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# PLANNING NEW FACILITIES FOR MAXIMUM PRODUCTIVITY IN SERVICING CONVENIENCE STORES

by  
Barry W. Wright  
Wawa Food Markets  
Wawa, Pennsylvania

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Examines the question of warehousing merchandise that Wawa sells in its stores and presents the results of an in-depth study on this subject.

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Wawa Food Markets is a chain of 141 convenience grocery stores in Pennsylvania, Delaware, Maryland, New Jersey and Connecticut. The corporate headquarters is in Wawa, Pennsylvania, about 16 miles west of Philadelphia on U.S. Route 1. "Wawa" is the Lenni-Lenape word for the call of the Canadian Wild Goose. In addition to the Food Markets, Wawa has a dairy division, which was primarily retail until our first convenience store opened in 1964. Wawa also has three small warehouses for delicatessen, produce, candy and tobacco.

The average convenience store does \$4,971 per week; Wawa's volume is higher. Therefore, Wawa Stores are built slightly larger than the 2,400 square feet which is the standard for convenience stores. New stores range from 2,600 to 3,000 square feet. All convenience stores serve neighborhoods. Wawa is mainly suburban; at least for now.

Hours of operation are basically the same as other convenience store chains: stores are open 7 days a week from 7 AM to 11 PM. However, some busy stores are open as much as 18 hours a day.

The product mix of convenience stores is typically characterized by heavy sales of tobacco, candy and beer. Wawa sells a negligible amount of beer, because of restrictive regulations in the area where the stores are located. Tobacco and candy do represent a large portion of Wawa's sales. Dairy products, probably because of Wawa's identification with an old and respected dairy, are quite important. The sale of fresh-sliced delicatessen is inordinately high in comparison with most other convenience stores.

An analysis of the company's specific product mix is the essential first step in deciding what and how to warehouse. The top ten product categories by sales are:

## NATIONAL

1. Tobacco Products
2. Grocery Items
3. Milk
4. Beer
5. Soft Drinks
6. Bread/Cakes
7. HABA
8. Candy
9. Magazines, Books, Newspapers
10. Delicatessen Items

## WAWA

1. Milk
2. Tobacco Products

3. Delicatessen
4. Bread/Cakes
5. Grocery Items
6. Soft Drinks
7. Ice Cream
8. Candy
9. Magazines, Books, Newspapers
10. HABA

The advantages of a complete warehouse operation are much greater than the mere saving of the middleman markup. They include the benefits of controlling inventory at store level so that although lower stock value is maintained, fewer stock-outs are experienced. Thus, not only is there a saving in money tied up in inventory, but also there should be improved sales by having greater consistency of product in stock. There are also advantages in combining shipment of product to individual stores so that supplier vehicles make fewer trips, thus saving considerable mileage and driver time.

Approximately a year ago we formed a committee to consider, from a very broad viewpoint, the question of warehousing merchandise that goes into our stores. Because of Southland's success with distribution centers, we considered a similar course. (Southland Co. operates the 7-11 stores and others.)

The choice to warehouse and deliver to our stores was made before the opening of our first store, as we already operated a dairy which continues as a semi-separate operation and serves other customers as well. Over our first ten years, for various reasons, we found ourselves opening three more warehouses for delicatessen, produce and tobacco and candy. We made ingenious, if unorganized use of existing dairy facilities. Two refrigerated trailers became our delicatessen warehouse; a calf barn became our tobacco and candy warehouse; and our old truck repair shop sufficed

for produce. Improvements have been made along the line but mostly just to buy time for further study. Our need, therefore, was to get organized what we already had, starting with the most critical: Tobacco and Candy. At the same time we had to consider possibilities of future opportunities.

The items we warehouse and other product categories within our top ten are in Table 1.

Our next consideration was location. Fortunately, we own an 80 plus acre tract surrounding our dairy, much of which is zoned for our planned activities. This plot is centrally located in our market area and the road system is more than adequate for servicing of current and planned stores. It also gives us enough room to create a warehouse complex and to take advantage of our existing dairy nearby.

