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Potential for Consolidated Delivery of Vendor Items to Retail Food Stores

Contents

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Potential for Consolidated Delivery of Vendor Items to Retail Food Stores

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Summary

Industry statistics show that the average chain supermarket receives three deliveries from the warehouse each week, compared with 98 direct store deliveries weekly from 35 vendors. The warehouse items account for about 75 percent of retail store sales, while deliveries from vendors account account for 25 percent.[2] Based on these statistics, it appears possible to improve distribution efficiency and reduce fuel consumption through consolidated warehousing and delivery of vendor items.

The cost for direct store delivery averaged $1.131 per case, while projected cost for the consolidated system totaled $0.688 per case with five deliveries per week and $0.726 with six deliveries. With five deliveries per week, this potential 39-percent savings, $0.443 per case, amounted to an average savings of $617.98 per week for each of the two stores studied that received an average 1,395 cases per week by direct store delivery. With six deliveries the potential 36-percent savings, $0.405 per case, would total $564.97 per week per store. Projected savings for a 50-store group, within a 20-mile radius of the consolidated warehouse, would total more than $1.6 million annually for five deliveries and nearly $1.5 million annually with six deliveries. While consolidated warehousing and delivery will maximize savings in the total distribution system for vendor items, it is likely that any method that will consolidate direct store deliveries will reduce system costs.

Many inefficiencies exist with direct store deliveries when compared with warehouse deliveries. These include: small size deliveries; expensive delivery equipment standing idle while the delivery person waits to have the order checked, arranges displays and services the store, and waits to have return merchandise checked; and use of more highly paid personnel for stocking displays. Typically, vendors use direct store deliveries for bakery items, cookies, crackers, spices, chips, ice cream, luncheon meats, milk, books and magazines, greeting cards, tobacco, health and beauty aids, and beverages.

Two types of direct store deliveries are used. One is basically a "rolling warehouse" or truck with sufficient inventory of each item for that day's route, operated by a driver-salesperson. At the store the driver straightens the product on the shelf or rack, removes damaged and out-of-code product, and writes an order in anticipation of sales. Product removed is checked by store personnel and returned to the truck. The driver assembles the order at the truck, has the assembled order checked by

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[2]Progressive Grocer magazine, Vol. 60, No. 4, April 1981 and Vol. 59, No. 12, November 1980.

store personnel, price-marks the product, and stocks the shelves.

The other system can be called a separate delivery or advance sales system in which a salesperson comes to the store, straightens the shelf, rotates the merchandise, writes the order, and telephones the order to the warehouse. A truck delivers the ordered product to the store, and the salesperson later returns and stocks, price-marks, and rotates the product on the display.

This study reports results of observations on direct store delivery in two supermarkets—one a corporate chain store and one independently owned. All activities of the vendor and store personnel in direct store deliveries, such as product handling, checking, and paperwork, were measured. Costs were determined for each activity on a per-case basis; a tray or basket of bakery product was regarded as a case.

This report also includes costs developed from eight vendors handling four product groups. Costs measured include labor, vehicle, and billing customers. Observations include billing and handling methods. Researchers traveled with the vendors in order to measure distance, travel time, delays, and other factors that must be considered in direct store deliveries as well as consolidated deliveries.

The consolidated delivery system as developed in the study uses store personnel for ordering, removing out-of-code product, stocking fresh product, and maintaining shelves. The consolidated warehouse and delivery personnel receive store orders and develop a consolidated order for each supplier, place orders with suppliers, receive bulk shipments from suppliers, prepare store invoices, assemble store orders, and deliver a consolidated order to each store either 5 or 6 days per week.

Advantages of the proposed consolidated delivery system include: store or headquarters control over vendor items, quantities, shelf space, prices, and frequency of ordering; substantially lower costs; simplified invoicing and accounts payable; data available on product movement; number of vendors and order frequency can be altered as needed with little effect on efficiency; and store control over display appearance. Disadvantages include: the store must order in advance, store personnel are needed to stock and police shelves, vendors lose merchandising ability and depend on store personnel to maintain their product displays, and procedures for handling out-of-code and damaged product must be established.

With continued need to conserve energy and reduce costs in distributing food products, this research was initiated to determine the feasibility of consolidated warehousing and delivery of items usually delivered directly to stores. Industry statistics show that the average corporate chain supermarket receives 3.0 deliveries from the warehouse each week, as compared with 98 direct store deliveries weekly from 35 vendors. The items delivered from the warehouse account for almost 75 percent of the food store sales while direct store deliveries account for only 25 percent of sales.[3]

The above statistics indicate that many deliveries by vendors are small. More miles and stops are required to deliver a truckload of product compared with full-trailerload shipments for warehouse-delivered products. Added costs are incurred by expensive delivery equipment standing idle while the delivery person services the store display. Also delivery personnel are usually more highly paid than store personnel who would price-mark and stock displays of product delivered from warehouses.

The use of consolidation to improve distribution efficiency is not a new art; it has been in use for decades in the mercantile trade, such as by department stores, discount stores, clothing retailers, and many others. It is the accepted practice for movement of merchandise in several areas of distribution: "Destination" consolidation serves the function studied in this project, receiving bulk shipments and assembling them into consolidated loads for nearby retail outlets; "Point-of-origin" consolidation collects small shipments from nearby suppliers to create consolidated shipments to stores, warehouses, and distribution centers.

Mass distribution of foods through supermarkets preceded the development of the distribution center concept for supplying the supermarket. Prior to and immediately following World War II, corporate chain warehouses as well as voluntary and cooperative group warehouses were principally distributors of dry groceries. Most supermarket organizations obtained products such as fresh fruits and vegetables, frozen foods, paper, cereals, meats, and dairy products from local speciality distributors who made direct deliveries to the store.

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[3] *Progressive Grocer* magazine, Vol. 60, No. 4, April 1981, and Vol. 59, No. 12, November 1980.

