FACTORS TO BE CONSIDERED IN DETERMINING WAREHOUSE CAPACITY FOR A RETAIL FOOD BUSINESS

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FACTORS TO BE CONSIDERED IN DETERMINING WAREHOUSE CAPACITY FOR A RETAIL FOOD BUSINESS

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CHAPTER I

INTRODUCTION

Purpose of Study

The typical study of space requirements in a grocery warehouse usually covers the engineering aspects of constructing the building. The purpose of this study is to examine the methods that could be used in operating a new grocery warehouse and the retail outlets, in so far as they affect space requirements in the warehouse. This includes some of the decisions that are made when buying merchandise, as the purchasing policy of a food company is one of the many factors that determine the size of a warehouse. Some methods of computing the space requirements are also presented to show how some of the operating problems are taken into consideration when arriving at the size of the structure. No attempt is made to present specific or even a general formula to be used in determining the space requirements. This is an impossibility, even though basically a warehouse does four things regardless

of what type of merchandise is handled. The four things are receiving, storing, assembling, and shipping merchandise. These are the essential operations performed in all warehouses, but there are also other operations that can be performed by one company and not by another. Some of these other operations may be commented upon, although they are only mentioned to show that if they are performed, there will be a different amount of space required in that particular situation.

Scope of Study

This study is limited to dry grocery items, both in the warehouse and in the retail outlets. Some mention is made of produce, meat, and some items that are of a nonfood nature, such as drug items and housewares, only to show that if they are handled through the warehouse instead of direct to the store from an outside supplier, thought and consideration will have to be given to them in planning the necessary amount of space needed for a warehouse.

The use of materials-handling equipment is mentioned wherever it affects the area required for storing merchandise. The relative merits of various types of materials-handling

equipment as well as whether or not it should be used is not considered in this study. The operating methods presently being used by the grocery industry will of necessity have to be taken as the ones that will be used basically in the near future. This does not mean that a particular company will continue to use the same methods in a new warehouse that it used in its old building, but that it will look at the newest methods of handling merchandise and adapt these to its own particular situation. There will continue to be improvements in handling and storing merchandise, and where these occur and prove to be worthwhile they will be incorporated by the industry.

Even though there is a trend toward one-story warehouses, the multistory warehouse is still in use; and it is here where several problems in utilizing space more effectively occur and are solved. Many of the methods of handling merchandise in the one-story warehouse have come about because of the problems involved in storing merchandise on several floors.

The multistory warehouse has certain inherent features that prevent the maximum utilization of the space in the building for storing merchandise. These features are not found in one-story warehouses. Space devoted to such items as elevators,

stair wells, thick supporting columns and walls, low ceilings, and still lower steam pipes and sprinkler systems cannot be used for storage purposes. An example of the amount of space lost in a multistory warehouse over that in a one-story warehouse can be seen in Table I. The multistory warehouse, as presented in Table I, has six floors and is 60 feet in width and 200 feet in length. The one-story warehouse is 150 feet in width and 480 feet in length.

The operation of a multistory warehouse is similar to that of a one-story building. The differences that may occur are due to the age of the building and certain other features of its construction. Conveyors may be used, but are usually only employed in selecting merchandise to be shipped. Fork lift trucks may not be used because of low door sills, low-capacity elevators, low ceilings, weak floors, and many other causes. In some cases they may be utilized completely throughout the multistory warehouse, and in some cases they are limited to the first floor.

Since the current trend is toward one-story warehouses, the problems involved in operating the multistory buildings are omitted from this study.

TABLE I

COMPARISON BETWEEN MULTISTORY AND SINGLE-STORY STRUCTURES WITH THE SAME GROSS FLOOR AREA*

	Multistory Warehouse	One-story Warehouse
Gross area in square feet	72,000	72,000
Area lost by:		
Columns	2,976	1,168
Elevators	1,512	-
Stairs	2,160	-
Approaches	3,600	-
Outside walls	3,120	1,260
Total	13,368	2,428
Total usable area	58,632	69,572

* Source: United States Department of Commerce. Streamlined Wholesale Grocery Warehouses. Bureau of Foreign and Domestic Commerce. U. S. Government Printing Office, Washington, D. C. 1946. p. 14.

There has been no attempt to limit this study to a business of any particular volume. Methods that are used by the large companies are often adopted by the small companies and vice versa. Volume is only one of the factors that is involved in how large the warehouse should be. A one-store business may not have a warehouse or, because it has a large volume, it may have a warehouse separate from the store. A business having sixty outlets might not operate a grocery warehouse, while another business having the same number of outlets might operate one or two warehouses. It is not the volume of the business that is involved, but whether or not it operates a separate warehouse.

The costs involved in constructing and equipping a new warehouse and the method of financing are also omitted from this study. It is evident that the desire for a new warehouse may be outweighed by the cost of constructing the building.

Certain policies which affect the operation of the retail outlets are not considered, as they do not affect the storage area in the warehouse. Some of these would be personnel, managerial, supervisory, merchandise, and merchandising

policies. It is felt that these are not sufficiently important to warrant consideration.

Sources of Data

Several books as listed in the bibliography of this study have provided the necessary background information on grocery chain stores. These books do not give a detailed description of the warehousing function, but instead, present it in rather broad and general terms. They do point out the increasing importance of the grocery warehouse as a distribution center, instead of stressing its storing function. The data describing the operation of the various warehouses come from two main sources: government, trade, and individual company publications; and personal visits to several chain warehouses and with the people in charge of these operations.

A considerable amount of valuable information was contributed by the Jewel Tea Company, Incorporated, of Chicago, Illinois, and in particular by Mr. Lee Smith, Warehouse Operating Manager.

CHAPTER II

OPERATION OF A WAREHOUSE

There are four functions that all warehouses perform, regardless of the type of merchandise handled or location. These functions are receiving, storing, selecting or assembling, and shipping. To perform these functions requires space, but the manner in which they are performed determines the amount of space required. In an old building, the construction itself sometimes determines the method that is used; for instance, the ceiling might be too low to use fork lift trucks. When planning a new warehouse the method can determine the size of the structure, and the ceiling can be placed high enough to allow fork lift trucks to be employed.

Receiving

Receiving begins with the unloading of the merchandise from the truck or the railroad car and ends when it is placed in storage.

There are three methods of receiving: by hand trucks, conveyors, and pallets. In receiving merchandise by hand truck, the hand trucks, or four-wheelers, are loaded by hand from either the trucks that are backed up at the receiving dock, or from railroad cars which are spotted on sidings at the warehouse. After they are loaded, as many men as are needed to keep the receiving platform clear are used to roll the hand trucks back to the storage area. This method is a laborious and costly way of handling merchandise and requires more space on the receiving dock than when pallets are used. Since the hand trucks cannot be stacked on top of one another, neither when they are empty nor when they are loaded, the space above the hand trucks is wasted and they require a storage area near the receiving platform. After they are loaded, they may be permitted to accumulate in large quantities during the receiving process. To reduce this problem, either more men are needed to remove the loaded four-wheelers from the receiving dock, or more space is required for the platform.

When merchandise is received by a conveyor system, the conveyor is extended into the truck or the railroad car by means of portable conveyor sections. The merchandise is then

placed on the conveyor and carried to the storage area. In receiving with a conveyor system, only one truck or one railroad car can be unloaded at a time. This reduces the amount of space needed for a truck receiving dock, except where merchandise from another truck is unloaded onto the dock and then placed on the conveyor during a slack period. This procedure would require more dock space than the one that unloads directly onto the conveyor.

Where pallets are used in the receiving operation, there are several ways of handling the merchandise. Two pallets can be placed on a hand truck and pushed into the truck or railroad car. The incoming merchandise is then placed on the pallets in a predetermined pattern. Each pallet contains the same number of cases of identical merchandise. When the pallets are loaded, the hand truck can be pushed to a convenient spot on the receiving platform to which a fork lift truck has ready access. The fork lift truck then carries the merchandise to the storage area.

Another method of handling the merchandise is to load the pallets in the truck or railroad car and have a transporter pull the loaded pallets either to the receiving dock, where a

fork lift truck can take them to storage, or directly to the storage area, where a fork lift truck operator places them in their proper position.

Still another method is to place the pallets on four-wheelers that can be hooked together to form a trackless train. The pallets can be placed on the four-wheelers and loaded in the truck or railroad car, or the pallets can be loaded first and then put on the four-wheelers with a fork lift truck. When there are three or four hand trucks completely loaded, a tow-motor truck can pull them to the storage area and leave them. A fork lift truck then places the loaded pallets in their proper place in the storage area.

Using pallets requires more dock space than either of the other two methods. This is caused partially by the need for space to maneuver the fork lift trucks, but more so because several trucks and railroad cars can be unloaded at the same time. Where just one truck is being unloaded at a time, there is no need for additional space, and even less may be needed if the fork lift truck can move directly from the truck into the aisle leading to the storage area.

Storing

After the hand trucks have been loaded and pushed to the storage area, they are unloaded and piled in tiers, by hand, in an assigned spot. The height of the pile depends upon how much labor and time the company wishes to invest. The higher the tier, the more labor and time is consumed in storing the merchandise. If the merchandise is fragile, it cannot be hand stacked to any great height without using shelving.

The merchandise may be tiered to the ceiling at the back of the pile and may be stacked about 6 or 7 feet high at the front. This will utilize more cubic feet than if the entire pile is kept within reach of a man standing on the floor. It, of course, costs more in labor to pile to the ceiling as the ceiling height increases.

As the merchandise comes to its assigned spot on the conveyor, it is hand stacked in piles in the same manner as if it were brought back by hand truck. There is available a portable stacker which can be adjusted to various heights. If this is used, one man takes the cases off the conveyor and places them on the stacker, while another man takes the cases from the stacker and places them on the top of the pile. The

stair-shaped pile may reach to the ceiling at the back and yet be within reach of an order picker at the front.

Where pallets are employed, a fork lift truck is used in the storage area. The fork lift truck handles the entire pallet load and places it in an assigned spot. It can stack pallets of merchandise to the ceiling, taking considerably less time to do it than when it is done by hand. Depending upon the layout, the pallet loads can be tiered to the ceiling, and there may be a stack only one or two pallets high in front of the pile for selection.

Selecting

When merchandise is selected from the stock to fill orders and it has been placed in storage using hand trucks or a conveyor system, the items can be selected directly from the storage area. This may also be the case when the pallet system is employed, but more likely there will be a separate selection area.

In selecting merchandise with hand trucks, the order picker or selector will take an order form and start out at one end of the warehouse and work through until he fills the hand

truck. He will then push this four-wheeler to the shipping platform, pick up another empty hand truck and continue filling the order. This continues until he has filled the complete order; it is known as a "crew" type of order picking.

