Improving Ice Cream Deliveries to Retail and Institutional Outlets

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The author outlines the problems encountered in the present ice cream delivery systems to retail outlets and makes suggestions for improvements.

INTRODUCTION

It was not until 1851 that ice cream was manufactured on a large scale in the United States. Around 1910, great progress was made in the industry because of a more complete understanding of the science of ice cream making [1]. Today, the ice cream industry is mature and thriving; the need for improvement is not in the quality of the product, but in finding the delivery system that will best preserve the quality. It is the aim of this paper to indicate delivery practices that will put a better product in the retail store's freezer.

PROCEDURE

The objectives of the research were to: (1) evaluate five different ice cream delivery systems by determining labor productivity and ice cream temperature fluctuations in each system during delivery from plant to retail store, (2) make recommendations to improve existing ice cream delivery systems, and (3) propose an ideal system..

For each of the five delivery systems, three delivery routes were selected which were representative of management's operation.

At all five distributors, ice cream orders were assembled and trucks were loaded during the afternoon or evening of the day preceding the delivery. During assembly of the order in the freezer, three half-gallon packages of ice creams were selected to use as test packages. A thermometer inserted into the center of each package remained in the package during the test.

As the truck was loaded, the test packages were placed in the load as follows: one at the front, one near the center, and one at the rear inside the truck body.

For each of the 15 truckloads, observations were made as to the methods used and the time required to select and assemble the order in the freezer, and to load the truck. During assembling and loading, the number of employees involved and the elapsed time between selecting and assembling the order in the freezer and loading it in the delivery vehicle were recorded.

At the first delivery stop, the temperature of the rear test package was read after it was removed from the truck. The center test package was read at the half-way stop. Likewise, the front test package was read at the last stop. At all the delivery stops, elapsed time for assembling, transporting, and unloading the individual orders was recorded.

System A - (Eight-Door Cold Plates, Preorder Call-in Delivery)

The refrigerated truck bodies used in this system had four access doors on each side (eight doors per truck). A cold-plate type refrigeration system was used.

In loading the truck, one worker handed packages which had been loaded on four-wheel carts up to another worker who stacked the packages inside the truck. After loading was completed, the electrical power cord of the truck refrigeration system was plugged in for the overnight holding period.

At each delivery stop, the driver, while standing at street level, opened one truck door at a time and reached in to remove ice cream as called for on the order for that stop. He usually opened several doors, and sometimes all eight doors, to fill an order.

As the driver removed ice cream from the truck, he placed the ice cream on a two-wheel or a four-wheel hand-truck which he then pushed into the store where he removed the ice cream and placed it in the display case.

System B - (Double Rear Door, Cold Plates, Preorder Call-in Delivery)

Each of the refrigerated truck bodies had a double walk-in door at the rear and one small reach-in door on the right side near the rear of the truck. A cold-plate type of refrigeration was used.

In the truck-loading operation, fully loaded four-wheel carts were pushed out of the freezer across a nonrefrigerated loading dock and into the truck by plant loaders. Inside the truck the loaders positioned the carts and clamped them against the truck's sides, leaving an aisle down the middle. A gap was left between two of the carts on the right side to allow access through the side door. After truck loading was completed, the refrigeration system was activated for the overnight holding period.

At each delivery stop, the driver entered the truck through the rear door, pulled the door shut behind him, and selected the items called for at that stop. He placed the items on the floor near the side door. After leaving the truck through the rear door, he removed the order by reaching through the side door. He then moved the ice cream into the retail store and placed it in display cabinets.

System C - (Rear Door, Nitrogen, Preorder Call-in On Carts By Stop)

The delivery trucks using this system had one walk-in door at the rear and were refrigerated by liquid nitrogen. A power-operated lift gate at the rear of the truck was used to move carts up or down between truck bed and street level. Trucks were not precooled before being loaded.

Loaded carts were pushed out of the freezer across the dock, and into the truck. Carts were secured inside the truck with a brace bar to prevent movement during transit.

At each delivery stop, the driver rolled the carts out the rear door of the truck and onto the lift gate, which was lowered to the ground. He then pushed the carts into the store where he either placed the carts in a walk-in freezer, or transferred the ice cream from the carts into a display case. He then rolled the empty carts from previous deliveries to the truck for return to the ice cream plant.