Initially, paper, cereals, frozen foods, and health and beauty aids were added to the warehouse and delivered with groceries. Health and beauty aids required little adaptation to regular warehouse handling methods for groceries, and frozen foods could be delivered to supermarkets on the same delivery trucks with groceries, using dry ice and insulated containers. Produce was generally the next line added, using many of the sales and warehouse handling techniques applied to groceries. Processed meats and dairy products were consolidated at the wholesale warehouse through a packer shipment program, and fresh meats were added as hanging quarters and later as primal cuts or boxed meats. Some warehouse distribution centers also deliver private label bread, milk, eggs, and other perishable products.

Even though warehouse distribution centers supplying retail stores have become relatively complete supply centers, other supliers are needed. Such suppliers, normally called vendors, deliver directly to retail stores such items as competing brands of bakery products, soft drinks, milk, ice cream and other dairy products, luncheon meats, some health and beauty aids, greeting cards, books, magazines, tobacco, and other miscellaneous products. There has been little apparent reduction in the number of direct store deliveries in recent years, and it appears unlikely that such deliveries will be further reduced unless there is a change in the method of handling and distributing direct store delivery items.

In this report, the concept of consolidated warehousing and delivery is applied to vendor-delivered bread and bakery items, soft drinks, chips and snacks, and cookies.

Some commodities, such as milk, delicatessen products, and ice cream, have special handling requirements and may utilize other forms of consolidation to reduce distribution costs. For example, they can be transported in compartmentalized delivery vehicles that have refrigerated and nonrefrigerated zones. It may be advantageous to deliver perishable direct store delivery items with a separate refrigerated truck. While consolidated warehousing and delivery will maximize savings in the total distribution system, it is likely that any method that consolidates direct store deliveries will reduce system costs.

The objective of this study was to determine costs for the present direct store delivery system (DSD) and to project costs for delivery of DSD items from a consolidated distribution warehouse. To achieve the objective, two supermarkets were selected to cooperate in the study. Each market was surveyed for 1 week to obtain the number of product items, cases, and vendor orders received each day. Arrival and departure time was obtained for each vendor delivery as well as a description of handling methods and equipment that each vendor used. Store personnel time was measured for checking vendor returns and deliveries and for processing invoices. Costs were developed for each activity on a per-case basis counting a tray or basket of bakery product as a case.

One of the cooperating stores was a regional corporate store located in an enclosed shopping center. The store had 24,000 square feet of sales area and weekly sales averaged $70,000. Direct store deliveries amounted to 36.1 percent of the total cases of dry groceries received at the store. During the week of the study, 88 direct store deliveries were received from 39 vendors, excluding 5 deliveries from the corporate store bakery.

The second cooperating store was an independent supermarket located in a small shopping center with 28,000 square feet of sales area and average weekly sales of $125,000. Direct store deliveries amounted to 33.4 percent of the total cases of dry groceries received. During the week of the study, 115 direct store deliveries were received from 40 vendors.

Labor and vehicle operating costs were obtained from records maintained by four vendors. The researcher traveled with eight vendors for 2 days each to obtain travel time, mileage, delays, and other factors associated with vendor deliveries. Records were kept on cases delivered at each stop and on labor costs by such functions as unloading, travel into the store, stocking, checking and ordering, and handling returns and empty containers. The eight food product vendors delivering nonrefrigerated products included two vendors of bread and bakery products; two, chips; two, soft drink; and two, cookies and crackers. The bread and bakery product vendors averaged 25 stops per day, the chip vendors averaged eight stops, and the cookie and cracker vendors averaged 13 stops per day. One of the major problems found in vendor deliveries was the close timing in servicing supermarkets, particularly when store personnel did not open their stores for receiving as scheduled. Many supermarkets require stocking of vendor items prior to opening, especially in the bakery department.

Comparison of Direct Store Delivery and Consolidated Delivery of Vendor Items

Based on information obtained in the study and simulations from standard data, a cost model for the consolidated warehouse distribution of DSD items was developed. This cost model includes delivery cost from vendor plant to consolidated warehouse; cost by warehouse function, including occupancy, materials handling equipment, and labor; delivery costs to the supermarket, including vehicle and labor; in-store handling costs, including price-marking, stocking, and handling returns; retail store cost for checking the order and processing invoices, as well as projected costs for ordering under the consolidated warehousing system; and billing costs for vendor and consolidated warehouse.

Figure 1.—A vendor driver-saleman determines store shelf needs before assembling the order in his truck.

All marketing systems have advantages and disadvantages. It is necessary to compare the strengths and weaknesses before deciding whether a new system should be adopted. Certain trade-offs will need to be made in the evaluation. One system may provide advantages at the retail store and at the same time incur additional costs in other parts of the system. Such factors must be carefully evaluated. Strengths and weaknesses of both direct store delivery and consolidated warehousing and delivery are presented, based on observations during the study.

Strengths and Weaknesses of Direct Store Delivery

Direct store delivery, when compared with consolidated warehousing and delivery, includes the following advantages:

- Orders are prepared at the shelf (fig. 1) and selected from the truck, resulting in delivery based on shelf needs (The vendor is more likely to be sure of having the desired quantity and mix of items on display that will result in maximizing sales and minimizing out-of-code losses with the rolling warehouse method of direct store delivery.);

- The vendor salesperson is more likely to maintain shelf allocations and other merchandising factors that will maximize both vendor and retail sales and profits than store clerks who may have other responsibilities;

- Vendors have control over distribution of their products; and

- The retail store has "free" labor for stocking and maintaining approximately one-third of the merchandise.