Using what is known as "area" order picking, the men selecting the order will be assigned a certain portion of the warehouse. They will select the merchandise on the order form in that area and will not pick the entire order. As they fill a hand truck, they will bring it to the shipping platform.

Both "crew" and "area" picking can be employed in selecting merchandise when conveyors are used in the warehouse. If "crew" picking is used, the entire load will be on the conveyor at one time. It can be fed directly into the truck, and causes no confusion in checking the order. Loading is limited to one truck at a time under this method. Using "area" picking, several orders will be on the conveyor at the same time. As this merchandise reaches the shipping platform, the cases must be separated and assembled into orders on hand trucks.

When using pallets, two different methods are employed in storing merchandise. Either there is a separate selection line, or selection is done directly from the storage area as

when using hand trucks and conveyors. Regardless of which method is employed in storing the merchandise, either "crew" or "area" picking can be used in the selection process. The men selecting the order can place the merchandise on hand trucks or on conveyors as above. However, when a pallet system is used, there is generally some mechanical means utilized to bring the loaded hand trucks to the shipping dock and bring back empty four-wheelers so that the selectors do not have to go back and forth between the storage area and the shipping dock. This will be some form of a towline, either overhead or in the floor, or a towmotor truck.

Shipping

When merchandise on hand trucks arrives at the shipping platform, it is checked against the order form and then placed into a truck by hand. This also applies when several orders are selected at the same time when using a conveyor system. If a complete order is selected and loaded, then the conveyor leads right into the truck and the merchandise is checked as it is loaded.

Sometimes merchandise is selected and put directly on hand trucks when a pallet system is used, and in other cases it is selected and placed on pallets which are on hand trucks. If pallets are not employed in selecting, then the shipping procedure is the same as when hand trucks or conveyors are used but if pallets are utilized, the merchandise is checked when it arrives at the shipping platform and then the entire pallet load is placed into the truck by a fork lift operator. Occasionally merchandise will be hand stacked on top of the pallet loads in the truck.

The West Coast Grocery Company, of Tacoma, Washington, installed conveyors in two branch warehouses. Both buildings have approximately 18,000 square feet of floor space and both are one-story structures. In addition to the conveyors, both warehouses use four-wheelers and fork lift trucks with pallets. The conveyors cover the entire building, and merchandise flows from the receiving dock to the storage area and then to the shipping platform.

The company claims the following advantages for its conveyor system over its former method of handling stock,

which was with four-wheelers, and with fork lift trucks and pallets for some items.[1]

1. A very fast selecting rate allows the regular crew to handle an increased number of orders, which are created when a holiday occurs during the week.

2. It is possible to load out trucks much sooner after the arrival of an order in the warehouse.

3. It saves space because of the very narrow aisles required. Also, by hand-stacking, we obtain maximum use of the total warehouse in cubage and eliminate the order platform.

4. Inbound merchandise is either put in its proper place or it will flow into an outbound truck. This keeps the warehouse much neater because it is impossible to just dump merchandise any place in order to get rid of it, as some of our fork lift truck drivers do.

5. It has increased our use of both trucks and drivers and has simultaneously cut drivers' overtime.

6. Each of the two selectors works half of the warehouse only and is therefore more familiar with his stock and fills orders more accurately and faster.

7. The absolute necessity of complete coordination of every man forces cooperation where we sometimes never had it before.

The disadvantages are:

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[1] Charles H. Hyde, "Our Conveyor System and How it Works," The Voluntary and Cooperative Groups Magazine (Vol. XXI, No. 7, July, 1951), pp. 17-19, 45, 58.

1. Large scrambled orders present a definite checking bottleneck.

2. In case of a complete power failure, we are temporarily out of business. It would take four to eight hours to tear out the track so four-wheelers could be used.

3. Neither can two inbound trucks nor two outbound trucks be handled at the same time efficiently in our small warehouses, which have no space for the so-called surge line.

The Seven Day Wholesale Grocery, Incorporated, of Woodville, Mississippi, remodeled its old warehouse and increased the area from 20,000 square feet of floor space to 32,000 square feet. At the same time the company remodeled, it installed a conveyor system. The warehouse consists of a basement and a first floor. Due to the different floor levels in the basement, only about 50 percent of this area was used for storing merchandise, as it was impractical to use a hand truck on this floor. Since the installation of the conveyor system, the company has cited the following benefits:[2]

1. Shipping and receiving time has been cut an average of 40 percent.

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[2] C. M. Treppendahl, Jr., "A Conveyorized Warehouse System," Wholesale Grocer News (Vol. 26, No. 12, March, 1952), pp. 14-16.

2. Basement storage space is increased 50 percent.

3. Non-conveyorables can be stored near receiving and shipping doors, reducing the time and effort involved in handling these items.

4. Fast moving case goods can be stored on either floor of the warehouse.

The Standard Grocer's, of Holland, Michigan, moved into a new one-story warehouse designed around a conveyor system. This warehouse serves 130 independent stores and 3 cash and carry stores. The company has approximately $450,000 in inventory at one time, or about a three weeks' supply of each item. Thirty-one thousand tons of merchandise a year are shipped out of its warehouse.

As the merchandise comes into the rear of the building it is placed on the conveyor and passes through four aisles. One man in each aisle removes the merchandise from the conveyor and stacks it in the proper bay within easy reach for order selection, which is about 6 or 7 feet high.

The "crew" method of order picking is employed, and one order is completely filled before another one is started. This method permits the company to make efficient use of available space, handle incoming merchandise and outgoing stock without confusion, and reduce man-hours and handling costs

considerably. The space requirements for this system are small, and permit the handling of a continuous flow of goods in and out of the warehouse.

The Alpha Beta Food Markets, Incorporated, of Los Angeles, California, uses a double belt conveyor to fill orders. Only one truck at a time is loaded from the conveyor. Twenty-two stores are served from the warehouse, which has 54,000 square feet of floor space out of a total of 82,000 square feet devoted to grocery items.

The company utilizes fork lift trucks and a pallet system in receiving and storing merchandise. The merchandise is stored on pallets in pallet racks adjacent to the conveyor belt in order form sequence.

Hillman's Pure Foods, Incorporated, of Chicago, Illinois, is operating out of an old multistory warehouse, which serves nine stores. When slow- and medium-moving merchandise is received, it is placed on hand trucks and pushed to an elevator, which takes it to one of the upper floors. Here it is hand stacked in the storage area, as there is no separate selection area. Fast-moving items are placed on pallets as they are received and are stored on the first floor, using fork lift trucks.

The upper floors have low ceilings and the floors will not support heavy loads. There are no fork lift trucks used on these floors for that reason.

In selecting merchandise, two pallets are placed on a hand truck and the selector places the merchandise that he has selected on the pallets. When the pallets are loaded, the hand truck is pulled to the elevator and sent to the first floor. Here a fork lift truck picks up the pallet loads and places them in a truck for shipment to their retail outlets.

This will be changed when they move into their new warehouse, which will be a one-story building having about 87,000 square feet of grocery warehouse space. The new building will have a reserve storage area and a selection line. The selector will use a low lift fork truck and place the order on a pallet as it is picked. When the pallet is loaded, he will take it to the shipping dock, where it will be checked and put into a truck for shipment. Whether or not "crew" or "area" order picking will be used has not yet been decided.

The Jewel Tea Company, Incorporated, of Chicago, Illinois, has a selection line separate from the storage area. Using "area" order picking, the selectors put the merchandise

on hand trucks which are placed on a moving conveyor, which is at floor level. The conveyor then takes the merchandise to the shipping platform. The American Stores Company, of Philadelphia, Pennsylvania, employs an overhead towline to carry the hand trucks from the selection area to the shipping dock. This company uses a modified form of "crew" order picking. The selector makes a complete tour of the warehouse, but he does not work on the same order on the complete trip. Both of these companies load their trucks by hand and as a rule do not ship loaded pallets to the stores.

The various methods of operating warehouses are exemplified by the above companies. However, there is some difference between companies using the same basic methods. There may be a difference in the ceiling heights of their warehouses, the width of the aisles, the height of the door sills, the number of railroad car spots, the number of truck spots, the type of merchandise handled, and the method employed in arranging the pallets in the selection area and the storage area. These will be discussed in the next chapter, along with the relationship between the method used in operating a warehouse and how it affects warehouse capacity.

CHAPTER III

PLANNING THE WAREHOUSE

When the plans for a new warehouse are being discussed, management makes certain decisions that affect the capacity of the proposed building. This chapter deals with those decisions and what the effect will be on the capacity of the warehouse.

One of the first decisions that management should make is the system to be employed in handling merchandise in the proposed building. The method decided upon will partially determine the answers to many of the other decisions.

Tiering Height

In Chapter II it was shown that tiering height is limited to 6 or 7 feet when either hand trucks or conveyors are used. This will keep the ceiling height to approximately 9 or 10 feet. The change in receiving and shipping that results from the use of a conveyor system over hand trucks is the method employed to bring the merchandise to storage and in transporting it to the shipping dock. The conveyor system will

also increase the efficiency of placing merchandise in the storage area and in sending it to the shipping platform.

Merchandise loaded on pallets may be stacked in tiers 20 feet high by using fork lift trucks. After the merchandise is placed on pallets from trucks or railroad cars, it is not touched by hand again until it is selected for an order.

Aisles

The question then arises, does a fork lift truck operation require more aisle space than with other methods? Assuming either one-way or two-way traffic in all cases, yes, fork lift trucks and pallets require more aisle space than either a hand truck or a conveyor operation. With a hand truck operation, the main aisles, where there should be two-way traffic, need to be approximately 3 feet wider than the combined width of two of the widest hand trucks. Usually, this does not exceed 10 feet. The feeder aisles, leading from the main aisles, are approximately 5 feet wide with one-way traffic. In some cases, these aisles are 2 feet wide and men carry the merchandise from the main aisles to its proper position. To reduce the distance these men have to walk, the number of feeder aisles

should be increased over that needed to permit the passage of hand trucks.

Where a conveyor system is in use, the main aisles and the feeder aisles may be the same width, which is between 3 and 5 feet. This will vary somewhat due to the width of the conveyor, which may be 12 or 18 inches. When the conveyor runs through the main aisles only, the feeder aisles are 10 to 15 feet long and about 2 feet wide.

The main aisles may run from 10 to 20 feet in width and the feeder aisles from 6 to 12 feet in width, when employing fork lift trucks. This depends upon the type of fork lift truck used and whether or not there is one-way or two-way traffic. A straddle-type fork lift truck is required in the 6-foot aisles.