System D - (Large Rear Door, Cold Plates, Driver-Salesman Delivery)

Trucks in this system had a large rear door for loading and a small door on the right side for unloading. Permanent shelves ran down each side of the truck, except for a gap in the shelves on the right side to allow access through the side door. A cold-plate type of refrigeration was used.

When the driver returned from his delivery, the loading crew rolled loaded carts out of the bulk freezer room and onto the dock. The crew then manually passed packages from the cart to the driver who placed the packages on the shelves in the truck. After the bulk ice cream items were loaded the driver moved the truck to the other freezer where novelty items were placed in the truck by a gravity conveyor.

At each delivery stop, the driver proceeded to the ice cream display case in the store where he restacked the items already in the case. He then determined what replenishment was needed and wrote up the order. After returning to the truck, he picked the order from the shelves in the truck and positioned the packages near the side door. From outside the truck, he removed the packages through the side door and stacked them on a two-wheel handtruck. He then wheeled the handtruck into the store and placed the packages in the display case.

System E - (Six Door, Cold Plates, Driver-Salesman Delivery)

System E was a driver-salesman delivery system with delivery vehicles that had three doors on each side (six doors per truck) and was refrigerated by cold plates. The loading differed from that of System D in that the driver transferred packages from the four-wheel carts into his truck without assistance from the loading crew. When the loading was completed, the truck's refrigeration system was plugged in for the overnight holding period. Unloading was performed in the same manner as in System D.

EVALUATION OF THE VARIOUS SYSTEMS

Labor costs for assembling and loading the delivery vehicles were less with systems that loaded trucks with orders assembled on carts. Costs for the two firms that used this method (Systems C and B) averaged $9.96 and $10.50 respectively, per 500 packages. Costs for the three firms that stacked orders in delivery trucks by hand (Systems E, D and A) averaged $14.82, $15.50 and $21.90 respectively, per 500 packages. Tables 1 and 2 show the average labor productivity and cost for assembling and loading and unloading ice cream for the five systems.

The lowest labor costs (System C) using carts for unloading ice cream at the distribution points, totaled $12.25 per 500 packages. The highest labor costs (System A), using preorder call-in and two-wheel carts for unloading, totaled $20.44 per 500 packages.

Total labor costs (assembling and loading and unloading) were lowest ($22.21 per 500 packages) in System C, where individual customer orders were assembled on carts and the carts loaded on trucks, the driver unloaded the carts with a hydraulic tailgate, and moved them into the retail store.

The temperatures shown in this paper represent only a limited sample from the systems studied, and the temperatures are not representative of the frozen dessert industry. The data are only intended to show variations in product temperature with various handling methods and to provide a guide for minimizing product temperature rise during delivery.

Ice cream temperatures increased in the five systems when the ice cream was held in the trucks overnight. The system that had the shortest door-opening time per stop experienced a rise of only 6°F from the time of loading to unloading at the last stop (-15° to -9°F, respectively). Table 3 shows the total door openings and times and Table 4 shows the product temperatures during delivery.

Table 1. Average productivity in assembly and loading of ice cream and unloading by the five systems.

System	Average Number of Packages	Assembly and Loading: Labor	Assembly and Loading: Time per Package	Packages per man-hour	Labor Time for Unloading: Per Stop	Labor Time for Unloading: Per Package
		Man-hrs.	Man-min.	No.	Man-min.	Man-min.
A	425	5.2	.73	82.3	11	.58
B	523	3.0	.35	172.3	19	.48
C	555	3.1	.33	181.1	23	.35
D	400	3.3	.50	121.1	22	.42
E	170	1.3	.47	127.8	6	.51

Table 2. Average labor costs for assembling and loading and unloading 500 packages of ice cream by the five systems.

System	Assembly and Loading: Time Required per 500 Packages	Assembly and Loading: Cost per 500 Packages 1/	Truck Unloading: Time Required per 500 Packages	Truck Unloading: Cost per 500 Packages 2/	Total Cost
	Man-hr.	Dollars	Man-hr.	Dollars	Dollars
A	6.08	21.90	4.87	20.44	42.34
B	2.92	10.50	4.03	16.94	27.44
C	2.77	9.96	2.92	12.25	22.21
D	4.13	15.50	3.47	14.56	30.06
E	3.92	14.82	4.30	18.06	32.88

1/ Based on an estimated wage rate of $3.60 per hour or $0.06 per minute for plant employees, and $4.20 per hour or $0.07 per minute for the driver.

2/ Based on an estimated wage rate of $4.20 per hour or $0.07 per minute for the driver.