Direct store delivery, when compared with consolidated warehousing and delivery, includes the following disadvantages:

- The system is more costly and energy inefficient;

- With few exceptions, shelf appearance deteriorates without interim stocking, as compared with other departments where shelf appearance is maintained by store personnel;

- To overcome the problem of display appearance, additional deliveries would be needed, which would substantially increase costs;

- It is difficult for the store and management to control the items displayed, prices, and inventories with vendor competition for shelf space;

- Security can be difficult with the number of vendors entering and leaving the store during the early part of the day (fig. 2); and

- Invoicing and accounts payable procedures are difficult and inefficient with the number and variety of invoices.[4]

Strengths and Weaknesses of Consolidated Delivery

Consolidated warehouse delivery for vendor items, when compared with direct store delivery, includes the following advantages:

- Store management personnel control the items stocked, quantities on display, prices, and shelf space allocations;

- The total system costs are substantially lower;

- Fewer invoices are needed, with byproduct information more accessible on such factors as item movement, gross and net profit by department, and item;

- Frequency of ordering can be changed with little or no effect on efficiency since there will be daily deliveries from the consolidated warehouse; and

- Additional vendor items can be added that may contribute savings to the total distribution system.

Consolidated warehouse delivery, when compared with direct store delivery, includes the following disadvantages:

- Ordering must be done in advance of delivery, usually some time during the day previous to delivery, rather than at the moment of delivery, thus increasing chances of excessive or insufficient shelf inventories and increased losses of perishable products;

Figure 2.—Congestion is created by several vendors serving the retail store at the same time.

- Competition for sales and shelf allocation by commission-paid salespeople at every delivery will be diminished (This does not preclude some kind of vendor sales effort, although such effort has not been included in the cost analysis);

- The retail store must provide personnel to price, stock, and maintain vendor product displays; and

- Procedures must be established for handling out-of-code and damaged product.

[4]A study is underway sponsored by the Food Marketing Institute and Grocery Manufacturers of America to develop guidelines for standard vendor delivery invoice. See *Supermarket News*, Dec. 1, 1980, p. 19.

Existing Direct Store Delivery Methods and Costs

Direct store deliveries are accomplished with two basic systems, described below. One is called a "rolling warehouse," or a truck with sufficient inventory of each item for the day's route, operated by a driver-salesperson. The other system is called a separate delivery.

Rolling Warehouse System

The rolling warehouse system typically operates with a driver-saleperson. The vendor drives a van or truck for store delivery of items such as bakery, chips, and snacks or drives a special side-loading truck for soft drinks. The trucks have an adequate inventory of products for each day's delivery.

Upon arrival at the retail store, the driver straightens items on the shelves, removes damaged and out-of-code product (fig. 3), prepares an order anticipating sales before the next delivery, and minimizes out-of-code losses. The driver then selects the order from truck stock, fills out and extends the invoice, and moves the product into the store (fig. 4) using dollies, rolling racks (bakery products on trays), two-wheel hand trucks (soft drinks, chips, and snacks), store stockcarts (large deliveries, particularly soft drinks), or store shopping carts (small orders).

Figure 3.—A vendor driver-salesman returns out-of-code product to the truck.

Figure 4.—Driver-salesman moves product into the store via the front door.

A store clerk checks the delivery with the invoice and credit slip for product removed (fig. 5). In some cases product removed is replaced with fresh product, involving no credit. Invoices received at the store vary considerably by vendor but are usually preprinted by item and price in "menu" form. Some of the invoices are pegboard multiple-part invoices used for weekly recapping.

After the product and invoice are checked by store personnel, the driver price-marks the product, stocks the shelves (fig. 6), disposes of the trash, and/or arranges empty cases and other packaging materials for transport back to the truck. Where bottle and can returns are required, the driver picks up cases or bags of empty bottles and cans; records the number on the invoice; has empty returns checked by store personnel; and returns to the truck to load product, packaging material, bottles, and cans that have been removed from the store.

In this study, the authors found that approximately one-third of the soft drink vendor's time was associated with bottle and can returns, when required. This occurred even though the bottles and cans were sorted by vendor at the bottle-receiving station in the store. In this study, the time for handling bottle and can returns was excluded.

Figure 5.—A store clerk checking product delivered with the vendor driver-salesman.

Figure 6.—A vendor driver-salesman stocking store shelves.

After making additional stops during the day, the driver returns to the terminal, has unsold product and returns checked, recaps sales for the day, and prepares an order for delivery the next day. Truck loading for the next delivery is done by either the driver or warehouse personnel at the end of the day or the beginning of the next day.

The vendor copies of the invoices go to a billing operation for preparation of statements, typically weekly. Store copies of invoices go to the retail accounts-payable operation for subsequent matching with vendor statements and ultimate payment.

Separate Delivery System

The separate delivery or advance sales vending system differs only slightly from the rolling warehouse system. A salesperson comes to the store, straightens the product on the shelf, and writes an order for needed product. The order is usually telephoned to the vendor warehouse and delivered 1 or 2 days later. The product is received and placed in backroom storage where it remains until the salesperson returns to the store to stock the shelves, rotating and aligning the product in the process. In the stores studied, cookies and crackers were typically handled with the separate delivery system.

Costs For Direct Store Deliveries

For comparative purposes, cost were developed for direct-store deliveries on a per-case basis. The bases for these costs were obtained from four vendors and grouped by product categories. Six categories of cost were isolated for direct-store deliveries: vendor labor, vehicle, rent, store labor, vendor billing, and retail store accounting.

Labor costs: For purposes of this study, labor costs include the cost of the driver, salesperson or driver-salesperson, and supervisory and warehouse personnel. As shown in table 1, labor costs per case for direct store delivery ranged from $0.619 per case for soft drinks to $1.224 per case for chips. Costs for supervision, fringe benefits, and labor rates were obtained from vendor company records. Delivery time was measured in the two cooperating supermarkets.

Vehicle costs: Vehicle costs include depreciation, repair and maintenance, insurance, and fuel. Data shown in table 2 reflect actual costs and methods used by vendors cooperating in the study. For example, the vehicle costs for vendor cookie and cracker vehicles were based on leasing, while other vendors owned their delivery equipment. Vendor delivery vehicle costs ranged from $0.214 to $0.252 per case. Costs, obtained from cooperating vendors, reflect the individual company methods.