Table II gives the recommended aisle widths for trucks having different lifting capacities. The load length upon which these figures are based is 48 inches. If a shorter pallet is used, the width of the aisles may be reduced slightly. These figures provide for two-way traffic and allow clearance for smooth and rapid operation, but are not the minimum widths

TABLE II

RECOMMENDED AISLE WIDTHS FOR FORK LIFT TRUCKS*

Truck Capacity (pounds)	Length of Truck (feet)	Aisle Width (feet)
2,000	9	10
4,000	10	12
6,000 to 10,000	12 to 13	14

* Source: Curtis H. Barker, Jr. Industrial Materials Handling. Cleveland: The Lincoln Extension Institute, Inc. 1950. p. 155.

in which the fork lift truck can turn and place or remove a loaded pallet.

Sometimes, even where a pallet system is in use, not all the items are palletized. Thus, some bulky items, such as cereals, soap flakes, and paper products, are hand stacked in the warehouse. Where this occurs, the aisles may be about 5 feet wide.

Wider aisles require more space, but the increased operating efficiency resulting from their use will usually compensate for the extra space needed. Where narrow aisles are

used, such as when hand stacking merchandise, more floor space is provided for the goods. However, in this case, the merchandise is not moved again until the tier is about exhausted. This results in several tiers of merchandise being only partially filled, while with a pallet system, this air space can be utilized and results in more usable space.

In an attempt to reduce the amount of aisle space necessary for a pallet system, angle stacking has been tried. Instead of placing the pallets at right angles to the aisles some companies have placed them at a 45 degree angle. This reduces the width of the aisle and the number of pallets that may be placed in a given area. It also results in one-way traffic and irregular alignment of the merchandise. Angle stacking may be employed in either the storage area or the selection area, or it may be used in both areas.

Using the same pallet sizes and the same aisle widths, the direction of the stringers, on the pallets, determines the number of pallets that may be placed in a given area. The stringers run the long way on a 40 inch by 48 inch pallet, but run the short way on a 48 inch by 40 inch pallet. In the former case the pallet has a 40 inch face and takes up 40 inches along

the aisle, and in the latter case it has a 48 inch face. More 40 inch by 48 inch pallets can be placed in a given area than those having a 48 inch face.

Pallet Racks

Where there is a separate selection area, merchandise is usually not stacked more than two pallet loads high. The space between the top of these pallet loads and the ceiling is space that could be used for storing reserve stocks of merchandise. There are several methods available to utilize this space, such as by using pallet racks, a mezzanine, and a mezzanine combined with hanging shelves.

With pallet racks in the selection area, the first pallet load of merchandise may be placed on the floor, the second in the middle, and two more on top. By placing one item on the floor and another item in the middle of the rack, the selection line is cut in half. Reserve stocks of these items are placed on top of the racks. Racks are expensive to install and it is extremely difficult for selectors to pick merchandise from under the rack or from the middle shelf. There is also a tendency for the selectors to pick merchandise from the front half of

the pallet load on the middle shelf. This results in the pallet load tipping over backwards when the equilibrium point has been passed unless the load is picked evenly. The advantages that pallet racks have are: they cost less than warehouse construction; selecting difficulties are outweighed by the decreased length of the selection line; and by placing reserve stock on top of the racks, the hauling distance to storage and in replenishing the selection line is greatly reduced. They are not justified when an abundance of warehouse space is available.

A mezzanine with hanging shelves is similar to pallet racks, except that the middle shelf is supported by hanging it from the mezzanine instead of supporting it from the floor.

The mezzanine allows for stacking one loaded pallet on top of another for selection, and two more loaded pallets are placed on the mezzanine for reserve stock. It does not permit a shorter selection line as to the other two methods, but it contains more flexibility for stock arrangement. In connection with a mezzanine, single pallet racks are available that are shaped like an inverted U and can be placed below the mezzanine and anywhere in the selection line. This can be used where an item does not sell fast enough to have two full pallet

loads on the line at the same time. Using this rack, one slow mover can be placed on the floor and another can be placed on top of the rack, with one pallet load of each item in reserve stock on the mezzanine. If more space is needed for a fast-moving item, the pallet rack can be omitted and two pallet loads can be placed on the floor under the mezzanine. This seems to be the best method to use in utilizing the space over the selection line and still retain flexibility.

Where selection is made directly from the storage area, pallet racks cannot be used to increase the utilization of the "air rights," or space above the front tiers of merchandise. This space is wasted just as it is when merchandise is hand stacked in storage.

Doors and Overhead Obstructions

In one-story warehouses, doors usually do not provide a problem on the interior of the building. Roll-back garage-type doors can interfere with storing capacity when they are not carried high enough before starting the roll back. They are carried back into the warehouse and prevent a fork lift truck from stacking merchandise in the space behind the doors.

This problem is not encountered in the many warehouses where both trucks and railroad cars enter the building for unloading. Several of the newer warehouses in the northern part of the country are incorporating both truck and railroad receiving inside the building. This is due to the climate, which requires heating the warehouse several months out of the year. By being able to close off the building, heating costs are reduced along with an improvement in working conditions. Receiving in warehouses located in the warmer sections of the country is usually done on the outside of the building, and the doors in these cases can decrease available cubage.

In planning the new warehouse, all overhead obstructions, such as lights, steam pipes, sprinkler systems, ventilators, and heating ducts, should be kept above the maximum stacking height.

Column Spacing

While column spacing in an old warehouse might not be suitable for a pallet system, it should be taken into consideration when planning a new building. This entails laying out the floor plan in advance, so that the pallets fit between the columns without wasting space. If two different pallet sizes are

in use, this can be difficult to accomplish. If the feeder aisles run the width of the building, the column spacing for the length of the building will, of necessity, be different, due to the length of the pallet. Once the direction of the aisles have been set they are not easily changed.

Receiving and Shipping Area

The space required for receiving and shipping varies with each company, as was pointed out in Chapter II. It depends upon the type of business the warehouse serves, such as chain stores, independents, or cooperatives, and the method the company uses to receive and ship merchandise. If fork lift trucks are used in receiving merchandise, there may be room for twenty-seven railroad cars and twelve trucks in the receiving area, and as many as thirty-five trucks in the shipping area. In other cases, there may be room for only five railroad cars and four trucks in the receiving area and twelve trucks in the shipping area. The amount of space devoted to receiving and shipping can vary above or below these figures.

Type of Merchandise Handled and Functions Performed

The type of merchandise handled through the warehouse affects the amount of space required. If it is strictly a dry grocery warehouse, of which there are very few, this problem is greatly reduced. There are certain items, such a macaroni products, that cannot be stacked very high, since the package is fragile and is easily damaged. Not all items fit on the pallet size being used in the warehouse, such as paper products. This merchandise may be hand stacked or there may be two pallet sizes used in the warehouse.

However, warehouses supplying the retail food business usually handle other merchandise besides dry groceries. They may handle fresh produce, fresh meats, frozen foods, dairy products, drug items, houseware items, and many other types of merchandise. Eggs may be candled in the warehouse, case goods may be broken down and repacked into smaller units, and there is always the salvage area which is used for salvaging damaged merchandise. Not all warehouses perform all of these functions, but if they do any of them, the space required is greater than that needed for just dry groceries. These

functions require added equipment and different handling methods than dry groceries.

In many cases, office space is needed in the new warehouse. The building may also have a cafeteria, washrooms, garages, sign shop, and many other facilities to service the retail outlets. The amount of space needed for these various facilities differs with each company, but when they are included they obviously increase the amount of space that is needed for the warehouse.

Certified Grocers of California, Limited, of Los Angeles, California, built its new warehouse on a tract of land that is 1,000 feet deep, 1,600 feet wide on the south end, and 1,080 feet wide on the north side, for a total of 31 acres. The warehouse office is 20 feet by 120 feet; the assembly area, in building one, is 250 feet by 260 feet; the reserve storage area in building two is 300 feet by 400 feet; the reserve storage area in building three is 200 feet by 360 feet; the reserve storage area in building four is 200 feet by 260 feet; the poultry dressing room is 20 feet by 120 feet; the frozen food department is 160 feet by 150 feet; and the compressor room is 30 feet by 20 feet, for a total area of 352,400 square feet.

In building one, the delivery shipping dock is 36 feet by 260 feet, the will-call shipping dock is 36 feet by 120 feet, and the truck receiving dock is 25 feet by 300 feet in building two, and 25 feet by 100 feet in building three. The truck receiving dock in building four is 45 feet by 200 feet. There is a total dock space of 40,080 square feet.

The maintenance building has 5,000 square feet of space. There are 19,200 square feet in the transportation building, and the main office has 36,000 square feet of space. These buildings cover a combined area of 60,200 square feet, while all the structures have a total area of 452,680 square feet.

The beam clearance is 16 feet in both the selection area and the reserve storage areas. The main aisles are 20 feet wide in both areas, but the feeder aisles are 12 feet wide in the reserve storage areas and 10 feet 6 inches wide in the selection area. There are sixteen aisles in the selection line for a total length of 3,200 feet. The selection line holds an average of 3,500 items. The pallet racks, of which there are approximately four hundred thousand, are 9 feet long and 104 inches high. The basement is served with two hydroelectric elevators, each having a capacity of 10,000 pounds. The railroad receiving

dock, at the south end of the storage area, has three tracks capable of spotting twenty-seven cars, and a steel canopy extends over the dock and the first set of tracks.

The Lucky Stores, Incorporated, of San Leandro, California,[1] handles groceries, fresh produce, and drug items in its warehouse, which is 820 feet by 200 feet. The grocery section has 96,100 square feet, the drug section has 28,000 square feet, and the produce section has 40,000 square feet of floor space for a total of 164,200 square feet. The loading platforms, for the warehouse, have a total area of 18,600 square feet, which is covered by a canopy. On the same 20-acre tract, there is an office building, 20,400 square feet; a kitchen and packaging plant, 10,600 square feet, with a loading platform of 4,000 square feet; a garage and service station, 6,900 square feet; a truck-weighing scale, 1,000 square feet; a silk screen, repair, and salvage building, 12,300 square feet, with a loading platform of 4,000 square feet; and railroad facilities covering 70,000 square feet. There is a paved area of 520,900 square

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[1] National Association of Food Chains Summary Report on the Warehousing and Delivery Clinic, National Association of Food Chains (Washington, D. C., January 15-17, 1951), pp. 2-5.

feet, and an unpaved area of 67,500 square feet. The combined total of all the buildings is 241,600 square feet, while the total area in the tract is 900,000 square feet.

The grocery warehouse handles about 2,400 items on a selection line 2,100 feet long. There are fourteen aisles, 145 feet long and 11 feet wide, in the assembly area, which covers approximately 60 percent of the building. The remaining space is used for reserve storage. The main aisles, throughout the warehouse, are 15 feet wide. Ninety-five percent of the selection line has pallet racks.

