except for emphasizing the basics, such as making sure that new employees were properly trained, keeping aisles clear, and notifying vendors of packaging problems. The remainder of the firms indicated that they were more concerned about damage and were taking various steps to combat the problem.

Some of the methods mentioned were to hold periodic meetings involving representatives of management and labor to discuss problem areas felt to be a source of excess damage. Others held meetings to educate employees on improved handling practices or to review existing practices. Some firms requested that employees file a report whenever they caused damage. (Not all employees complied.) One firm had an incentive program in which money was contributed to the employee welfare fund when damage figures fell below a predetermined amount. The money was used to fund employee recreational activities. Another firm placed signs on the end of each warehouse aisle indicating the cost

of damage that had occurred in that aisle the previous week and which product was involved. This method was quite effective because it motivated personnel to exercise additional care in handling certain products, plus it showed them the dollar cost of damage. In addition, several firms posted signs around the warehouse alerting personnel to their responsibilities to prevent damage. (See figure 7.)

Tangible efforts to reduce damage were visible in all warehouses. Such efforts included wrapping outgoing orders with tape or shrink-wrap (figures 5 and 6), hanging safety nets between pallet slots and under elevated conveyors (figure 8), taping flaps on cases which came unglued, placing slip-sheets between pallets and bagged products (figure 9), and storing certain items in floor slots rather than in elevated racks.

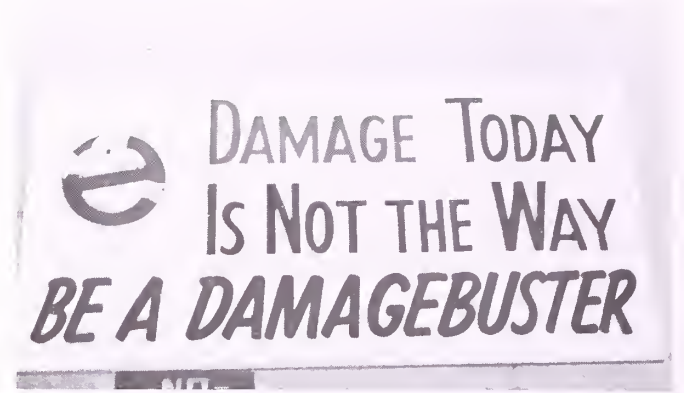


Figure 7.—A sign posted in warehouse to alert personnel to damage problem.



Figure 8.—Installation of nets at elevated conveyor turns to catch errant products (viewed from below).



Figure 9.—Use of slip sheet between pallet and bagged products.

### Damage Costs

Many factors contribute to the real costs of product damage. The most obvious is the wholesale value lost, or the difference between the wholesale value and the amount recovered through the sale of the damaged product. Other factors are indirect and include recouping costs, damage cleanup, credit memos, recordkeeping, supervisory time, extra handling, putting recouped merchandise back into the system, and replacing damaged merchandise discovered at the loading dock. These factors are certainly not all-inclusive and will vary from firm to firm, depending on operating procedures followed.

An attempt was made to gather damage figures, either in dollars or as a percentage of sales, from each cooperator. Some firms were reluctant to comply for reasons of confidentiality. Others were willing to divulge figures, but all figures were derived in a different way. For instance, one firm's damage figures included damaged items returned from the retail stores, another included losses from sales of close-dated merchandise at reduced cost, others included items that were recouped and subsequently sold as undamaged merchandise, and some included costs of recoup labor while others did not.

Notwithstanding the inconsistencies listed above, the damage figures that were reported ranged from 0.06 percent to 0.24 percent of sales. In addition, one firm reported that 0.24 percent of all cases passed through the recouping operation, and one firm reported that 0.18 percent of all cases were damaged in the warehouse. (It is unclear what percentage of these cases were recouped and subsequently sold either at full or partial price.) No hard conclusions should be drawn from these figures; they are provided only as rough indicators of the magnitude of damage.