Table 1—Labor costs per case for direct store delivery by vendor type

Vendor type	Driver/ salesperson	Supervisory personnel[1]	Warehouse personnel[2]	Total
		Dollars[3]		
Bakery	0.711	0.089	0.089	0.889
Soft drink	.450	.056	.113	.619
Chips	.980	.122	.122	1.224
Cookies/crackers[4]	.556	.069	.069	.694

[1]Based on a ratio of one supervisor for eight driver-salespersons.
[2]Based on a ratio of one warehouse worker for eight driver-salespersons except soft drinks where there was one warehouse worker for four driver-salespersons.
[3]Cost per case includes commission and fringe benefits.
[4]The cookie/cracker salesperson received $0.376 per case and driver salary and fringe benefits totaled $0.180 per case.

Table 2.—Vehicle cost for direct store delivery by vendor type

Vendor type	Vehicle	Repair and maintenance	Insurance	Fuel	Total annual cost	Weekly cost[1]	Cases delivered weekly	Cost per case	Proportion of store receipts	Allocated cost per case
	Dollars						*Cases*	*Dollars*	*Percent*	*Dollars*
Bread, chips, and snacks	[2]2,954.53	500.00	250.00	[3]1,625.00	5,329.53	102.49	495	0.207	56.8	0.118
Soft drinks	[4]7,254.43	1,000.00	800.00	[5]2,200.00	11,254.43	216.43	1,013	.214	27.1	.058
Cookies and crackers:										
Salesperson auto[6]	3.600.00	--	--	[7]2,166.00	5,766.00	110.88	--	.042	--	--
Delivery truck[7]	16,588.00	3,348.80	2,132.00	[8]6,673.16	28,741.96	552.73	--	.210	--	--
Total cookies and crackers						663.61	2,625	.252	16.1	.041
GRAND TOTAL						982.53	4,133	.238	100.0	.217

[1]Annual cost obtained from cooperating vendors divided by 52.
[2]Based on $11,200 initial vehicle cost, depreciated in 5 years at 10 percent interest.
[3]Based on $15,000 miles at 12 miles per gallon and $1.30 per gallon at fuel cost.
[4]Initial vehicle cost of $27,000, depreciated in 5 years at 10 percent.
[5]Based on $15,000 miles at 7.5 miles per gallon and $1.10 per gallon fuel cost.
[6]Based on annual lease that includes insurance, repairs, and maintenance.
[7]Based on weekly lease of $319 per truck, $41 for insurance, and mileage charge of $0.092 for 700 miles.
[8]Based on 36,000 miles at 6 miles per gallon and $1.10 per gallon fuel cost.

Rental cost: Based on data obtained from cooperating vendors, the average vendor in this study required 5,000 square feet of warehouse space at an average annual rental cost of $2.50 per square foot. Thus, annual rental would total $12,500 or $250.00 per week. With an average weekly sales by product type, the rental cost ranged from $0.012 to $0.10 per case of direct store delivered product, as shown in table 3.

Table 3.—Distribution warehouse rental cost for direct store delivered items by vendor type

Vendor types	Average weekly rental cost per driver	Average weekly cases delivered	Average rental cost per case
	Dollars	*Cases*	*Dollars*
Bakery	31.25	678	0.046
Soft drinks	31.25	1,013	.031
Chips	31.25	313	.100
Cookies/crakers	31.25	2,625	.012

Store labor cost: In the two stores studied, an average of 227 worker-minutes per week were spent checking vendor shipments into the store and returns out of the store. Based on a wage rate of $7.50 per hour, or $0.125 per minute, store labor cost $28.375. With an average of 1,395 cases of vendor product received, the store labor cost associated with direct store deliveries averaged $0.02 per case. Measured costs related only to the items being studied. In some larger stores the store labor costs associated with direct store deliveries may be substantially greater because one person is dedicated to receiving and checking store deliveries.

Vendor billing costs: Vendor billing costs were developed based on data obtained from cooperating vendors. To develop a cost for vendor billing, the authors found in the vendor plants studied that three people, at a cost of $250 per week each or a total weekly cost of $750, were required for billing labor. With 200 customers being billed and an average of 167 cases per billing, the $750 labor cost is divided by 33,400 cases to provide a billing labor cost of $0.023 per case. Materials cost associated with billing averaged $0.30 per store. By dividing the 167 cases per billing, the average materials cost totaled $0.002 per case. Labor cost $0.023 per case plus materials cost of $0.002 per case would total $0.025 per case for direct store delivery billing cost.

Store accounting cost: An average of 6 hours per week was associated with accounting for DSD deliveries in the two stores studied. At a labor rate of $6.00 per hour and average receipts of 1,395 cases, the store accounting cost would average $0.026 per case.

Total distribution cost for direct store deliveries: To develop a cost per case for DSD items each product group cost must be weighted by the percentage of receipts at the store. Table 4 provides a weighting for costs measured by products, i.e., vendor labor, vehicle, and distribution warehouse rental costs, which total $1.06 per case. Other costs must be added, including costs for store labor amounting to $0.02 per case, vendor billing costs of $0.025 per case, and store accounting costs of $0.026 per case. Thus, the total per case cost for direct store deliveries was $1.131 per case. This cost reflects measured costs, including normal delays, found in the study.

Table 4.—Vendor labor, vehicle, and rental costs per case weighted by store receipts

Product group	Labor cost	Vehicle cost	Rental Cost	Total labor, vehicle, and rental cost	Proportion of store receipts[1]	Prorated cost
			Dollars		*Percent*	*Dollars*
Bakery	0.889	0.201	0.046	1.142	51.0	0.583
Soft drinks	.619	.214	.031	.864	27.1	.234
Chips	1.224	.215	.100	1.539	5.8	.089
Cookies/crackers	.694	.252	.012	.958	16.1	.154
Average cost[2]	.804	.217	.039	1.060		
Total					100.0	1.060

[1]Percentage of receipts in the two stores studied which average 1,395 cases per week per store.
[2]Average for labor, vehicle, and rental cost based on proportion of store receipts.