There are 4,400 items carried in the drug warehouse, which uses pallet racks throughout. Reserve stocks of drug items are carried on top of the pallet racks.

The produce warehouse is palletized, except for a few of the 150 items that are carried.

There are four small rest rooms and one large locker and rest room for the three warehouse buildings.

The merchandise is placed on pallets, which are on warehouse trailers, when received. These trailers are formed into trains and pulled to reserve section fork lift truck operators, who place the merchandise in storage. About 20 percent of the

drug and grocery items are received by railroad cars, and the rest of the items by truck. As there is no railroad dock, the merchandise that is received by rail is taken directly to the storage area.

The grocery warehouse operated by the Jewel Tea Company, Incorporated, of Chicago, Illinois, is 316 feet wide and 564 feet long. (See Figure 1.) The selection area covers approximately 60 percent of the warehouse, with the remaining space being used for reserve storage. There is a conveyor, 316 feet long, at floor level, running from the reserve stock area, through the selection area, to the shipping platform. Bulky items are hand stacked on the west side of the conveyor, while the remaining items are palletized on the east side of the conveyor. Eight aisles, in the palletized section, are 10 feet wide and 185 feet long. Nine aisles, on the west side of the conveyor, are 5 feet wide and 80 feet long, while one aisle is 10 feet wide and 80 feet long.

There are two railroad tracks inside the north end of the building, which provide space for eleven car spots. On the northeast side of the building, truck receiving has a capacity of ten trucks. The shipping platform is 40 feet by 300 feet,

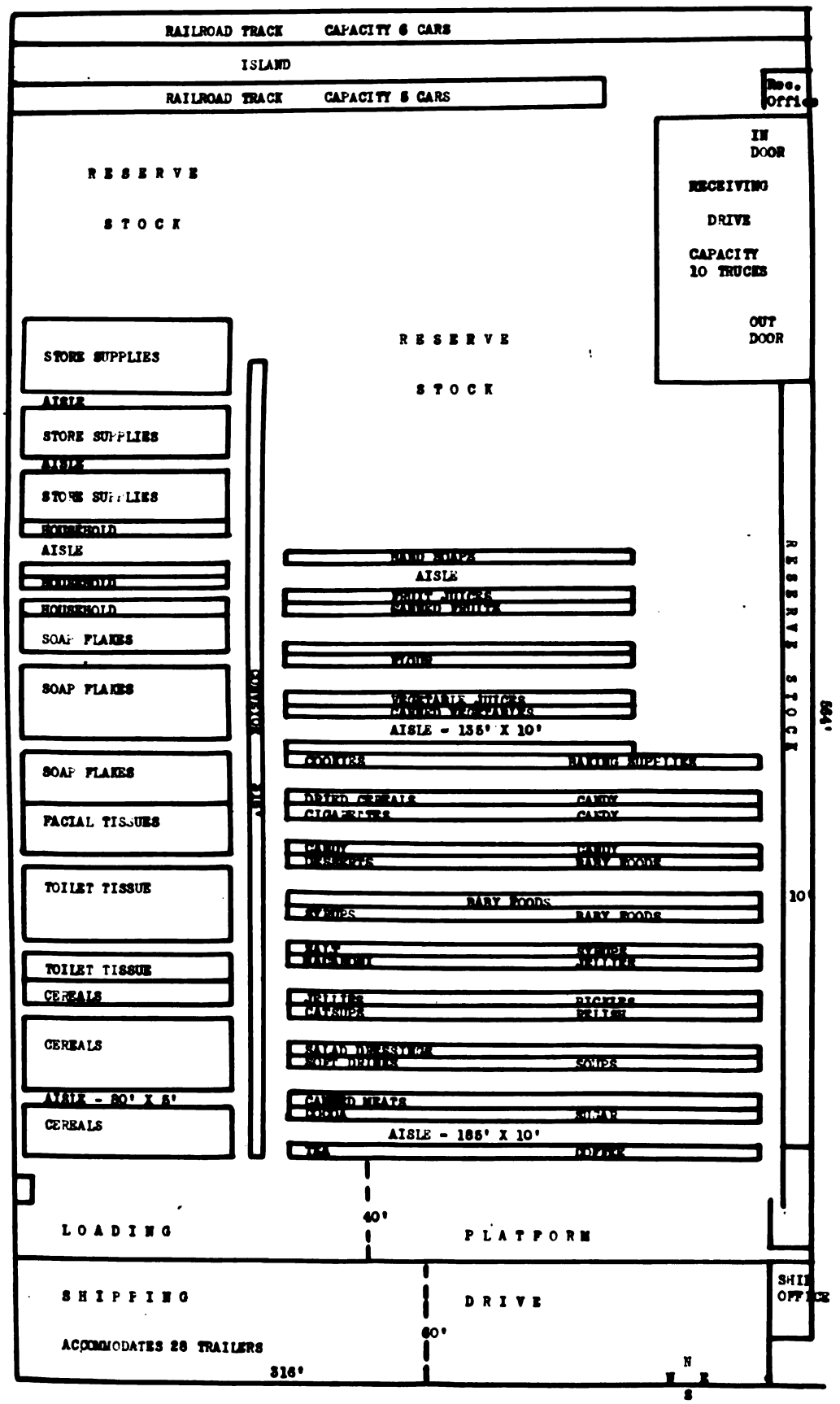

Figure 1. Warehouse layout of the Jewel Tea Company, Incorporated.

with room for twenty-eight trucks in a shipping drive 60 feet by 300 feet. There is a receiving office, a shipping office, a locker room, three rest rooms, and a salvage area within the warehouse.

When this building was completed in 1941, there was enough land left vacant for future expansion. The proposed expansion plans (Figure 2) show the amount of space needed for 1952 and for 1956. Based on the present inventory, the plan also shows the amount of extra space that would be required for an additional week's inventory for 1952.

The proposed plan shows an increase in aisles to fifteen, aisle widths to 12 feet, railroad car spots to nineteen, and room for twenty-seven additional truck spots on the south end of the building. Pallets are to be used throughout the warehouse. Pallet racks are not being used in the warehouse and they are not included in the proposed expansion.

Hillman's Pure Foods, Incorporated, of Chicago, Illinois, is building a new warehouse. The tract of land covers 260,000 square feet and the total building area is 133,701 square feet, leaving room for future expansion on the west side of the warehouse. There is a frozen food storage space of 2,304 square

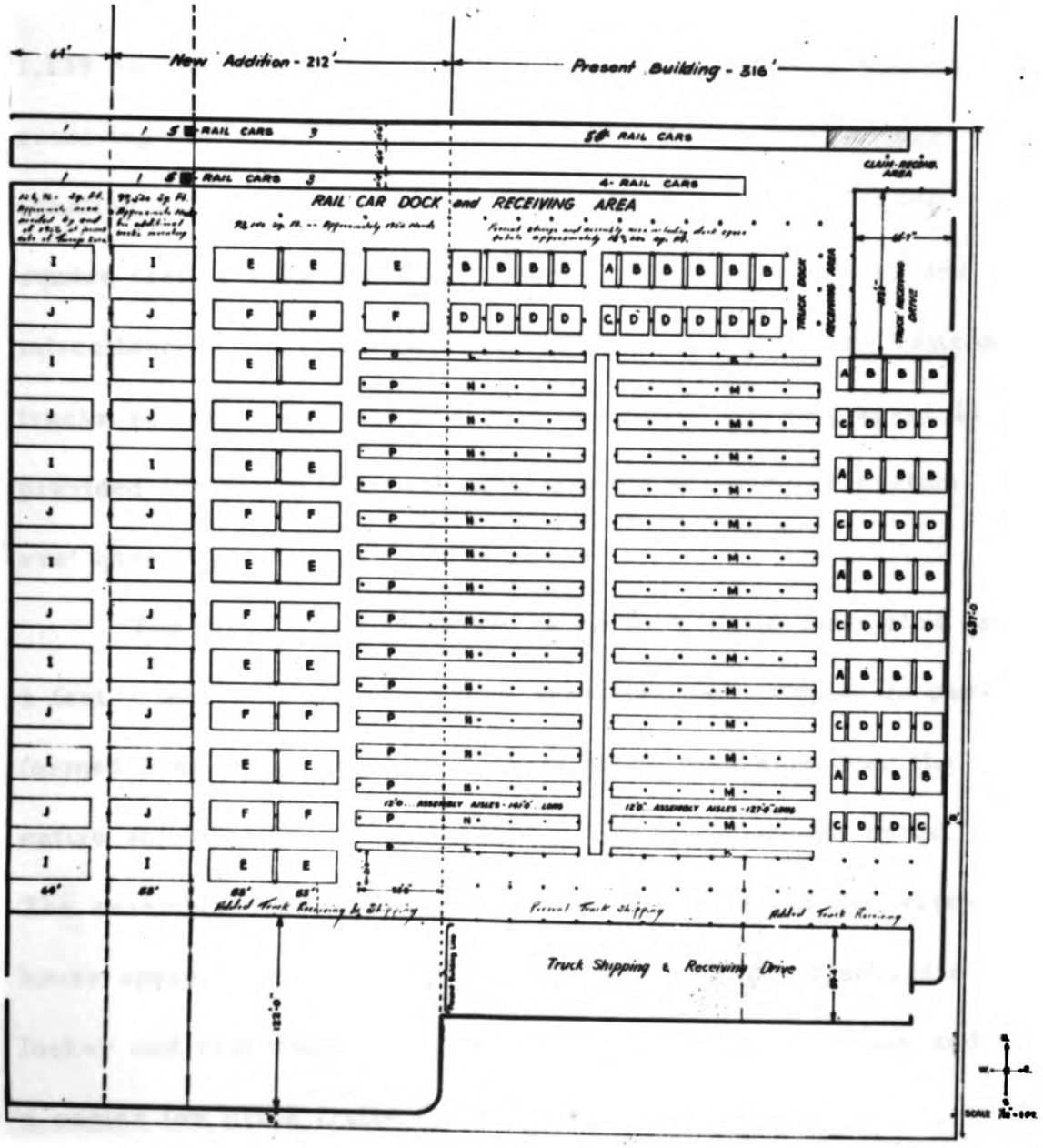

Figure 2. Present building and proposed expansion of the Jewel Tea Company, Incorporated.

feet, an equipment room of 1,151 square feet, a boiler room of 1,139 square feet, a warehouse of 86,811 square feet, a truck receiving and shipping platform of 7,048 square feet, an egg-candling room of 1,885 square feet, a future store of 10,000 square feet, a shop building of 10,500 square feet, offices and miscellaneous facilities requiring 1,435 square feet, and railroad tracks requiring 2,966 square feet of space. Parking space is provided for ten employees' cars and for seventy-two customers' cars.