After interviews were conducted in 10 wholesale food warehouses and their operations were observed, the following conclusions were reached:

*Damage to dry groceries in warehouses can be reduced.* For some firms the costs of reduction efforts would be minimal. For others, the costs would be considerable and, for some, probably not economically feasible.

*Inferior packaging is a major contributory cause of damage.* There is a need for dialogue between wholesalers and manufacturers to improve shipping containers. Improvements can be made in the areas of dimensions, strength of container, type and location of closures, stacking patterns, and uses of materials such as shrink-wrap, tape, and glue to improve pallet stability. Initially, manufacturers should attempt to comply with the packaging guidelines established by the Grocery Manufacturers of America in 1983. Portions of those guidelines are reproduced in the appendix. This subject is discussed further in "Opportunities in Shipping Container Design," by A. T. Kearney, Inc., January 1986, available from Food Marketing Institute, Washington, D.C. 20006.

*Human error is another major contributor to damage.* As pointed out earlier, few firms expend significant effort communicating to their employees the cost of damage and how to reduce it through proper materials-handling techniques and storage practices. Employees should be made aware of damage problems and should take an active role in programs aimed at reducing damage because they often know better than anyone else how to alleviate the problem.

*Work incentives and performance standards can influence the damage rate* because a large part of the damage can be attributed to employees working too fast and becoming careless. In establishing an incentive program, a firm must consider the tradeoffs between speed, accuracy, and damage. It would be advisable to include these factors in the performance standards.

*A multitude of physical deterrents to warehouse damage are available.* Such information is common knowledge to the industry and appears regularly in trade publications. Physical deterrents include signs, barriers, railings, safety nets, shrink-wrap, and the use of slip sheets between pallets and bags.

*Some firms experience an excessive rate of returns from stores.* This usually results in increased rates of damage. This refers mainly to goods returned due to the store management's decision not to accept everything that it originally ordered, or because the items delivered were not what the store ordered. The increased damage is caused by the extra handling to which the cases are subjected, i.e., reloading into the truck, shipping back to the warehouse, restocking, and reselecting. Returns can be minimized through the ap-

plication of proper managerial guidelines at both the warehouse and the stores, regardless of whether the stores are company owned.

*Damage rates between mechanical and conventional operations are not appreciably different.* The contributory causes of the damage, however, may differ. The mechanical operations, by nature, are more sensitive to inadequate container strength, improperly sealed cases, leaking cases, and related packaging deficiencies; one bad case can easily create a chain of problems resulting in several damaged cases. In a conventional operation, certain packaging deficiencies can be overcome by special handling or by employees exercising extra care in handling a particular case.

*Excess humidity in a warehouse can cause cases to weaken and flaps to come unglued.* This humidity is caused by condensation of moisture in the air and usually appears on the lower levels of storage. The problems created by excess humidity range from labels falling off cartons to stacks of cases tumbling to the floor. There are several techniques for alleviating humidity problems. One involves lowering the relative humidity by removing moisture from the air. This technique is usually expensive and is rarely economically feasible. The other technique involves ensuring that temperature distribution in the warehouse is uniform, i.e., temperatures at the lower levels are not significantly different from the rest of the warehouse. This alternative is usually more practical than lowering the relative humidity. Before committing substantial funds and effort to the solution of this problem, an engineering firm should be consulted. It is also possible that development and use of different glues would reduce the problems mentioned above.

*Warehouse management should monitor damage on a regular basis.* Monitoring requires gathering timely and accurate data on damage occurrences. In addition to recording data such as product identification, and number of cases damaged, salvaged, and recouped, the cause of the damage should be noted, especially for the most damage-prone products. This information will be useful in identifying specific problems to be brought to the attention of the manufacturer as well as problems that can be dealt with and alleviated within the warehouse.