Once having decided generally what and where to warehouse, we needed to find ideas on how to do so. The most helpful sources available in designing of warehouses are: trade and equipment journals; professional seminars such as the FDRS; friends in the trade and their warehouses; work or observation in existing warehouses; and consultant services.

Of these sources, the most revealing was our own existing warehouse. Theory is no substitute for personal experience. On paper, a hundred-pound bag of roasted peanuts and a pack of gum are just line items; they are equally easy to keypunch orders for. But, try picking the peanuts! Each of the other sources has value; in our case, the consultant service was most helpful as a review.

Table 2 shows that we are primarily a less than case lot warehouse with

Table 1. Internal Supplies and the Use of Outside Vendors

Wawa Supplies			Outside Vendors			
Category	Percent of Mix	Deliveries per Week	Category	Percent of Mix	Vendors	Deliveries per Week
Dairy	16.0	3	Groceries	8.5	1	1
Delicatessen	16.1	1	Bakery Prod.	11.8	10	41
Candy	5.1	1/2	Ice Cream & FF	5.7	2	3
Tobacco	16.4	1/2	Sodas	5.0	6	6
Produce	3.4	2	HABA	2.2	1	1/2
	57.0	7	Mags., Books & Newspapers	4.3	5	27
				37.5	25	78-1/2

most of our candy items having a picking frequency of less than ten times per day. It is also significant that almost one-fourth of the demand is through allocated distribution.

Table 3 shows sales by vendor and the amount of inventory on hand by vendor. We are sure we can improve this turnover with our new system. To determine candy equipment requirements and capacity, it is necessary to combine Tables 2 and 3 with a knowledge of the products gained, in our case, from work and employee contacts. The result is shown in Table 4, candy equipment requirements and capacity.

We anticipated growth in picking and reserve requirements and supplied adequate capacity for a minimum of five years and a maximum of ten years if no additional product lines are added.

Sources disagree as to when to use flow racks (especially for case goods), but because of the number of items carried and the relationship of picking to all other activities, the most important consideration in our design was picking

exposure. Restocking cycle will be approximately every five picking days with second lanes for faster items.

Table 5 shows the same process applied to cigars and pipe tobacco. Since demand for all but two items was less than one case per week and cases are so bulky, bins are adequate for picking all but the two fastest moving items.

Table 6 shows cigarette requirement and capacity. The real challenge in organizing a warehouse for tobacco and candy was handling cigarettes. On the surface it seems quite simple--only 75 items and an average volume of around 450 cartons per week per brand. Consider, however, that we tax-stamp for five states and that there are five different sizes of cigarette packages, four of which require special settings on the stamping machine and one which is too large for our machine and must be hand stamped. Furthermore, two types of stamping machines are necessitated by the specific requirements of the various states we serve: heat transfer and ink transfer. Also,

Table 2. Demand Stratification by Order Picking Mode - Candy

Demand Category	Mode Order Pick	Standard Items				Allocated Distribution				Total		
		Less Than Case		Full Case		Less Than Case		Full Case		Items	Demand Whse Unit	
		Items	Demand Whse Unit	Items	Demand Whse Unit	Items	Demand Whse Unit	Items	Demand Whse Unit			
1,000+	-	-	-	-	-	1	1,551	1	1,551	1	1,551	
900	1	911	-	-	-	-	-	1	911	1	911	
800	-	-	-	-	-	-	-	-	-	-	-	
700	2	1,535	-	-	-	-	-	2	1,535	2	1,535	
600	-	-	-	-	1	659	1	612	2	1,271	2	1,271
500	1	580	-	-	-	-	-	1	580	1	580	
400	1	408	-	-	3	1,290	-	-	4	1,698	4	1,698
300	4	1,519	-	-	3	1,059	-	-	7	2,578	7	2,578
200	16	3,798	1	221	5	1,256	4	1,036	26	6,311	26	6,311
100	49	6,698	7	885	5	623	3	356	64	8,562	64	8,562
50-99	80	5,642	22	1,401	-	-	2	124	104	7,167	104	7,167
1-49	102	2,443	83	1,884	-	-	-	-	185	4,327	185	4,327
<b>Total</b>	<b>256</b>	<b>23,534</b>	<b>113</b>	<b>4,391</b>	<b>17</b>	<b>4,887</b>	<b>11</b>	<b>3,679</b>	<b>397</b>	<b>36,491</b>	<b>397</b>	<b>36,491</b>

