PHYSICAL HANDLING SYSTEMS OF SHELL EGGS
BETWEEN PLANT AND STORE

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The author discusses distribution costs for shell eggs holding distance constant and emphasized alternative types of handling equipment and master cases.

Traditionally, considerable attention has been directed toward identifying and minimizing costs associated with the production and processing of shell eggs, whereas the handling and transporting of these eggs from the end of the packing line to the retail outlet have not been given as much attention. Because of rapidly rising costs of labor and equipment, more emphasis is now being directed toward the distribution of shell eggs. The effectiveness of distribution includes being able to recognize and understand alternative systems and subsystems of distribution.

The following discussion is comprised of a cost comparison between two systems of handling and transporting shell eggs from the end of the packing line to the display shelf in retail stores. These systems are direct-store delivery--from packing plant to retail store, and warehouse-to-store delivery-- from packing plant to and through a central distribution warehouse to retail store.

During the last five years, two analyses of these two delivery systems have been published.[1,2] Those studies emphasized the difference in costs between systems and the major variable was the distance between the packer and the retail outlet. In the present study, distance was held constant and alternative types of handling equipment and master cases were emphasized. Therefore, differences in costs are shown between and within systems.

This study was conducted in three large egg packing plants, one each in Virginia, Maryland, and Pennsylvania; three food distribution warehouses in the Washington, D.C. metropolitan area; and nine retail outlets that receive eggs from the three warehouses.

Although two sizes of master cases were evaluated, all costs are expressed in a "per 30-dozen case" equivalent basis. Costs and design of egg cartons were not studied.

This discussion is divided into three parts: packing plant, distribution, and retail store.

PACKING PLANT

Shell eggs at the packing plant are moved from the end of the packing line to the cooler for storage, and then into the delivery vehicle.

Costs of handling were determined for a manual, an electric pallet jack and for three types of master cases. There were 24- and 30-dozen collapsible cardboard cases, and 30 dozen noncollapsible

(one-way) cases. Because two of the three types of master cases were paid for by the packing plant, total cost of all cases was allocated to the packing plant.

Total costs per 30-dozen case for labor, equipment and cases for moving shell eggs from the end of the packing line through refrigerated storage, and handstacking in the delivery vehicle (Table 1) ranged from $.08 with an electric pallet jack and a 30-dozen, collapsible case, to $.28 with a manual pallet jack and a 30-dozen, one-way case.

The master case cost per trip ranged from $.05 for the 30-dozen collapsible case to $.24 for the 30-dozen one-way case. Costs differed widely between case types because collapsible cases can be used a variable number of times and one-way cases generally are not reused.

DISTRIBUTION

For both systems, the average trailerload at the packing plant was about 15 tons, and the average one-way distance between plants and destinations was slightly under 150 miles.

The warehouse-to-store system, part of which is the basis for distribution costs of the direct-store system, will be reviewed first.

Warehouse-to-Store

Within the warehouse-to-store system, distribution was divided into three segments.

The first involved the delivery of shell eggs from the packing plant to a central distribution warehouse and included all costs incurred by the truck and driver from the time the vehicle departed from the packing plant until it

returned. This amounted to about $.21 per 30-dozen case.

The second segment included those costs occurring at the warehouse from the time incoming vehicles backed up to the dock, to the time outgoing vehicles were loaded (Table 2). Costs were for unloading and moving eggs into storage, warehouse rental, assembling, and loading out on delivery trucks. These costs ranged between $.07 and $.08 per 30-dozen case depending on case size.

The third segment involved delivery of shell eggs from warehouse to supermarkets. Loads ranged from 7 to 11 tons and round trip distance between warehouse and retail stores ranged between 45 and 70 miles. This amounted to $0.27 per 30-dozen case.

The total labor, equipment, and warehouse rental cost for these three distribution segments of the warehouse-to-store system (Table 3) ranged from $.55 to $.56 per 30-dozen case depending on case size at the warehouse.

Direct-Store

Packing plant owners and managers reported that delivery costs for direct-store delivery to retail stores were based on the same costs as shipping to central warehouses plus a minimum of $0.01 per carton differential. Based on this information, the cost to deliver direct from plant to retail outlets was $0.51 per 30-dozen case as shown in the following calculations:

Let D = cost per 30-dozen case

A = cost differential per dozen eggs ($0.01)

B = cost per 30-dozen case to ship from plant to warehouse ($0.21)

Table 1. Cost per 30-Dozen Case for Labor, Handling Equipment, and Cases to Move Shell Eggs From End of Packing Line, Through Refrigerated Storage, to Handstacked in Delivery Truck using Three Types of Cases, Two Case Sizes, and Two Types of Equipment.