Projected Consolidated Warehouse Distribution System

The operation of a consolidated distribution system would be appreciably different from the existing DSD system. The system involves using store personnel to order, stock, price, and maintain items on shelves—tasks that are currently done by DSD personnel. The consolidated warehouse personnel would receive store orders, prepare a consolidated invoice, receive bulk quantities of needed items, assemble orders by store, and deliver a consolidated load to each store. The basis for cost projection is consolidation of direct-store delivered items for 50 stores within a 20-mile radius, based on data obtained from the intensive study of two stores.

Ordering Procedure

Each day, store personnel would create an order listing appropriate items and quantities of each item. To maintain the frequencies of delivery found in the stores studied, the following schedule of deliveries-per-week would be used: bread and bakery products, 5 or 6 times; soft drinks, 2 or 3 times; chips and snacks, once or twice; and cookies and crackers, once.

The order is then relayed to the consolidated warehouse by any number of systems commonly used between warehouses and retail stores. At the consolidated warehouse, store orders are recapped by warehouse personnel to create bulk orders that are relayed to appropriate vendors of the products. In addition, an invoice is prepared for each consolidated store order for purposes of order assembly and delivery.

Consolidated Warehouse Operations

In order to develop a consolidated warehouse layout, it is necessary to determine the quantities of product that will be handled. Based on the data obtained at the two supermakets studied, projections were made for a facility and personnel to supply DSD items to 25 independent and 25 corporate chain supermarkets, shown in table 5.

Staffing of the consolidated warehouse and delivery operation is based on meeting the needs of peak volume days because of the limited time available to schedule delivery trucks at the supermarkets early each morning. Thus, staffing and capacity is based on shipment of 15,875 cases per day.

While the stores studied received DSD items 6 days per week, projections for the consolidated warehouse operations are on the basis of 5 days per week. Only bread and bakery items were delivered on Saturday in the stores studied. In some areas of the country, deliveries of bread and bakery products are made to the stores 5 days per week by eliminating deliveries on Sunday and Wednesday. In fact, the corporate store in this study received only five deliveries weekly from the company-owned bakery. It is anticipated that the consolidated warehouse could operate on a 5-day week basis by delivering product on Monday, Tuesday, Thursday, Friday, and Saturday. While there will be problems associated with five instead of six deliveries weekly, particularly with high-volume retail stores, in all probability, these problems can be resolved through cooperative effort by the retail store, consolidated warehouse, and vendor suppliers.

Table 5.—Projected consolidation warehouse volume for 50 supermarkets

Delivery day	Units repacked	Cases repacked	Full cases	Total cases	Average perstore
			Number		
Monday	39,000	3,250	[1]12,625	[1]15,875	[1]318
Tuesday	41,100	2,425	9,400	11,825	236
Wednesday	20,100	1,675	7,625	9,300	186
Thursday	55,500	4,625	6,225	10,850	217
Friday	[1]62,400	[1]5,200	10,525	15,725	314
Saturday	42,000	3,500	2,675	6,175	124
Total	260,100	20,675	49,075	69,750	1,395
Six-day average	43,350	3,446	8,179	11,625	232
Five-day average	52,020	4,135	9,815	13,950	279

[1]Peak volume shipments.

Projecting the data obtained in the two markets studied results in a weekly shipment of 69,750 cases. However, staffing the consolidated warehousing and delivery operation to meet the maximum daily requirement of 15,875 cases results in a weekly potential of 79,375 cases capacity, or an excess capacity of 14 percent during the week without the use of overtime.

Figure 7 shows a schematic layout for a consolidated warehouse for servicing 50 typical supermarkets with nonrefrigerated items normally handled under direct store delivery systems. Product is received on docks at one end of the building and loaded on store delivery trucks at the other end. Product shipped in case-lot quantities, such as soft drinks, is assembled in unit loads, such as pallets, and placed in a load line designated for each store. Some product, such as bread, chips, and snacks is not shipped to stores in case-lot quantities. This product is moved to a repack area for store order assembly and to load lines for truck loading.

Estimated management requirements for operation of the consolidated distribution warehouse include a warehouse manager, one receiving supervisor, and one shipping supervisor. It is proposed that the receiving supervisor work from 4 p.m. to 1 a.m. and the shipping supervisor from 1 a.m. to 10 a.m. The warehouse manager would supervise the overall operation and be responsible for coordination of operations with vendor suppliers and retail stores serviced.

Since facility cost for office space was not measured for direct store delivery, office space is not provided in the schematic layout (fig. 7). However, office space could be provided on a mezzanine over the shipping or receiving dock, as an addition to one side of the warehouse, or even at another nearby location.

Estimated direct warehouse labor would inlude two receivers and two transporters who receive and transport product to designated places in the warehouse from 4 p.m. to 12:30 a.m. An estimated 12 repackers would be required, based on the assembly of 54 repacked cases per hour, to meet the maximum requirement of 5,200 repacked cases required on Friday (table 5). In vendor plants an average of 66.8 cases were repacked per worker hour; thus, liberal staffing is provided. Repackers would work from 4 p.m. to 12:30 a.m. Three checkers would be used to check outbound shipments by case count and item description. Delivery truck drivers would be used to assemble full-case orders by store and place orders, unitized on pallets or carts, in load lines at the rate of 250 cases per worker-hour. This assembly would take place between 1 a.m. and 5 a.m., and drivers would load delivery vehicles between 5 a.m. and 5:30 a.m., with unitized products on pallets or carts.

Delivery Operations

As indicated under warehousing operations, delivery truck drivers would be employed in the order-assembly and truck-loading operation from 1 a.m. to 5:30 a.m. and would leave the warehouse at 5:30 a.m. to deliver product to the stores. Sixteen drivers would deliver loads consisting of three or four store orders on each truck between 6 a.m. and 8 a.m. Drivers would return to the consolidated warehouse by 8:30 a.m. and unload out-of-code product, empty containers, carts, pallets, and other return items.