Table 3. Relationship of Inventory to Demand for Major Vendors - Candy

Vendor	Number Items	Total Demand	Total Inventory	Weeks on Hand
2020 Am. Chickie	60	2,719	7,811	2.9
2132 Life Savers	38	1,155	3,876	3.4
6938 Scrafft	25	260	1,546	5.9
3804 Topps Gum	22	1,613	794	.5
3575 Reed Candy	14	382	912	2.4
2665 Hershey Foods	12	209	843	4.0
2980 Ludens Inc.	8	85	147	1.7
3062 M&M - Mars	8	275	1,627	5.9
2230 Chex Co.	6	28	161	5.8
2290 Curtis Candy	6	70	283	4.0
3392 Peter Paul	6	69	95	1.4
3408 Phila. Chew. Gum	6	28	34	1.2
3803 Tootsie Roll	6	42	149	3.5
3881 Vicks Chem. Co.	6	79	246	3.1
3947 W. M. Wrigley	6	1,084	380	.4
3957 Y & S Candies	6	85	106	1.2
2494 Fleer Corp.	5	59	285	4.8
3742	5	33	1	.1
<b>SUBTOTAL</b>	<b>245</b>	<b>8,275</b>	<b>19,296</b>	<b>2.3</b>
67 Vendors 1-4 Items	121	1,466	8,765	6.0
<b>TOTAL</b>	<b>366</b>	<b>9,741</b>	<b>28,061</b>	<b>2.9</b>

Table 4. Candy Equipment Requirements and Capacity

Item	Number Items	Weekly Pick	Picking Requirement	Reserve Requirement
<u>Candy</u>				
1. Full Case Regular (Batch Pick, Daily Set Up)	8	260 cs.	4 Floor Positions	20 Pallet Rack Positions
2. Full Case Regular (Flow Rack)	105	760 cs.	120 Flow Rack Lanes or 6 Flow Racks	160 Pallet Rack Positions
3. Full Case Distribution (Distribution Area) (Daily/Weekly Set Up)	11	1,650 cs.	22 Floor Positions	22 Pallet Rack Positions
4. Broken Case Distribution (Flow Rack) (Distribution Area)	17	1,130 w.u.	20 Flow Rack Lanes or 1 Flow Rack	18 Pallet Rack Positions
5. Broken Case Regular (Flow Rack) and (Bins)	256	5,440 w.u.	180 Flow Rack Lanes or 9 Flow Racks 120 Bins	20 Pallet Rack Positions
Total Candy Requirement	397	9,240 units	26 Floor Positions 320 Flow Rack Lanes 16 Flow Racks 120 Bins	240 Pallet Rack Positions
Total Candy Capacity	466		32 Floor Positions 16 Flow Racks 120 Bins	660 Pallet Rack Positions

NOTES: Future Growth

1. Pallet picking and overflow storage provided.
  2. Double flow rack and bin capacity with mezzanine.
- Supporting Exhibits
- A. Demand stratification by order picking mode.
  - B. Relationship of inventory to demand for major vendors.