Type of Case	Manual Pallet Transporter				Electric Pallet Transporter			
	Labor	Equipment[1]	Case	Total	Labor	Equipment[1]	Case	Total
24-dozen, 275-lb. bursting strength, collapsible	$0.043	$0.002	.074	$0.119	$0.033	$0.004	$0.074	$0.111
30-dozen, 200-lb. bursting strength:								
Noncollapsible	.035	.001	.240	.276	.026	.003	.240	.269
Collapsible	.035	.001	.054	.090	.026	.003	.054	.083

[1] Includes cost of pallets.

Table 2. Costs per 30-dozen Case for Labor, Handling Equipment, and Warehouse Rental to Unload, Assemble, and Load Shell Eggs at Warehouse Using Electric Pallet Transporter and Two Case Sizes

Case Size	Labor	Handling Equipment	Warehouse Rental	Total
24 Dozen[1]	$0.052	$0.004	$0.025	$0.081
30 Dozen[1]	.043	.003	.025	.071
30 Dozen[2]	.044	.003	.025	.072

[1]Cost based on 30 cases per pallet at unloading.

[2]Cost based on 25 cases per pallet at unloading.

Table 3. Total Distribution Costs per 30-dozen Case Between Packing Plant and Retail Store by Two Delivery Systems

| Case Size | Direct Store | Warehouse-to-Store | | | Total |
		Plant to Warehouse	Through Warehouse[1]	Warehouse to Store	
24 Dozen	$0.513	$0.213	$0.081[2]	$0.270	$0.564
30 Dozen	.513	.213	.071[2]	.270	.554
30 Dozen	--	.213	.072[3]	.270	.55

[1]Based on data in Table 2.

[2]Cost based on 30 cases per pallet while unloading at warehouse.

[3]Cost based on 25 dozen cases per pallet while unloading at warehouse.

Then D = 30 A + B = $0.30 +
$0.21 = $0.51

Total Costs

Table 3 shows the total distribution cost for each delivery system between packing plant and retail store. Distribution cost for the direct-store system amounted to $0.51 per 30-dozen case. Cost for the warehouse-to-store system ranged from $0.55 to $0.56 per 30-dozen case depending on case size and pallet load at the warehouse.

RETAIL STORE

At the retail store, handling methods for direct store receipts differed from warehouse-to-store receipts because the truck came directly from the packing plant and the cases of eggs were not palletized in the trailer.

Information was obtained on labor productivity, and costs were determined from tractor-trailer arrival at the store to the storage of eggs in the display shelves.

An electric pallet jack was used to unload palletized eggs from trailers which came from warehouses and 2-wheel handtrucks were used for direct-store receipts. Receipts were moved from trailer to cooler storage in the store.

Three types of equipment were used to move cases of eggs from cooler storage to display counter in the store: a manual pallet jack, or either a 2- or 4-wheel handtruck.

In addition to unloading and transporting to cooler storage, and moving from storage to display shelf, times and costs were analyzed for reworking old cartons on the display shelves, opening cases, marking prices, and stocking shelves.

Table 4 shows the total labor and equipment costs to unload and handle shell eggs at the retail store using two case sizes and various types and combinations of equipment. The data are arranged to express costs for particular handling equipment combinations and not for individual pieces of equipment. Depending on the particular combination of equipment and cases, costs ranged from $0.23 per 30-dozen case to $0.41. The low figure was possible only with palletized receipts from the warehouse.

COSTS OF TOTAL SYSTEMS

Table 5 and Figure 1 compare the total costs to handle and transport shell eggs from packing plant to the retail store display counter by direct-store and warehouse-to-store delivery systems. Three types of master cases are shown for each system. The data were developed from the most efficient handling equipment studied for each system.

The most significant finding of this study was that costs differed more within than between the two systems.

Within the direct-store system, lowest cost was slightly under $0.91 per case with the 30-dozen collapsible case. Assuming a 650 case trailerload, this amounts to almost $589 per shipment.

Within the warehouse-to-store system, lowest cost was slightly over $0.86 per case or $562 per shipment-- also with a 30-dozen collapsible case.

The difference in costs between systems, with the most efficient cases and equipment for each system, was $0.042 per case or about a $27 savings per shipment with the warehouse to store system.

The difference in costs within each system when comparing the 30-dozen collapsible case with the 30-dozen

Table 4. Total Labor and Equipment Costs per 30-dozen Case to Unload and Handle Shell Eggs at Retail Store Using Two Case Sizes and Various Types and Combinations of Equipment.