The clear stacking height is 18 feet, while the aisles are 6 feet 9 inches in width. Truck receiving and shipping is performed over the same dock. There is a mezzanine over the entire selection area to provide for additional storage space. The assembly area is between 60 and 70 percent of the warehouse space. There is a fish work room, lounge, a separate locker and rest room for women and men, a cheese room and a cooler for dried fruits.

These are but a few examples of how various companies have entirely different warehouse space requirements. They show differences in aisle widths, tiering heights, and the amount of space needed to handle the various types of merchandise.

The next chapter shows the effect storing merchandise in the retail outlets may have on warehouse space requirements.

CHAPTER IV

WAREHOUSING IN THE RETAIL OUTLET

The retail outlet of a food business has as its primary purpose the sale of merchandise. To be able to sell, the store must have the merchandise on the shelves. Typically the stock is delivered to the store throughout the week by truck from a warehouse. The manager of the store ordinarily orders enough merchandise to keep his shelves filled from one delivery to the next. What is left after a delivery has been processed, is called overstock. This consists of half cases, merchandise from previous sales, and a few cases of fast-moving items. Before another delivery arrives at the store, the fast-moving items are moved from the storage area out onto the shelves. The storage area for a retail outlet may consist of a back room; a back room and a balcony; a basement; a basement, back room, and a balcony; or a basement and a balcony. The dollar value of the overstock amounts to approximately one to two weeks' sales for the store. This overstock can be called a normal reserve stock.

Two factors determine if the retail outlets can be used to warehouse merchandise. The first one is the amount of storage area available, and the second is the number of deliveries each store receives during the week. These two factors are not independent, but are dependent upon each other. This can be seen by examining the practices followed by different companies.

The majority of the 158 retail units operated by the Jewel Tea Company, Incorporated, of Chicago, Illinois, have been constructed with a storage area that handled 50 percent of the opening week's business. The company's policy is not to warehouse merchandise in the retail outlets, and the amount of storage space in each store was therefore kept to this limit, which enabled the merchandise to be processed efficiently. However, after these stores had been open for a year or two, volume increased beyond that originally planned. This resulted in the storage area being too small for an efficient operation, and in one case the amount of merchandise needed for three days' business would not fit in the back room. Part of the grocery load was left behind the store until a night crew could put the merchandise on the shelves. Increased deliveries have

assured these retail units of a needed supply of merchandise. The exceptions to this are the retail units that have basements and/or balconies. They receive a week's supply of merchandise at one time. Some of the newer stores have been planned with a storage area that is not needed for their present volume, but as volume increases this space is available, with no changes in the delivery schedules. The present delivery schedules are arranged so that approximately thirty trucks are loaded each warehouse working day. The layout of the back room, in the newer stores, is being planned to create a greater degree of coordination between the driver in delivering the merchandise and the employees handling it in the retail unit.

The Wrigley's Stores, Incorporated, of Detroit, Michigan, operates its retail units on the basis of having only a one day's supply of merchandise in the storage area. The company started with one store and received its merchandise from a wholesaler. As the company grew from one store to sixty-four, it has continued this policy of having only a one day's supply of merchandise in the back room. The company still purchases its dry groceries from a local wholesaler, Abner A. Wolf, Incorporated, and each retail unit receives a daily

delivery. The source of supply is located on the same tract of land where Wrigley's Stores, Incorporated, has its office and produce warehouse. By purchasing from a wholesaler, the company does not have to own a grocery warehouse.

At the other extreme is Hillman's Pure Foods, Incorporated, in Chicago, Illinois. Its retail outlets have large storage areas for warehousing merchandise. As was mentioned earlier, they ship palletized loads of merchandise to the stores, receiving and handling the palletized loads in the store with electric transporters and electric fork lift trucks. Fast-moving merchandise is shipped in pallet loads from the warehouse to the retail outlets for storage. This has been due to a high sales volume, approximately sixty thousand dollars weekly, in each outlet, and also because of an inadequate warehouse. The company is experimenting with the method of ordering only merchandise which is needed on the shelves between deliveries in its store at Harlem and North Avenues. This store receives daily deliveries, but each commodity group is delivered only twice a week. Room is available in the basement for handling a month's supply of merchandise.

Its store at Devon and Artesian Avenues has a back room with pallet racks along two sides. These are used for storing full pallets of fast-moving items, such as number five cans of fruit juices, bulk cookies, and certain brands of coffee. Approximately one-half of the back room has shelving, which holds small quantities of hand-stacked merchandise, usually slow-moving items such as spices. The remaining space is utilized for stacking fast-moving items on pallets in rows, medium movers and bulky items, a frozen food storage room, room to charge the batteries of the transporters and fork lift trucks, and an area for price marking the merchandise needed on the floor.

In servicing a store daily, the size of the orders handled in the warehouse is decreased, and this can lead to increased warehousing costs. Mr. James K. Robinson, Jr., Vice President in Charge of Warehousing and Transportation, American Stores Company, commenting on the special problems involved in servicing small stores said that:[1]

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[1] National Association of Food Chains Summary Report on the Warehousing and Delivery Clinic, National Association of Food Chains (Washington, D. C., January 15-17, 1951), pp. 13-15.

> It is true that to stop at one place in a warehouse and pick up ten cases of milk is easier and faster than starting and stopping at ten different piles and picking up one case each time. Good judgment says that selecting the large store order is more efficient than selecting the small store order.

When stores doing a large volume of business do not have the space in their back rooms to handle large shipments of merchandise in one or two deliveries a week and need more frequent deliveries, servicing these stores begins to result in some of the same problems involved in handling orders for small volume stores. This also depends upon the number of items going into each order. It is possible that a high volume store will have a large enough order on each delivery so that warehousing costs will not be increased out of proportion.

Although Hillman's Pure Foods, Incorporated, gives their stores daily deliveries, each item on the order form cannot be ordered for each delivery. The items are grouped by commodities on the order form and each commodity group is ordered twice a week. This enables the selector in the warehouse to cover just that portion of the line carrying the specific commodity group that is being shipped. By breaking up the order into commodity groups, large sections of the selection line, where only a few cases are picked, do not have to be covered.

This increases the number of pieces the selector can pick. This would eliminate the problem involved, as in servicing a small store, when a large-volume store receives a complete order daily.

Several of the newer retail outlets opened by Ralph's Grocery Company, in Los Angeles, California, also handle palletized units of merchandise from the warehouse. The back rooms of these stores have been laid out to enable fork lift trucks to handle large quantities of merchandise. The merchandise is shipped from the company's warehouse on 30 inch by 40 inch pallets in company-owned trucks to the retail outlets. The truck is unloaded in the store by a Load King Hydraulic fork lift truck and moved to a specified section in the back room. Its retail outlet, in Santa Anita, California, has 9,000 square feet of floor space devoted to receiving; and produce trimming room; meat and prepackaging rooms; and a storage area, which has pallet racks throughout. These racks are 10 feet high, 14 feet long, and 36 inches deep, containing three compartments or bays, and are movable to any part of the back room. Each compartment has three adjustable shelves which are used to store the working stock. The working stock

is placed into the compartments by hand and the reserve stock is left on the pallet and placed on top of the rack with a Clark fork lift truck.

The above companies follow different policies in warehousing merchandise in their retail units and also in the number of deliveries each store receives during a week. If a company has followed a policy of not warehousing merchandise in the retail units, as Wrigley's Stores, Incorporated, has, it cannot suddenly turn around and decide that it should reverse this policy. The retail outlets have been designed to conform to original policy and do not have the room that is required. It is less expensive for the company to construct or add to a warehouse instead of enlarging each store. A reversal in this policy would also create a demand for additional cash, which reduces the rate of return it now receives on its investment. Under its present policy, the company is turning its inventory approximately fifty-two times a year.

Hillman's Pure Foods, Incorporated, has already provided the required space in each of its stores to warehouse substantial quantities of merchandise. The company can take two courses when planning a new warehouse. It can continue to follow its

present policy and reduce the amount of space that would be needed, or it can reverse its policy and do all of its warehousing in the new building. Neither course would cause any additional demands for funds to finance the inventory, except what is needed because of additional retail outlets, growth, or price fluctuations, nor would there necessarily be an increase in the number of deliveries, which are already daily.

The companies that have some leeway in deciding whether to warehouse more merchandise in their retail units are those that fall in between these two extremes, as does the Jewel Tea Company, Incorporated. If these companies decide to warehouse more in the stores, there are several ways this can be accomplished.

Stores with a small storage area can receive a large order twice a week, and by working a night crew to stock the shelves, the back room can be kept cleared. With the bulk of the merchandise being placed on the shelves at night, just the fast-selling items are carried in the back room, which then can be used for warehousing if necessary. An example of this is the operation performed by the American Stores Company. Employing contract drivers, the company makes night deliveries

to approximately 20 of its 180 stores in the Kearny, New Jersey, branch. The store manager knows the time the delivery will arrive and has a night crew available to remove the load from the truck and transport it to the sales area. The merchandise is piled in the aisle in front of its shelf position. After the load is removed, the merchandise is then price marked and placed on the shelves, with only overstock remaining in the back room.

Some chains make separate distributions of merchandise that is to be advertised, while others add the advertised merchandise onto the regular grocery order. This merchandise usually arrives in the retail outlets from one to two weeks before the sale. By storing this merchandise in the retail outlets, the need for additional space in the warehouse is eliminated or it can be used for some other purpose. When the advertised merchandise is shipped with the regular grocery order, it is handled in the same manner as any other item on the order form. It is placed on the assembly line in a specified place and is selected along with the rest of the order. This creates a need for a man to fill continuously the selection line from reserve stock, as this merchandise is picked in

quantities of five to fifty cases at a time. To overcome this constant restocking of a few items, several pallet loads of advertised merchandise are placed on the shipping dock. When the order checker checks the order, he fills in the required amount of merchandise. This practice is used by the American Stores Company. Jewel Tea Company, Incorporated, ships the advertised merchandise in special trucks from its produce warehouse. The truck driver has the order forms for ten to fifteen stores, which list approximately five items each. He then delivers these five items to the stores, leaving the number of cases each manager has ordered. These are items that have been heavily ordered, while merchandise that has been lightly ordered will be shipped along with the regular grocery order.

Along this same line, certain types of merchandise are purchased for the entire year when the new crop is packed. In some cases, this merchandise has to be warehoused by the purchaser, since the vendor does not provide storage facilities. At other times, an advantageous price requires the vendee to provide the warehouse space. If the warehouse has not been planned to provide for these situations, this merchandise is often shipped to each retail outlet the company owns. Management

notifies each store as to the number of cases it is expected to handle before the merchandise is shipped. The amount shipped depends upon the available storage area in each retail unit. This merchandise is often unloaded directly from the railroad cars into trucks for shipment to the stores and bypasses the warehouse completely.