Retail Store Operations

Product is received and checked by store personnel. Out-of-code product together with trays, baskets, and recycle material is loaded on the truck for return to the consolidation warehouse. A credit document is prepared, with a copy for the warehouse and store, for items returned to the warehouse. From this point, the handling system varies, since store personnel price-mark as necessary, stock shelves, and rotate and align merchandise as needed.

Billing Procedures

Consolidated billing statements are prepared for each store, including all vendor products delivered from the consolidated warehouse. The consolidated statement will include credits for returned merchandise and will be sent weekly to each store or store headquarters, as required.

Estimated Costs for Consolidated Distribution

Costs analysis for consolidated distribution can be handled in many ways. However, for purposes of this study, costs will be defined and estimated by functions such as warehousing, delivery, and work by office and store personnel.

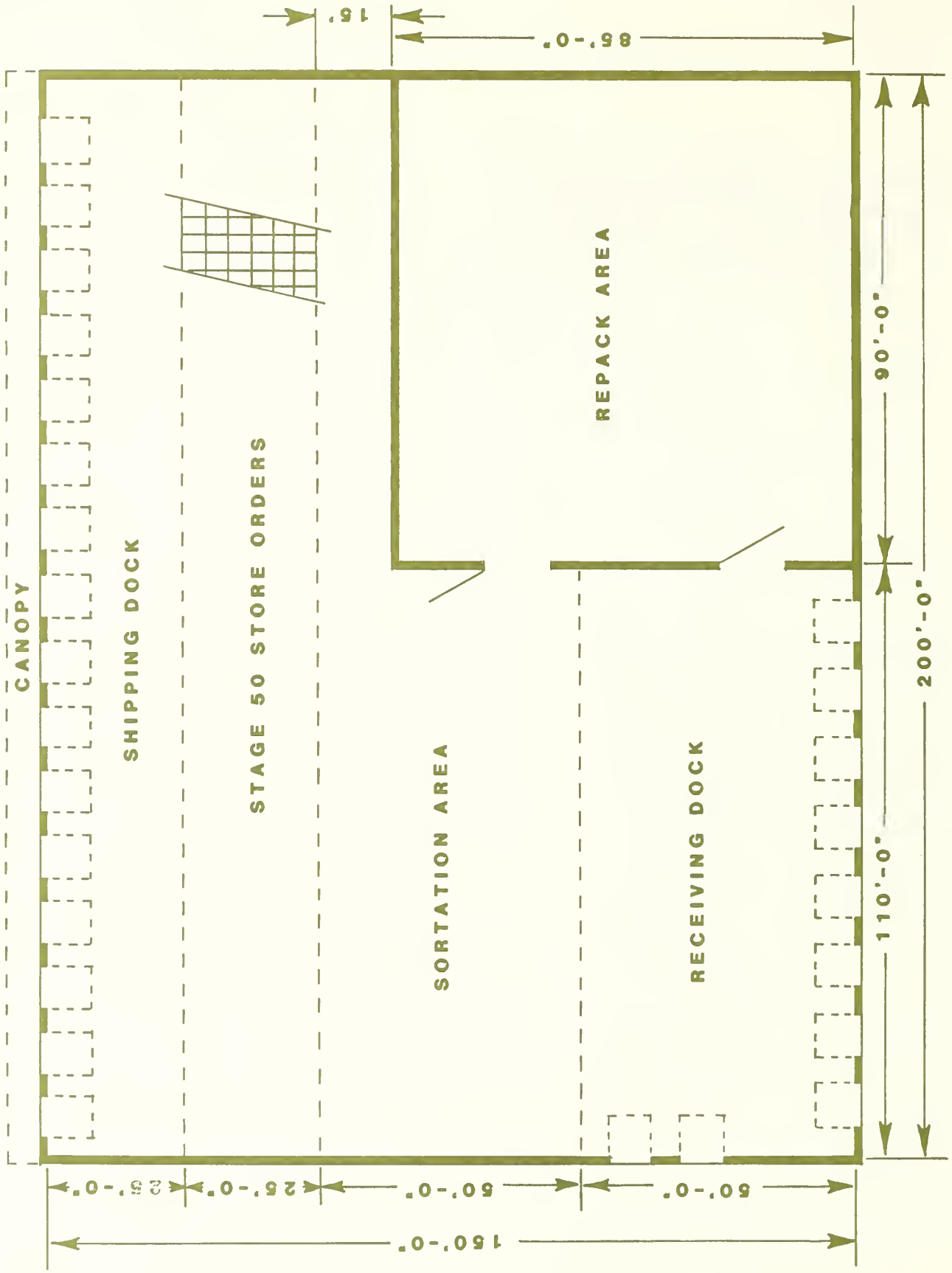

Figure 7.—Schematic layout of a proposed consolidation warehouse.

Consolidated Warehousing Costs—Two basic costs are estimated for warehousing: labor and rental. Part of the driver's time will be assigned to warehousing, since drivers are used to assemble and load orders and are estimated to work 4.5 of their 8 hours in the warehouse. One receiving supervisor, 1 shipping supervisor, 12 repackers, 2 receivers, 2 transporters and 3 outbound checkers work full time in the warehouse. Table 6 shows the daily hours, hourly rate, and weekly cost of warehouse personnel, based on a 40-hour work week, for full-time warehouse personnel, with shipments made to stores 5 days per week. Also shown are overtime hours required and estimated added costs that would be incurred if six deliveries per week are required.

Thus, an estimated 1,200 worker hours will be required to handle the warehousing operation on a five deliveries per week basis, at an estimated cost of $11,760. With a volume of 69,750 cases per week, the warehouse personnel would cost $0.169 per case.

If it is determined that six deliveries per week are necessary, overtime will be required for the warehousing function. As shown in table 6, an estimated 146 overtime hours would be required, which would add $1,608 to the weekly labor cost, and would result in total warehouse labor costs of $13,368 per week or $0.192 per case.