Table 5. Cigars and Tobacco Requirements and Capacity

Demand Category	Items	Monthly Demand Whse. Units	Average Demand Per Item	Average Pack	Average Monthly Usage (Cases)	Average Peak Inventory (Months)	Expected Cases @ Average Maximum	Storage and Picking Mode
150+	2	682	341	50	4	1	4	FR-1 RP-1
100-149	7	795	113	50	2½	1	2½	FR-1 RP-1
50-99	38	2,696	70	50	1½	2	3	7-B R-10
25-49	29	1,077	37	50	1	2	2	38-B R-76
1-24	17	281	17	50	½	3	1½	29-B R-29
0	15	0	-	-	-	-	-	17-B R-10
Total	108	5,531						FR-2 RP-2
Cigar & Tobacco Requirement								91-B R-125

NOTES:

- Total Cigar & Tobacco Capacity
- 1. Use flow rack and pallet rack as required. Minimal requirement
- 2. 14 bins @ 16 openings each = 224 bin openings.

- Future Growth
- 1. Selected fast moving items move into flow rack to replace full case candy.
- 2. Remaining growth within bins provided and with second level mezzanine.

FR - Flow Rack  
 RP - Reserve Pallet Rack  
 B - Bin  
 R - Reserve Bin



Table 6. Cigarette Requirement and Capacity - Demand Stratification by State  
(Cartons/Week)

Number of Brands	Pennsylvania	New Jersey	Connecticut	Delaware	Maryland
3000+	1				
1500-2999		1			
1000-1499	2				
900-999	1				
800-899					
700-799					
600-699	1				
500-599	1	1			
400-499	2	1	1		
300-399	3	1			
200-299	15	2			
100-199	17	14	3	1	1
50-99	15	20	2	1	
0-49	17	35	69	73	74
Total	75	75	75	75	75

NOTES:

Requirements and Capacity Specification

Pennsylvania: 60 Flow Rack Lanes and 20 Bins

New Jersey: 60 Flow Rack Lanes and 20 Bins

Other States: 240 Bins

Additional Capacity: 8 Bins

Future Growth: Double Capacity with Mezzanine

consider the demand stratification by state as shown on Table 6.

One brand in the top state actually has more activity than all 75 brands in the smallest state. That same brand also accounted for almost 75% as many units through the system as did all 397 candy items and accounted for 22% of all cigarette volume. We now ship this brand in half case lots only, by passing the normal pick line to go directly to shipping. No other brand can currently be shipped to all stores in half case lots because of the impact on store inventory levels, but high volume stores are encouraged, when possible, to order in lots of 30 (1/2 case).

The rest of the brands for the two highest volume states are handled on flow racks and bins. The slowest three states are now handled in bins. As activity increases in these states, picking will go to the combination of flow racks and bins used in the two top states.

So far we have considered principally order picking. There are, of course, other handling functions: receiving, storage, checking, packing and shipping. In our present warehouse of 5,600 square feet with a maximum clearance of 10 feet, we have not had the luxury of even considering these functions as separate; they all blend together at a tremendous cost in efficiency.

Receiving and shipping will be on pallets as much as possible with pallet mules being used throughout the receiving area. There is no need to use a lift truck for low level lateral movement. Approximately 2,100 square feet has been set aside for these two activities. This amount may seem excessive but it allows for efficient consolidation of deliveries as our complex grows.

Goods will be stored in standard pallet racks, serviced by lift trucks. Retrieval from storage to pick line is convenient.

Packing is combined with picking; cigarettes will remain in half case units, candy will be either in cases or in tote boxes for less than case lot items. Since the value of small candy items is relatively low, checking will be left at a case count for candy. Cigarettes will be double checked by a carton count method before shipping.