*Management should be aware of the factors that contribute to the total cost of damage and keep adequate records so that the real cost of damage can be ascertained.* These factors include, but are not restricted to, the cost of goods scrapped, the cost of selling damaged goods at a reduced price, and the costs of recouping goods. Several indirect costs discussed earlier are more difficult to quantify. Warehouse damage data and costs should be isolated from in-transit and in-store damage data and costs. By accurately recording such information, management will be aware of any damage problems and can make informed decisions regarding their solutions.

## Appendix Grocery Industry Packaging Guidelines<sup>1</sup>

### A. Shipping Cases

Shipping containers must provide adequate product protection and be compatible with materials handling procedures from the end of the packing line to the retail shelf.

*Recommendation:* Efforts to standardize case dimensions and to seek modular fit with the 48 x 40 (122 x 102 CM) unit load base are encouraged, recognizing that each company must decide by itself what shipping cases and pallets it will purchase and use, which suppliers of such items it will deal with, and what prices it will pay for such items. Shipping containers should be designed to ensure maximum cubic space utilization in stacking and handling.

### B. Case Marking

Proper identification and handling of shipping containers is facilitated when case markings are concise and legible. Sufficient identification should be provided so that both manual and mechanized handling is achieved in an efficient manner.

*Recommendations:* Marking on cases should be on all four sides. In addition, top and bottom identifications are optional. Advertising messages on the case obscure shipping and unpacking instructions and should be avoided. However, promotional merchandise should be clearly identified.

Printing in single primary colors is suggested. Multi-colors for coding purposes is discouraged.

Case markings should identify the manufacturer, brand, pack, UPC or other codes with a minimum of other information. Case symbols should be located near the natural bottom of the case on all four sides.

Special opening advice or instructions can be helpful in minimizing cut-to-open damage. If a tear strip is used, the case should be so marked. In many instances an "X" cut on the appropriate panel can eliminate damage to contents and should be so marked.

### C. Case Shapes and Constructions

The shape and construction of a shipping case has an important influence on shipping, storing and handling methods. Both manufacturers and distributors, therefore, desire that shipping cases be designed for efficiency as well as compatibility within the total system.

*Recommendations:* Cases should be designed for efficient handling and stacking on the 48 x 40 (122 x 102 CM) grocery industry unit. The use of square cases is discouraged. However, the use of stabilizing films is recognized as an alternative to interlocking and a positive improvement in stacking strength and stability of all unit loads in storage and transit.

The case should be designed to incorporate efficiency and economy through the entire system. For example, tray-stacking capability incorporated into a case that performs well in shipping and storing should be considered when cases are designed. Continuing research and development to improve construction and utility is encouraged.

Case quantities should be routinely reviewed for overall response to optimize manufacturing, wholesale, and retail operations. Content quantities should be consistent with the functional needs and costs of the product.

Multi-case promotion units should be designed for handling at stores with a minimum of mechanical assistance. These units should be designed for normal storage and handling on the 48 x 40 (122 x 102 CM) pallet.

### D. Placement of Goods in Case

The proper placement of goods in the case can enable distributors to reduce labor costs.

*Recommendations:* Merchandise should be packed end to end, with preferably no more than two layers in a case, to eliminate the necessity of opening cases on the sides or bottoms.

Items should be placed in the case in such a manner as to facilitate the use of modern price marking tools, and if necessary, the outside of the case should contain price marking instructions.

### E. Pallet Exchange

While there are other methods of unit load handling in the grocery industry, many manufacturers and distributors choose to use the standard wooden pallet for all or part of their operations. When pallet exchange between manufacturer, carrier, or receiver is used, the following guidelines can help reduce costs and maintain effective operation of the system.

*Recommendations:* Use the "Standard" 48 x 40 (122 x 102 CM) four-way entry grocery pallet. Exchange pallets immediately for pallets of equal quality and quantity.

Continuing development of different pallet and slip sheet methods is encouraged.

Shippers, carriers and receivers should give major attention to the order quantity requirements and the rules for pallet exchange unique to each transaction.

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<sup>1</sup>Trade Practice Recommendations for the Grocery Industry, pp. 9-11, Grocery Manufacturers of America, Inc., 1983.





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