The other major warehousing cost is rental. As shown in figure 7, the schematic warehouse measures 150 by 200 feet (30,000 square feet). At an estimated annual rental rate of $3.50 per square foot, the annual rent would total $105,000. Based on an average shipment of 69,750 cases per week or 3,627,000 cases annually, the rental cost would total $0.029 per case.

Delivery costs—Two major costs are associated with the delivery operation: labor and vehicle. As indicated previously, 16 drivers are used for warehouse order assembly, loading, and delivery of product. Drivers are estimated to use 3.5 hours daily in driving and unloading product at either three or four retail stores. With 16 drivers, working 3.5 hours daily, and 5 days per week, 280 driver-hours would be required. At a wage rate, including fringe benefits, of $11 per hour, the weekly driver cost would total $3,080, or $0.044 per case for five deliveries per week. However, if six deliveries per week are required, an additional 56 hours of overtime are estimated to be required (3.5 hours for 16 drivers). Added wage cost would total $739, and weekly driver cost would total $3,819 or $0.055 per case.

Delivery vehicle cost is based on leasing the equipment. Table 7 indicates the estimated vehicle cost components.

Table 6.—Estimated warehouse labor costs for consolidated distribution

Position	People	Daily tour	Warehouse personnel cost					
			Hourly rate[1]	Weekly hours	Weekly cost	Overtime hours	Overtime cost[2]	Weekly cost including overtime
Title	*Number*	*Hours*	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*	*Dollars*
Receiving supervisor	1	4 p.m.-1 a.m.	--	40	650	5	--	650
Shipping supervisor	1	1 a.m.-10:00 a.m.	--	40	650	5	--	650
Repackers	12	8 p.m.-4:30 p.m.	8.00	480	3,840	40	384	4,224
Receivers	2	4 p.m.-13:30 a.m.	9.50	80	760	7	80	840
Transporters	2	4 p.m.-12:30 a.m.	9.50	80	760	7	80	840
Outbound checkers	3	9 p.m.-5:30 a.m.	9.50	120	1,140	10	114	1,254
Drivers, (assembly and loading)	16	1 a.m.-5:30 a.m.	11.00	360	3,960	72	950	4,910
Total				1,200	11,760	146	1,608	13,368

[1]Includes fringe benefits.
[2]Based on: time-and-a-half wages plus effect of fringe benefit costs equals 1.2 times straight time wage rates. Overtime would be used only if it is determined that six deliveries are required.

Table 7.—Estimated delivery vehicle cost for consolidated distribution

Unit	Item	Weekly Cost	
		Five deliveries	Six deliveries
		Dollars	*Dollars*
Tractor	Lease	331.00	331.00
	Mileage	21.35[1]	25.62[1]
	Insurance	41.00	41.00
	Fuel	63.46[2]	76.15[2]
Trailer	Lease	78.91[3]	78.91[3]
	Insurance	27.00	27.00
Total		562.72	579.68

[1]Based on 15,000 miles per year for five deliveries and 18,000 miles per year for six deliveries at $0.074 per mile.
[2]Based on 15,000 miles per year for five deliveries and 18,000 miles per year for six deliveries at 5 miles per gallon and $1.10 per gallon fuel cost.
[3]Lease cost, including a hydraulically operated tailgate.

With a weekly tractor and trailer cost of $562.72 or a total cost of $9,003.52 for 16 vehicles, the vehicle delivery cost would total $0.129 per case based on 69,750 cases delivered per week. If six deliveries per week are required, vehicle and fuel cost will increase 3 percent to $9,274.88 per week, or $0.133 per case.

Office and Managerial Cost—A manager would be necessary to oversee the warehousing and office procedures at the consolidation warehouse. An estimated salary of $800 per week, including fringe benefits, would be paid the manager. Two additional people would be required to receive store orders, consolidate them, order product from vendor suppliers, and handle the accounting operations. One combination office-electronic data processing supervisor would be required. The office and managerial personnel cost would total $3,025 per week or $0.043 per case as shown in table 8.

Additional costs associated with the office relate to use of a computer for order consolidation, accounting, and billing purposes. Such costs are estimated to be about $60 per day for one-half hour of use or $300 per week. Costs of materials, forms, and other items are estimated to total $25 daily or $125 per week. These added costs of $425 per week, together with associated managerial costs, total $3,450 per week, or $0.05 per case based on 69,750 cases delivered.

Table 8.—Estimated warehouse office and managerial costs for consolidated distribution

Position	People	Weekly salary[1]	Total weekly cost
Title	*No*	*Dollars*	*Dollars*
Company manager	1	800	800
Security personnel	2	350	700
Clerks	3	300	900
Office/EDP supervisor	1	625	625
Total	7	--	3,025

[1]Includes fringe benefits.

Retail Store Costs—The cost for store labor is based principally on productivity achieved by vendor delivery personnel. Estimated personnel costs by store function are shown in table 9.

Applying a wage rate of $7.50 per hour, including fringe benefits, for 48 hours equals a weekly labor cost of $360, or $0.258 per case for 1,395 cases.

Table 9.—Estimated retail store personnel costs by function for consolidated distribution

Function	Weekly personnel requirement
	Worker hours
Receive and check product	5[1]
Transport product	3[2]
Stock and price-mark	27[3]
Order and straighten shelves	13[4]
Total	48

[1]Based on five receivings per week at 1 worker-hour each.
[2]Transport product to shelves and out-of-code product to backroom, one-half hour per day.
[3]Based on vendor delivery personnel productivity of 52.3 cases per worker-hour for 1,395 cases.
[4]Based on vendor delivery personnel productivity of 108.0 cases per worker-hour for 1,395 cases.

Vendor Billing Costs—Costs for vendor billing will be reduced because only one bill will be prepared for the consolidation warehouse instead of separate bills for 50 supermarkets. Data obatined in studies of vendor billing procedures indicated an average billing of 167 cases per week per supermarket and three people required to handle the billing for 200 supermarkets. Projecting this data to consolidated warehousing and delivery procedures, the authors assumed that each vendor would supply four consolidated warehouses and would bill each consolidated warehouse.