When a store receives orders from more than one warehouse, it may receive two deliveries a week on slow and medium movers out of one warehouse, and one delivery a week of fast-moving items out of another. This is presently being tried by the Jewel Tea Company, Incorporated. Another method of distributing the merchandise is to place fast-moving and bulky items in one warehouse and ship them once a week, and place slow and medium movers in another warehouse and ship them once a week. Still other operators split the order form into separate sheets, divided between fast and slow movers. The fast movers are delivered two or three times a week, while the slow movers are delivered once a week. Each method results in more merchandise being stored at the retail level, and can also result in more deliveries to each store. The costs of

delivery must always be balanced against the costs of warehousing in the retail outlet.

Along with the number of deliveries to each retail outlet, the distance from the warehouse to the store is another factor that affects costs. Where this distance is short, a driver can make several trips to a store in a day, if the merchandise is shipped on pallets. Mr. Neal D. Ramsey, from The Market Basket, Los Angeles, California, said in a speech[2] that one of the major points that put his company in the top ten in the National Association of Food Chains Warehouse Operating Efficiency record was that orders were placed on pallets as they were picked and the pallets were loaded onto trucks. The drivers can make two to three trips per day by traveling short distances. Its warehouse services twenty-seven stores, with an average haul of 15 miles one way, 17 miles being the longest one-way haul.

Steinberg's Wholesale Grocerterias, Limited, of Montreal, Canada, services twenty-nine stores, and the longest haul is 25 miles. Orders are selected on skids, and the skids are

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[2] Ibid., p. 28.

loaded directly into trucks and are shipped to the stores where they are unloaded onto dock-height freight elevators and lowered into the stock rooms. This company ranks high on the Warehouse Operating Efficiency record.

With stores only a short distance from the warehouse, the smaller load carried in the truck on pallets is just as reasonable, if not cheaper, than loading the truck solidly by hand. However, when the distance from the warehouse is increased, this technique becomes less economical. Wrigley's Stores, Incorporated, tried to locate its new warehouse in the geographical center of Detroit so as to be conveniently located to all of its stores. There were only 7 acres of land available at its old site and this was not large enough for its new warehouse. Consequently, it was located on 13 acres of land outside of the business district. The reduced traffic, through which the drivers had to travel, increased their travel time enough to offset the outside location.

Produce deliveries may be daily, as is the practice with Jewel Tea Company, Incorporated; every day but Saturday, as it is with National Tea Company; or three times a week, as it is with American Stores Company in delivering to certain

stores. The space devoted for produce storage in the retail outlets is usually only enough to hold a carry-over for one or two days. Since produce is highly perishable, the amount of space required for storage is small. Frequent deliveries mean that the store can do without a large amount of storage space and is not used for storing fresh produce. Hillman's Pure Foods, Incorporated, delivers no produce from its warehouse; but instead, has it delivered directly to the retail outlets from the produce market. The stores have capacity for carrying three days' supply.

Meat is in the same category as produce. Due to its perishability, it requires a small amount of storage space in the store. The space allotted for meat storage is usually large enough to hold a week's supply of meat, and frequent deliveries make more space unnecessary.

It can be generally conceded that no retail food business has the same policies in regard to handling merchandise in the retail outlet. What the specific business wants determines whether or not it will warehouse merchandise at the retail outlet, how frequent it will make deliveries, and where it will locate its warehouse in relation to its stores.

CHAPTER V

METHODS USED TO ESTIMATE WAREHOUSE SPACE

With modern materials-handling equipment being designed for more and more purposes, it would be well to consider what can be done to modify the present operation to take advantage of this mechanized equipment. One of the first things management should do before deciding to relocate in a new warehouse is to survey their present facilities with this in mind.

Mr. J. P. Williamson, Executive Vice President of the Dixie-Home Stores, Greenville, South Carolina, suggested the following points that should be checked before finally discarding the present warehouse:[1]

> 1. The floor is certainly of basic importance and it should be determined whether the floor capacity is sufficient to carry heavy industrial trucks, whether the composition of the floor will stand up under industrial truck usage and whether the floor is sufficiently even to permit a satisfactory industrial truck operation.

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[1] J. P. Williamson, An Approach To The Reduction of Warehousing and Transportation Costs, Annual Meeting of the National Association of Food Chains (October 14, 1949), pp. 1-2.

2. Column spacing is often fundamental in developing a mechanized handling system--a definite selection and storage pattern is an absolute necessity and these patterns must conform to the dimensions of existing building bays. Column spacing often determines the pallet size that is to be used: the grocery industry is presently standardizing on the 48" X 40" and the 40" X 32" dimensions. If neither of these two pallet sizes conforms to existing column spacings another size pallet must be adopted but here you run into the danger of a pallet that will not adequately conform to the case dimensions of grocery merchandise.

3. Elevator size and capacity are important factors in adapting an older building. The primary question here is whether existing elevators can carry heavy industrial trucks between floors.

4. Doorway clearances should be carefully examined with regard to width and height in order to determine whether they can accommodate the over-all height of industrial trucks.

5. A clear ceiling height of less than ten feet renders a building questionable from the standpoint of modern materials handling practice.

After having made a survey of the old facilities, a survey of the proposed new warehouse should be made. Some of the points to be checked before finally deciding whether or not to move into a new one-story warehouse are:[2]

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[2] National Association of Food Chains Summary Report on the Warehousing and Delivery Clinic, National Association of Food Chains (Washington, D. C., January 15-17, 1951), p. 11.

1. Check to see if the cost of a good location is excessive.

2. Check for a possible reduction in insurance costs.

3. Estimate reduction in maintenance labor.

4. Recognize that protection costs (guards) are probably the same.

5. Check to see if costs are higher or lower in transportation, both inbound freight and outgoing shipments.

6. Recognize that there will be repair and upkeep on any building.

7. Can materials and equipment be obtained for a new building?

8. Check total cost of new installation, including building and equipment, and compute cost of the total investment as compared with cost of present warehouse investment or liquidating value of present warehouse.

9. Estimate savings in man-hours which might be accomplished by having a new warehouse and compute savings in dollars.

10. Compare total of savings indicated above under point nine, plus or minus other savings or losses, as an indication of whether there should be further analysis of the "new warehouse" problem. It isn't every case that demands a new warehouse now. If, however, a company can pay for a new building in 25 years, it might be profitable to build a one-story warehouse.

Once the decision has been made to move into a new warehouse, the amount of space that is needed can be decided by the firm from its own records and experience or it can put

this job in the hands of an outside firm, which specializes in this type of work. If it decides to do the estimating itself, Mr. W. L. Sundstrom, of the First National Stores, Incorporated, Sommerville, Massachusetts, suggests this formula for estimating the required space: "twenty-five square feet times the average tons shipped weekly times the average number of weeks supply carried in the warehouse."[3] For example, assume that a warehouse handles 1,100 tons per week and has an average of five weeks' supply on hand, then multiply 25 square feet by 1,100 and then by 5 to arrive at 137,500 square feet of floor space.

In using this formula, it should be realized that it is for a building with a clear ceiling height of 16 feet using H columns 8 inches square with column spacing 21 feet on center. The reason for using 25 square feet per ton is that "experience has proven" this to be "a good figure to use." The area that is derived from this formula includes platforms, aisles, locker rooms, lavatories, shipping office, battery charging room, and boiler room. It excludes a main office and space for warehousing

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[3] Ibid., p. 12.

meats and produce. To effectively utilize the cubage in this warehouse, materials-handling equipment should be employed.

Along with estimating the space required, if a new warehouse is decided upon, the building should be designed to meet the specific requirements of the company. In arriving at a solution to the design of the building and the system to be employed, some of the following points should be carefully considered and answered:[4]

> 1. Size of Pallet. The problem is one of adopting the pallet size which will best conform to the dimensions of the merchandise handled. We at Dixie-Homes selected the 48" X 40" pallet and have found it very satisfactory for our standard line of grocery merchandise. In addition, the 48" X 40" pallet ties in nicely with our trailer size. Our weekly outbound tonnage averages around 1,100 dry grocery tons per week and we feel that this pallet works very satisfactorily for this volume.
>
> 2. Weight of Unit Load. The lighter unit loads permit the use of smaller trucks and narrower operating aisles. The heavier loads necessitate larger and heavier trucks and wider aisles but make possible the handling of more tonnage for each fork truck trip. In our new warehouse at Greenville we have chosen a unit load of two thousand pounds, which permits us to use a relatively small fork truck with an over-all length, including load, of 113 inches and permits us to use a ten foot six inch aisle with right angle stacking.

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[4] Williamson, op. cit., pp. 2-6.

3. Relationship of Storage Areas to Selection Areas. Here the problem is one of determining the location of reserve storage in relation to selection, and also to determine the amount of space assigned to reserve storage in relation to the amount assigned to selection. In our new warehouse, approximately half of our grocery warehouse space is devoted to reserve storage and half to selection; so far our experience indicates that this is about the correct relationship for our inventory requirements. With regard to the relative location of reserve and selection, we have two large general reserve areas which replenish our selection line and approximately 800 feet of selection line backed up directly with reserve merchandise. In addition, we are using pallet racks on our slower moving items with the reserve stored on top of these pallet racks.

4. Selection Systems. The towline, the tow tractor train and the selection conveyors are the popular choices. The towline requires a rather large initial investment and probably requires at least 400 to 500 outbound tons weekly to justify the expenditure. In our operation of 1,100 tons weekly, we feel that it pays off in that it tends to reduce the fatigue factor of our selectors and provides a means of pulling fully loaded selection trucks from various points on the selection line to the shipping floor.

The tow tractor train apparently has considerable flexibility being adaptable to both the small and large operations.

Conveyor selection systems are used by several chains and apparently are doing a good job, however, this type of system did not seem to provide the degree of flexibility that we required.

In summary, we haven't found any better system of selection to meet our particular problem than the towline system.

5. Tiering Height. Tiering height determines how much merchandise can be accommodated in a given storage area. Many factors enter into this decision and they should

be closely appraised. Greater height will give increased storage tons per square foot but it will also tend to decrease the speed of your fork truck operation. All merchandise will not stand high tiering and this factor should be weighed against the increased costs of additional height. The choice of pallet size and unit load weight will affect this decision since the larger fork trucks which are required to handle the heavier loads have greater stability in tiering to the greater heights.

In our new Greenville warehouse we are tiering merchandise 16 feet high in storage and feel this is a sensible height for our 2,000 lb. unit load operation.