Function and Equipment		24-Dozen Case	30-Dozen Case
Unloading	Handling to Display Counter		
Electric Pallet Jack[1]	Manual Pallet Jack	$0.267	$0.229
	2-Wheel Handtruck	.312	.266
	4-Wheel Handtruck	.263	.226
2-Wheel Handtruck[2]	Manual Pallet Jack	.360	.304
	2-Wheel Handtruck	.406	.341
	4-Wheel Handtruck	.356	.310

[1] Warehouse to store delivery system only.

[2] Direct delivery system only.

noncollapsible case amounts to $0.185 per case or a $120 savings per shipment with the collapsible case.

FOOTNOTE

[1] Jackson, Geoffrey H. and Olan D. Forker. An Analysis of Factors Influencing Shell Egg Distribution Costs. Dept. Ag. Econ. AE Res. 318, Ithica, N.Y.; Cornell University, 1970.

Vertress, James G. and Henry E. Larzalere, Factors Affecting Shell Egg Distribution Channel Costs. Dept. Agr. Econ., AE 214, East Lansing, Mich., Michigan State Univ., 1972.
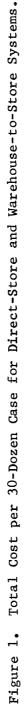
Table 5. Comparison of Total Costs per 30-Dozen Case to Handle and to Distribute Shell Eggs From Packing Plant to and Through Retail Stores by Direct-Store and Warehouse-to-Store Delivery Systems Using Three Types of Master Cases.
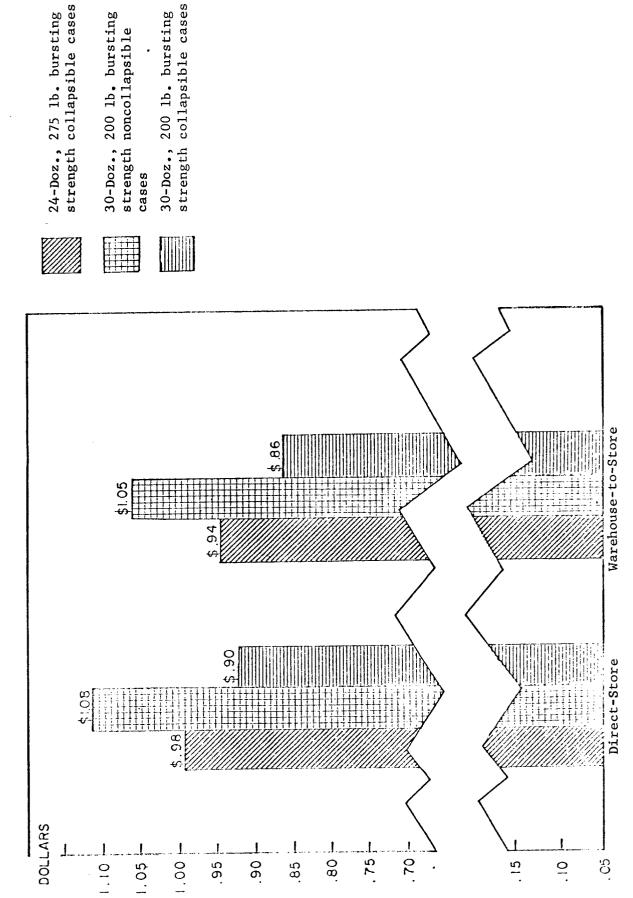
Delivery System and Type of Master Case	Packing Plant[1]	Distribution[2]	Retail Store[3]	Total
Direct-Store				
24-Dozen, 275 lb. bursting strength, collapsible	$0.111	$0.513	$0.356	$0.980
30-Dozen, 200 lb. bursting strength, noncollapsible	.269	.513	.310	1.092
30-Dozen, 200 lb. bursting strength, collapsible	.083	.513	.310	.906
Warehouse-to-Store				
24-Dozen, 275 lb. bursting strength, collapsible	.111	.564	.263	.938
30-Dozen, 200 lb. bursting strength, noncollapsible	.269	.554	.226	1.049
30-Dozen, 200 lb. bursting strength, collapsible	.083	.555	.226	.864

[1] Based on using electric pallet jack at packing plant.

[2] Based on data in Table 3.

[3] Based on data in Table 4, since all eggs were assumed to be shipped unpalletized from packing plant, unloading at retail store for direct-store delivery system was based on 2-wheel handtruck, whereas unloading at retail store for warehouse-to-store system was based on electric pallet jack because eggs were palletized at warehouse and so shipped to retail stores. Handling to display counter was based on 4-wheel handtruck.

Figure 1. Total Cost per 30-Dozen Case for Direct-Store and Warehouse-to-Store Systems.

Legend:
- 24-Doz., 275 lb. bursting strength collapsible cases
- 30-Doz., 200 lb. bursting strength noncollapsible cases
- 30-Doz., 200 lb. bursting strength collapsible cases