To develop an estimated per-case cost for vendor billing to the consolidated warehouse, it was assumed that one person would handle the vendor billing to four consolidated warehouses. With a wage rate of $250 per week, including fringe benefits, and 167 cases shipped per store, or 8,350 cases per consolidated warehouse, and/or 33,400 cases for four consolidated warehouses, the vendor labor billing cost would total $0.008 per case. It was further assumed that materials cost would total $0.001 per case based on use of five spread invoices per week for each consolidated warehouse. Thus, total vendor billing cost would total $0.009 per case with the consolidated distribution system.

Total Consolidated Distribution Costs

As shown in table 10 and figure 8, projected costs for a consolidated warehouse and delivery system total $0.688 per case for five deliveries per week and $0.726 per case with six deliveries. This compares with direct store delivery costs of $1.131. Savings total $0.443 per case or 39 percent with consolidated warehousing and five deliveries weekly, and $0.405 or 36 pecent with six deliveries weekly. Savings of $0.443 per case amount to an average savings of $617.98 per week for each of the two stores studied that received an average of 1,395 cases per week by direct store delivery. Projected savings for a 50-store group would total more than $1.6 million annually with five deliveries, and nearly $1.5 million annually with six deliveries. Such savings provide a potential that should encourage suppliers, wholesalers, and retailers to initiate a consolidated warehousing and delivery program that will reduce marketing costs and benefit consumers of the products they handle.

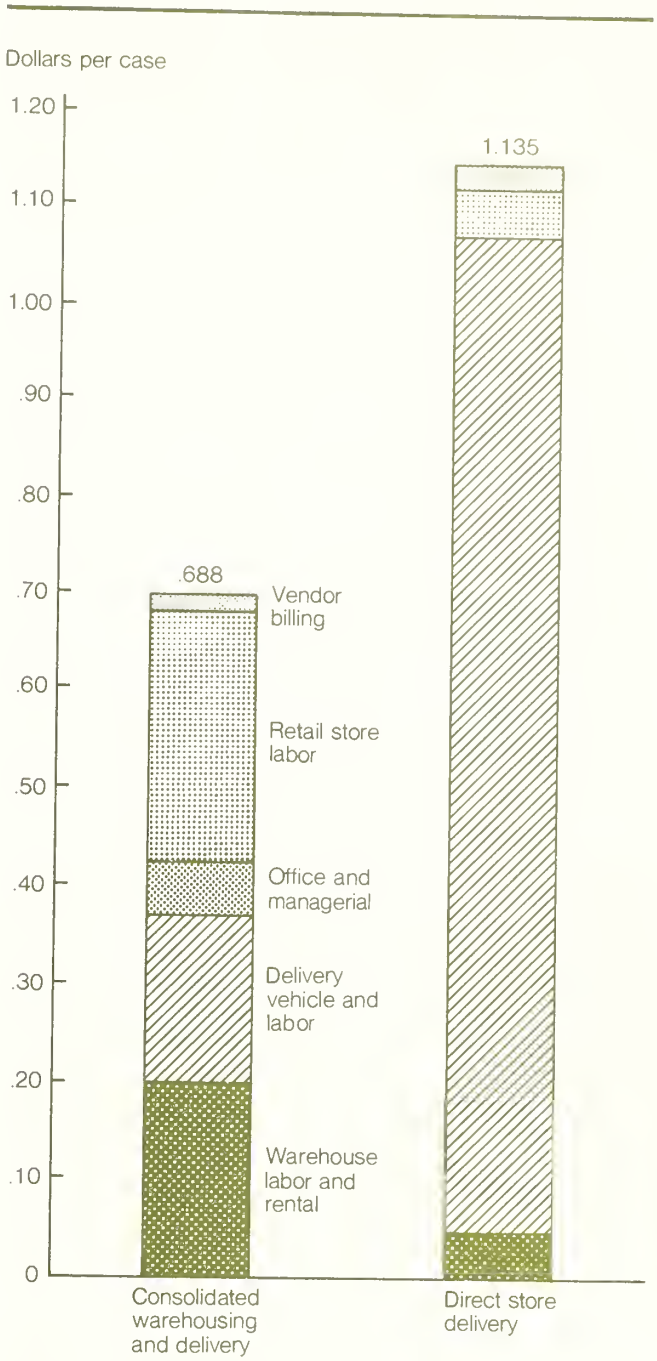

Figure 8.—Projected consolidated system cost compared with direct store delivery cost.

Table 10.—Projected system costs per case for consolidated warehousing and delivery compared with direct store delivery

Cost item	Consolidation warehousing and delivery		Direct store delivery
	Five deliveries	Six deliveries	
	Dollars		
Warehouse labor	0.169[1]	0.192[1]	--
Warehouse rental	.029	.029	0.039
Delivery vehicle	0.129[2]	.133[2]	.217
Delivery labor	.044	.055	.804[3]
Office and managerial	.050[4]	.050[4]	--
Retail store labor	0.258[5]	.258[5]	.046
Vendor billing	.009	.009	0.025
Total	.688	.726	1.131

[1]Table 6 and discussion.
[2]Table 7 and discussion.
[3]Includes labor for warehouse handling, delivering, and retail store delivery.
[4]Includes store billing, table 8 and discussion.
[5]Includes store personnel costs for receiving, checking, transporting, and price-marking, and stacking shelves.

Principal savings with the consolidated system are in delivery labor and vehicle costs. With the direct store delivery system vehicle and delivery labor total $1.025 per case, while the per-case total is only $0.173 for five deliveries and $0.188 for six deliveries with the consolidated system. On the other hand, retail store labor and managerial costs increase from $0.046 per case with direct store delivery to $0.308 per case with consolidated delivery. Other cost increases for warehouse labor to assemble orders and load consolidated delivery vehicles amount to $0.169 per case for five deliveries or $0.192 per case for six deliveries.

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