6. Ninety Degree Stacking or Angle Stacking. This problem is present in both the selection and reserve storage areas. Ninety degree stacking requires wider aisles and makes possible the accommodation of more pallet items along any given line. Angle stacking permits narrower aisles, develops somewhat greater accessibility, but will not accommodate as many items along a given line as will 90 degree stacking.

We have used 90 degree stacking on both the selection line and in the storage areas and while we cannot submit dollars and cents proof of the advantages of 90 degree stacking, we can say that we are well pleased with our decision to adopt 90 degree stacking throughout.

7. Special Selection Procedures. The changing character of the chain store business from small stores to the larger super markets points to the necessity for specialized handling of a relatively few fast moving items that make up a substantial share of the total tonnage. This does not necessarily mean that present selection systems (the towline and tractor train) are outmoded or obsolete, but merely that warehouse planning should recognize the change and provide special means and techniques for handling such high velocity items.

> We have made a start in this direction by concentrating some of our fastest movers close to the shipping floor where they can be handled into the delivery trucks by the pallet load. I understand that certain chains are experimenting extensively in an attempt to develop a successful means of handling high velocity items. This development should be watched closely as it is an obvious means of substantial cost reduction.
>
> 8. Size and Shape of Warehouse. This decision is almost completely governed by individual conditions of turnover and number of items handled.
>
> At Greenville we built our warehouse 968 feet long and 240 feet wide. We allocated this approximately 60 percent to dry groceries, 25 percent to produce and 15 percent to meat. If we were doing it again, we might plan it more on a rectangular basis with a little more length and a little less width. All in all, we feel that our present size is about right for our present operations and could handle a volume up to 1,800 tons of dry groceries weekly without difficulty.

Using the figures given by Mr. Williamson, of the Dixie-Home Stores, there is a total of 232,320 square feet of floor space in its Greenville warehouse. Since 60 percent of this is for dry groceries, there is approximately 139,400 square feet devoted to this type of merchandise. Assuming that Dixie-Home Stores carries a five-week supply of merchandise in stock and using the formula advanced by Mr. W. L. Sundstrom of the First National Stores, Incorporated, there should be approximately 137,500 square feet of floor space devoted to dry

groceries. The answer is within 1,900 square feet of the space actually devoted to dry groceries.

Mr. Nelson Friz, of the Construction and Maintenance Division, Marketing Department, Esso Standard Oil Company, New Jersey, suggested that a method used to estimate warehouse space requirements for his company can also be used for other companies handling different products.[5] One of the first steps to be taken is to make space estimates for warehouse additions or for a new warehouse. This is done by making a careful study of space requirements. In doing that, a stock layout should be made showing where the items are to be located and whether or not materials-handling devices will be employed. Consideration should be given to palletization, but even if pallets are not going to be used, a stock layout will answer these questions.

1. Is there cover for all the stocks requiring it?
2. Is the proposed building large enough, or--
3. Is it too large, even considering future expansion?[6]

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[5] Nelson Friz, "How to Estimate Warehouse Requirements," Modern Materials Handling (Vol. VI, No. 6, June, 1951), pp. 23-27.

[6] Ibid., p. 24.

However, Mr. Nelson Friz assumes that pallets will be used and that a pallet layout should be made. In making a pallet layout, the first step is to determine the annual throughput by unit containers or items. Next, determine the number of weeks' or months' inventory required, including that needed to meet seasonal demands. This step determines the maximum amount of stock that must be stored in the warehouse at any one time. The fact that not all seasonal items are in the warehouse at the same time should be taken into consideration. Therefore, the space required for one seasonal item is occupied by some other seasonal item during another part of the year. At this point use the form in Figure 3.

Figure 3 is called a "Table For Computing Warehouse Size Using Fork Truck-Pallet System." It consists of fourteen columns, headed respectively from left to right: product; approximate brands, grades, or sizes; throughput estimate yearly; inventory, average and peaks by months; size of pallets; square feet per pallet, including overhand; number of items per stack from floor to ceiling; number of pallets required; number of stacks required; total square feet of floor area required; percentage increase in business or inventory; number of additional

					1950	
1	2	3	4	5	6	7
Product	Approximate Brands, Grades, or Sizes	Throughput Estimate Yearly	Inventory Avg. and Peaks by Months	Pallet Size	Sq. Ft. per Pallet Including Overhang	No. of Items per Pallet
Subtotal						
Receiving and Shipping						
Aisle Space						
Office						
Total						

Source: Nelson Friz. How to Estimate Warehouse Requirements. Modern Materials Handling. Vol. VI, No. 6, June, 1951. p. 24.

Fig. 3. Form I - Table for computing warehouse size using fork truck-pallet system.

				1955		
8	9	10	11	12	13	14
No. of Items per Stack (floor to Ceiling)	No. of Pallets Required	No. of Stacks Required	Total Sq. Ft. Floor Area Required	% Increase in Business or Inventory	No. of Additional Stacks Required	Additional Sq. Ft. Floor Area Required

Fig. 3 (Continued)

stacks required; and additional square feet of floor area required. At the bottom of the form, there is a subtotal line; a line for the amount of space required for each of the following items: receiving and shipping facilities, aisles; an office; and a line for the total. The first eleven columns apply to this year, while the last three apply to some period in the future, such as five or ten years hence.

Column two, the approximate brands, grades, and sizes, is used as a reminder that there is no standard case and that, for example, there is more than one brand of peas. Using the same pallet size throughout the warehouse, the dimensions of the case determine the number of containers to be placed on each pallet. The smaller the package, the more cases to a pallet load. If pallets of different dimensions are used in the warehouse, the merchandise placed on the pallets occupies varying amounts of floor space and cubage. This must be considered when determining space requirements.

For each item carried in stock, an estimate should be made as to how much will pass through the warehouse for the year. This amount is placed in column three.

From the information in column three, the average monthly inventory can be obtained and this is entered in column four. Along with these figures, any seasonal peak inventories, such as the increased amount of cranberry sauce necessary for Thanksgiving, Christmas, and New Years, are also entered.

At this point fill out the form in Figure 4, which is called "Estimating Data on Palletized Materials For Use in Determining Warehouse Size (Area)." Across the top of this form, place the various ceiling heights that are being considered. Below each ceiling height, place the rated maximum load the mechanical handling devices in use are capable of lifting. Next, have a column for each pallet size that is in use or will be employed. For each pallet size, enter the number of cases or units per stack, the number of pallets used in a stack, and the square feet of floor area occupied by each stack for each item. After Figure 4 is filled out, the fifth to the eleventh columns can be filled out on Figure 3.

The pallet size used for each item in column five is taken directly from Figure 4.

The square feet required for each pallet, including overhang, is taken from Figure 4 under the column headed

Ceiling Height (feet)	9			12	15
Maximum Load of Equipment					
Pallet Size (5-1/2" thick)	24" by 48"			24" by 48"	40" by 48"
Item	No. of Cases or Units per Stack	No. of Pallets Used in a Stack	Sq. Ft. of Floor Area Occupied by Each Stack		

Source: How to Estimate Warehouse Requirements. Modern Materials Handling. Vol. VI, No. 6, June, 1951. p. 25.

Fig. 4. Form II - Estimating Data on Palletized Materials For Use in Determining Warehouse Size (Area).

square feet of floor area occupied by each stack. This figure is placed in column six.

To get the number of items per pallet, for column seven, take the number of cases or units per stack, from Figure 4, and divide this by the number of pallets used in a stack, which is also from Figure 4.

The number of items per stack, from floor to ceiling, is placed in column eight, and is taken directly from Figure 4.

To determine the number of pallets required, take the product of the number of stacks required from column ten and the number of pallets used in a stack from Figure 4 and enter this figure in column nine.

The total inventory of items divided by the number of cases or units per stack, from Figure 4, gives the number of stacks required to enter in column ten.

To arrive at the total square feet of floor area required, take the product of the number of stacks required, from column ten, and the square feet of floor area occupied by each stack from Figure 4, and place this figure in column eleven.

Odds and ends that are handled in such small quantities that they do not lend themselves to palletization can be included

by taking the dollar value of the inventory that is to be stored and divide this by twenty-five to find the square feet of floor area required. This includes the aisle space and gives the same result regardless of the ceiling height.

To estimate the amount of additional space needed for aisles, excluding an office, add 33 percent of the total warehouse storage area when using a 1,000 pound fork lift truck with a 24 inch by 48 inch pallet, 36 percent when using a 1,000 pound fork lift truck with a 24 inch by 48 inch pallet, 38 percent when using a 2,000 pound fork lift truck with a 24 inch by 48 inch pallet, 45 percent when using a 3,000 pound fork lift truck with a 40 inch by 40 inch pallet, and 50 percent when using a 3,000 pound fork lift truck with a 48 inch by 48 inch pallet. The estimated space needed for a loading and unloading zone and an order-filling area can be computed by using 5 percent of the total warehouse storage area. This does not include the area required for an office or for aisle space. To be used for a grocery warehouse, the total storage area, as determined in this method, would include the order-filling area or the selection line as it is better known in the industry.

To fill in column twelve, percentage increase in business or inventory; column thirteen, number of additional stacks required; and column fourteen, additional square feet of floor area required; estimate the percentage that the business will increase during the next five years and apply it to the figures in column four, throughput estimate yearly, column ten, number of stacks required, and column eleven, total square feet of floor area required, respectively. Fill in the space required for receiving, shipping, aisles, and an office and then total columns eleven and fourteen. The sum of these two columns gives the total space required for the warehouse, inside the walls, including an office, but excluding warehouse lavatories, locker rooms, boiler rooms, and any other miscellaneous items that are not covered in the forms.

In applying the above percentage to columns four, ten, and eleven, it should be remembered that many factors can influence the rate a business expands. Since the inception of the second world war, the food industry has experienced an unparalelled growth. This has occurred in an inflationary economy and can easily lead management into thinking that this situation will continue forever. The assumption that a

company continues to progress at a certain definite rate each year does not hold true. Competition, changes in markets, and shifts in population are but a few of the reasons why there cannot always be a definite percentage growth every twelve months. A 10 percent change in sales volume is not always reflected as a 10 percent increase or decrease in tonnages handled through the warehouse. This 10 percent change may occur through price fluctuations or be caused by shifts in types of merchandise sold. For example, merchandise delivered directly to the retail outlets may account for the entire change. Even the addition of new items to the line will cause changes in warehouse requirements, which are not reflected in past percentage figures. Expansion policies followed by the company in the past may change. The future may not always be reflected by past history. When applying this percentage figure, management should realize that the results are not as accurate as two plus two equals four, but are instead a rough estimate of what might be needed.

Besides determining the size of the warehouse, the lot should be large enough to provide for any possible expansion, without resorting to another floor. The above method of

estimating the area for a warehouse should insure that a new warehouse will not be too small within a year or sooner. However, by providing for a large enough lot, expansion in the future can be undertaken without building an entirely new building in some other location.