#### Show Layout by Function

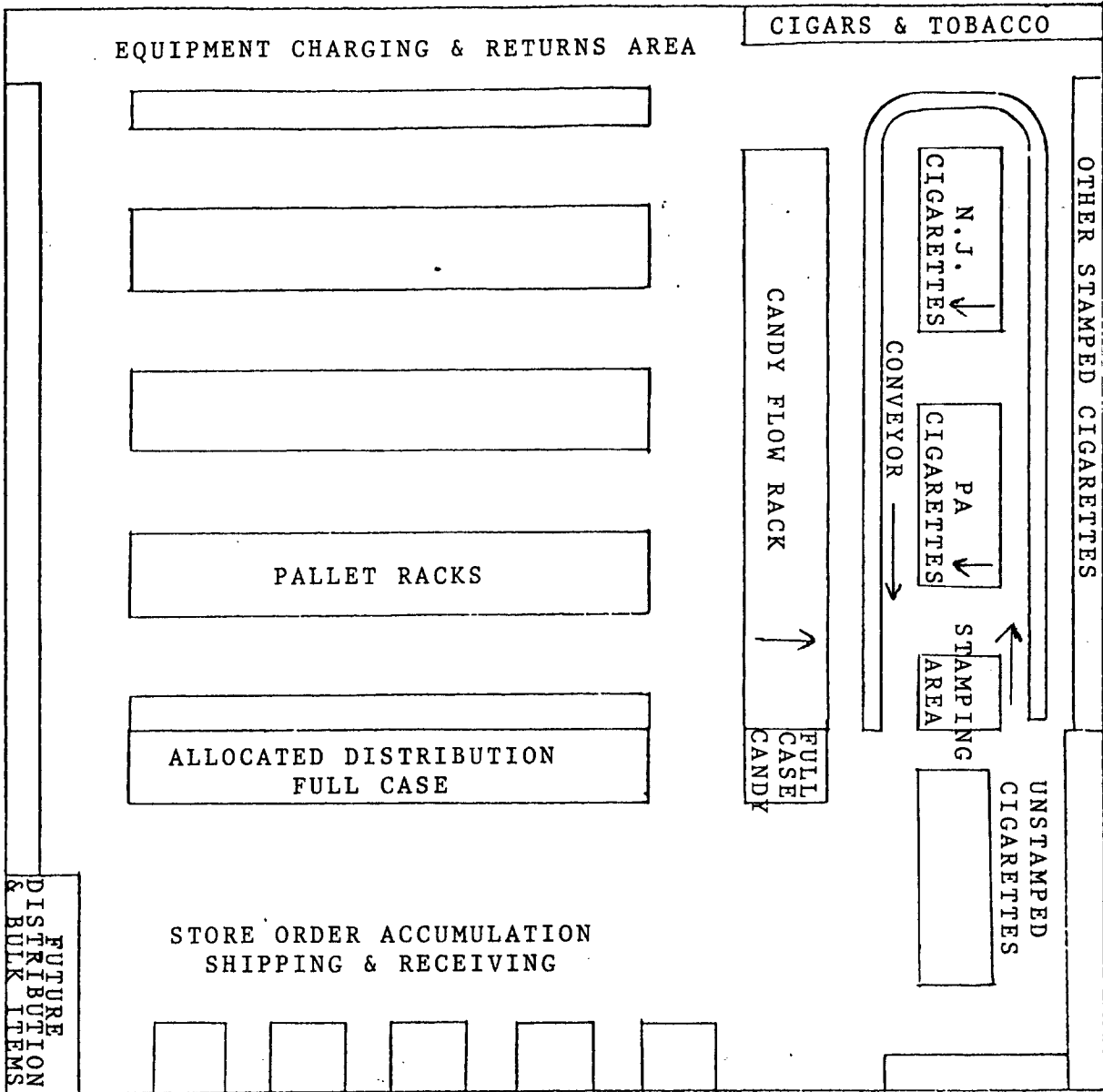
This layout by function is the outcome of the first phase of our study, Figure 1. We tried to keep all functions free from crossing patterns and to avoid dead-heading as much as possible. Picking for an individual store will be on a continuous cafeteria-style conveyor line, with two route options for cigarettes. Replenishment of the picking lines will be from the rear to avoid interference with picking activities.

There are other important considerations in designing and building itself. To provide comfortable working conditions, we set aside a 1,600 square foot mezzanine for offices, locker rooms and lunch room which will allow employees to get away from their jobs to pleasant surroundings on breaks.

Construction will be standard, allowing for other uses should we get out of the warehousing business. More importantly, the construction will allow for modular expansion to 50,000 square feet and will allow flexibility for the inclusion of other product lines.