Table 3. Average number of doors and length of time for door openings in delivering ice cream by five systems

System	Number of Stops	Average Packages per Stop	Truck Door Openings Total Number	Total Time Min.	Time per Package Min.	Time Per Stop Min.
A	21	20	93	63	.15	3.00
B	13	40	56	45	.09	3.46
C	9	64	19	42	.07	4.67
D	8	53	24	10	.02	1.25
E	15	12	51	12	.07	.80

Table 4. Average product temperature for five delivery systems.

System	Temperature of Product at-- Loading °F	First Stop °F	Mid-stop °F	Last Stop °F
A	-14	+2	0	+5
B	-19	-13	-7	-2
C	-18	-3	+1	+4
D	-22	-8	-4	-2
E	-15	-10	-9	-9

IDEAL SYSTEM

Based on the study reported here, an ideal ice cream delivery system could be devised that would comprise the most efficient aspects of the five systems studied. Orders could be called in by the retail stores and be preassembled and loaded on carts by stop at the warehouse freezer at loading time. It is no greater effort for the warehousemen to assemble and load a cart by stop than by product type. But, if the preorder on carts system were used, retail outlets would have to determine their own needs and not rely on driver-salesmen. At unloading, drivers would not spend time assembling store orders in the trucks. Trucks should be well lighted to avoid the need for drivers to keep the doors open while they work in the truck. In all systems product temperatures rose when the ice cream was held in the truck overnight. Therefore, an ideal delivery system would provide for loading the vehicle the morning of delivery by using a rapid loading method, such as preassembled orders on mobile carts.

The following practices in one or more of the systems tend to cause inefficiencies in ice cream deliveries:

At the Ice Cream Plant

1. Short order--The loading crew at the freezer plant sometimes miscounted and put a smaller quantity of an item on the truck than called for on the load sheet. Consequently, at one of the delivery stops, the driver spent considerable time looking for an item that actually was not in the truck.

2. Misplaced items--Sometimes the loaders would not put all of a particular item at one location in the truck. For instance, the load sheet might call for 20 half-gallons of chocolate, and the loader would put 16 packages in one compartment and four in another. Subsequently, the driver would spend much time trying to locate the four packages that were separated from the main group of 16. With Systems D and E, however, the driver-salesman had no trouble locating items. Evidently, this was because he loaded his own truck and knew the location of all items. The drivers in Systems A and B did not load their own trucks. Consequently they spent more time in hunting for items.

3. Uneven loading of compartmentized vehicles--The loaders sometimes loaded one compartment to the ceiling while leaving other compartments empty. As a result, the relatively high-stacked load of ice cream toppled during transit. Also, removal of the packages from the middle of the high-stacked load was difficult for the driver.

4. Package labeling not visible--In loading the truck, the loaders positioned packages with the product labels facing away from the driver, thus making it difficult for the driver to identify items.

5. Ice cream on nonrefrigerated dock--Sometimes a pallet load of ice cream would be brought out on the dock, and half of the pallet load would be put into a truck. Instead of returning the rest of the pallet load of ice cream to the freezer until the next truck was available for loading, the pallet was allowed to remain on the nonrefrigerated dock. Thus the remaining ice cream was exposed to warm air for some time before it was loaded into trucks so that the ice cream temperature went up.

Delivery Vehicles

1. Loose-fitting doors and gaskets, which allowed cold air to escape and warm air to enter, were observed on a few trucks.

2. Poor interior lighting, which caused drivers to leave their doors open occasionally while assembling orders, was observed at some delivery stops.

3. Heavy frost allowed to build up on cold plates over a period of days decreased refrigeration efficiency.

4. Truck floors covered with ice, which caused packages to slide and load to shift resulted in damaged and broken packages. Also, ice was a safety hazard to the driver as he moved inside the truck.

At the Retail Store

1. Store personnel allowed ice cream to sit on the floor for some time before checking the items and putting the product in the refrigerated display case.

2. Over ordering--display case was not large enough to hold the order, so some of the ice cream had to be returned, moved to a holding freezer, or transferred to another store.

3. Delivery restrictions--some stores allowed delivery only at certain hours. This practice made it necessary for the driver to go out of his way to be at a particular store at a stated time.

4. Improper maintenance--retailers who maintained refrigerated storage rooms and display cases improperly decreased the salability and shelf life of the product.

REFERENCE

1. Sommer, Hugo R. Theory and Practice of Ice Cream Making 1951, p. 1.

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