Permits are now pending with the township fathers for construction and

Figure 1. Planned Warehouse



hopefully a successful application of our theories. There was a time when proper zoning was all that concerned the township; the building inspector being the only one concerned with the actual plans. Now, however, we are faced with a delay over the winter because there are so many agencies which feel the need to review the plans.

We are investigating upgrading the other existing warehouses and including them in the new complex. This would make possible a more sophisticated and efficient consolidated delivery system. Limits on consolidation are now imposed by space limitations within the stores, but store plans are being revised to include more receiving space.

Future warehousing plans must be guided by our product mix. The most likely candidates for warehousing are ice cream and frozen food because they go together well for storage and handling and account for almost 6 percent of sales. They are also compatible in seasonality. Stores are currently designed with adequate freezer capacity to allow for this consolidation in deliveries, and consolidation would be welcome because check-in is time consuming and difficult since deliveries are now handled one handtruck at a time.

For us to get into frozen storage and delivery would require a large investment in facilities and delivery equipment (both trucks and dollies). With the more pressing need to upgrade and consolidate current operations, this will have to wait or be done by current suppliers. Preliminary talks have been held with both ice cream and frozen food suppliers to see if we can work out a solution which would be beneficial to all parties, but no decisions have yet been made.

As shown in Figure 1, we have too many deliveries of bakery products. There are two possible solutions now: minimize the number of suppliers, minimizing the variety we can offer; or stock longer shelf-life items, minimizing the number of deliveries per vendor and losing profitable sales of our fresh Italian bread and rolls.

Logically, we could ask our suppliers to consolidate deliveries. But the major bakers and their unions cannot come to an agreement allowing delivery to a central warehouse. Until they do, we will have to continue paying for six deliverymen and six trucks where one of each would do. Many of the supermarket chains bake and deliver to their own stores, placing us in a noncompetitive position. This must eventually be changed.

Drastic changes in our product mix are unlikely unless it becomes legal for us to sell beer and wine in many more stores. Changes in types of locations are much more likely. We may find ourselves moving increasingly into inner cities: suburban planning and zoning boards are becoming more restrictive, existing near-city store neighborhoods are becoming increasingly urbanized, and more opportunity exists for small stores in urban areas as larger stores are moving out.

We have not yet had the problems of many in the industry, but there are security and safety consideration in serving inner cities and implications for warehousing as a result of delivery problems. Consolidating deliveries will become more important as will means of making a rapid delivery at the store. Thus, we would have to find a container system suitable at all levels: warehouses, trucks and stores.

An external force leading to change is the possibility of our grocery wholesaler's converting to automated warehousing. Automation is increasingly popular among wholesalers. However, automated warehousing is designed to supply stores in case lots. How will automation affect our chain of small stores? We may become less desirable customers and be required to pay premiums. We may need to buy in larger lots, thereby hurting our cash flow and creating storage problems. We may need to become sub-station warehouseers.

It may be that Wawa would be better off giving all business to one wholesaler and getting out of the wholesaling business. However, no such satisfactory exists in our area.

We must evaluate what present or future services the warehouses could provide to customers other than Wawa. Our dairy has other customers, primarily institutional and home delivery. By law, in order to qualify as a cigarette wholesaler in the Commonwealth of Pennsylvania, we must serve outside

customers. We do, but few. We might expand to supply other outlets in our trading area. If nothing else, we would have the advantage with our volume alone. Also, we would have a hedge against falling short of anticipated growth in stores. This certainly merits further study on our part.

We have now begun constructing not just a warehouse, but a warehouse system adaptable to consolidate hip-ping. We have designed the system with enough flexibility to allow consolidation without precluding the possibility that it may be more economical for others to do it for us.

We have avoided expensive overspecialization in the physical design of our plant so that we have flexibility to expand or change our emphasis as market conditions change.

Whereas the solutions I have given are specific to our needs, the principle is that warehouse systems must be tailor-made to avoid waste and rigidity. The process used in our design is transferrable to the needs of others, although the particulars may differ.