The majority of the new warehouses that have been built by the food industry are planned for a larger volume of business than they are doing. The Dixie-Home Store's warehouse was handling 1,100 tons weekly and can easily handle 1,800 tons weekly. The new Wrigley's Stores, Incorporated, warehouse in Detroit, Michigan, is capable of handling 25 percent more than its present volume. However, even with this increased capacity available in the new one-story warehouses, they are being built on large enough lots to provide for future expansion by adding to the present building.

The Jewel Tea Company, Incorporated, is operating out of a warehouse that was built in 1941. To estimate the amount of additional space that will have to be added to its present building, the company surveys the peak loads handled during the year, which includes the warehouse at capacity, with the docks loaded and loaded cars on track that cannot be unloaded

due to lack of space. The total is then converted into the amount of space that the merchandise requires, using a number two or two and one-half case to figure cubage and square feet. This gives the amount of space required to operate at the present volume, but as tonnages have been increasing each year by a certain percentage, this percentage figure determines the amount of space required for next year or for three or four years hence. Considered along with the rate of increase in tonnages are the budgeted sales for the next year as well as plans for new stores to see if they will affect tonnages in the coming year as well as tonnages presently being shipped to the stores. Expansion plans are only for three or four years in the future in order to remain flexible. With new methods and procedures constantly being developed in materials handling, it is possible to utilize the available space in the present warehouse more effectively. This reduces the capital investment that would be necessary in a large warehouse that would not be operating at capacity for some time, as well as taxes, interest, and overhead charges.

In estimating space requirements for a new warehouse, space that is presently being used in public warehouses should

be taken into consideration. Will this space continue to be utilized or should the merchandise be transferred into the new warehouse? Wrigley's Stores, Incorporated, use public warehouses for storing its year's supply of frozen foods. In building its new warehouse, the company did not plan on storing any large quantities of frozen food in Detroit. Instead, the 3,000 square feet of frozen food space in its new warehouse is to be used to provide a steady supply of merchandise to its stores; in other words, it is just a distribution center.

The American Stores Company, Philadelphia, Pennsylvania, carries only a small supply of sugar in its warehouse. This is used to fill orders for small volume stores and in case a store runs short during the week. The majority of its retail outlets receive a direct shipment each week from the nearby sugar refineries. The Jewel Tea Company, Incorporated, ships sugar to its retail outlets from a nearby sugar warehouse, carrying only a small supply in its warehouse to service certain suburban stores. If this merchandise were to be transferred to their own warehouses, both of these companies would require more space, provided the supply of all other items remained the same. This would also be the case if merchandise

that is now delivered directly to the store, such as cookies, crackers, and beverages, were to be warehoused by the companies instead of by the suppliers.

Where additional space is required and there are restrictions, either financial or governmental, that do not permit either expansion or construction, a nearby building can be leased to obtain additional space. The National Tea Company, in its Chicago branch, leased the building next to it to obtain the added space required. The Jewel Tea Company, Incorporated, has leased a building across the street from its dry grocery warehouse to obtain additional space. This is often a more flexible arrangement and is usually cheaper than utilizing public warehouses.

There is no set way to compute the space requirements needed for a specific case, either by using some formula that has worked for another business or by using some method adopted by another industry, even though warehousing is similar in all industries. Each individual business requires its own formula due to its own characteristics, its methods of operation, its geographical location, and its policies. This can be seen by considering that Wrigley's Stores, Incorporated,

operates without its own grocery warehouse, buying merchandise from a wholesaler, who also serves some eight hundred other accounts. Hillman's Pure Foods, Incorporated, does not warehouse meats or produce, these items being shipped directly to the stores from the packers or the produce market in Chicago. Still other businesses operate without warehousing meats, being close to some packer, who will make direct store deliveries, but they do warehouse produce. Mr. Williamson had this to say about planning a new warehouse:[7]

> Here, it is of primary importance to design the building to fit that warehousing system that most satisfactorily meets the requirements of your particular business. No one solution will satisfy the requirements of all operators: it should be a system custom made to meet your particular problem.

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[7] Williamson, op. cit., p. 2.

CHAPTER VI

PURCHASING POLICIES AND WAREHOUSE CAPACITY

Purchasing policies determine the amount of merchandise that must be warehoused. Some of the policies mentioned in this chapter have been presented in earlier chapters. However, their effect on warehouse capacity is important enough so that they are presented separately. The formula used by the Esso Standard Oil Company and presented in Chapter V requires an estimate of how much merchandise is to be carried in the warehouse for a definite period of time. In Figure 3, this is listed as a month's supply; however, it can be two or six weeks' inventory, depending upon the policy followed by the particular company. The effect an increase from two weeks' inventory to three weeks' supply can have on warehouse space is shown in Figure 2. In this case, it requires 98,000 square feet of floor space with a tiering height of 16 feet.

A larger inventory requires a greater capital investment and can result in a lower turnover for the year. It also requires

more space in the warehouse for a given volume of business. Since company policy differs, the turnover rate varies.

The distance the vendors are located from the warehouse determines how much must be carried. This is reflected in the minimum and maximum order points. When the minimum order point is reached, an order is placed for enough merchandise to bring the inventory to the maximum order point. This is six weeks' supply for the Jewel Tea Company, Incorporated. The minimum order point is determined by the location of the supplier, the length of time it takes for an order to be placed and received, and a small reserve. This can be a day's supply, as it is with some items in the Chicago area, or it can be a month's inventory.

Many manufacturers have quantity discounts, which increase as the order increases. To be able to take advantage of these, the company must have the storage space available. If the company's policy is to buy in quantities that gives them the greatest discount, then its minimum and maximum order points are set at these levels.

When suppliers are located nearby, a smaller amount of merchandise may be carried in the warehouse. With assurances

of quick delivery, the warehouse can be used strictly as a distribution center. However, when the supplier is located some distance away, a larger amount of merchandise needs to be carried. Even in this situation, there may be a railroad car of merchandise ordered for delivery early in the week and another car ordered for later in the week. In this way, the storing function can still be left to the supplier, and the warehouse can be used for distributing the merchandise to the retail outlets. Where slow-moving items are involved, there may be only enough merchandise ordered to fill the selection area. When the warehousing function is passed back to the supplier, merchandise has to be delivered on schedule. If it is not, it may result in the warehouse being out of merchandise, which causes lost sales and customer dissatisfaction. The new warehouse constructed for Abner A. Wolf, Incorporated, of Detroit, Michigan, was located on a site where delivery could be achieved one day earlier than previously. Where they were served through a belt-line railroad, they are now served directly. Since the Wrigley's Stores, Incorporated, does not operate its own dry grocery warehouse, its storage problems are passed to its supplier, Abner A. Wolf, Incorporated, who is located next door.

When merchandise is contracted for on a yearly basis, the vendor usually makes a periodic delivery from his warehouse. An annual supply is assured, while the space requirements in the vendee's warehouse are not increased. The delivery schedules may be further apart and the quantities shipped may be greater than if the merchandise were reordered each time the minimum order point was reached. In other cases, the purchaser may contract for a year's supply, and can order against this in any quantity desired, as long as the entire amount is ordered by the end of the year.

In planning a new warehouse, space must be provided for the large quantities of merchandise that are ordered for the weekly specials. This merchandise begins to arrive from four to six weeks in advance of the sale, which allows time for distribution to all of the retail outlets. Sale merchandise does not have to be stored in the warehouse, but can be shipped directly to the stores from the railroad cars, as was pointed out in Chapter IV.

Premium and coupon merchandise is in the same category as weekly specials. This merchandise has to be carried in huge quantities to meet consumer demand. However, it

places a terrific strain on warehouse capacity. This class of merchandise can usually be handled the same as weekly specials, since the manufacturer gives the vendor several weeks' notice before the coupons are distributed to the consumers. The coupons are not distributed throughout the entire trading area at once, but are on a staggered schedule.

Throughout the year, a company has several opportunities to purchase merchandise at favorable prices, providing it can take a specified quantity at that time. If the warehouse is large enough to handle the required amount of merchandise, the company can take advantage of this low price. However, the cost of storing the merchandise in a public warehouse must be added to the price of the goods when warehouse capacity is not available.

The point where a favorable purchase passes into speculation is difficult to determine. Some companies have a policy of speculation in a rising market, while others do not. This policy increases the need for additional warehouse space and can also leave a company with a large inventory of merchandise sitting in the warehouse when the market breaks. Several companies have found that an item suddenly quits selling, while

merchandise that has been ordered continues to arrive at the warehouse. This was the case when soap flakes became plentiful after the second world war. The price increase might not justify the cost of the extra space.

Several food companies control their own line of branded products. Since these may be purchased for the entire year, they are handled in the same manner as a favorable purchase or a periodic delivery.

As was mentioned in Chapter V, seasonality of certain items creates a need for space. If the buyer has ordered more merchandise than can be sold, the unsold portion is carried in the warehouse for the entire year. This wastes space that can be employed for merchandise that is constantly being turned over.

There are certain manufacturers who deliver merchandise directly to the retail outlet. The food company purchases this merchandise on a contract basis, but the individual retail outlets place the orders. The manufacturer has several reasons for wanting to service the individual stores instead of having his merchandise pass through the food company's warehouse. These are: better service, quality control, inventory

control, and perishability of the merchandise. This arrangement reduces the amount of warehouse space the food company requires.

Do buyers have space allotments in the warehouse? There is usually very little cooperation between the buyers and the warehouse manager as long as the warehouse is not overstocked. The buyer purchases what he thinks is needed, and in the quantities he believes will give him the best possible price. However, when the warehouse begins to bulge at its seams and demurrage charges begin to increase, the buyers and the warehouse manager begin to work together. Instead of ordering six weeks' supply, the buyer only orders two weeks' supply. He also notifies the warehouse manager on any large shipments of merchandise. This cooperation is usually not secured until the warehouse is overstocked and there is need for more space.

If the warehouse uses a pallet system, the buyers should cooperate with the warehouse manager and order in even pallet loads. This eliminates the oldd cases that waste space. Thus, if a pallet held 25 cases of number two cans, the buyer would order in multiples of 25. If 102 cases of merchandise are ordered instead of 100 or 125, there are 2 cases

of merchandise that occupy the same amount of space as 25 would.

The buyer can work with the warehouse manager and the company's suppliers in adopting standardized pallets. This in turn can lead to the company receiving merchandise already palletized from its suppliers, which would decrease the time it takes to unload the trucks or railroad cars.

To enable the warehouse manager to schedule the work in the warehouse on an efficient basis, the buyer can send a copy of the purchase order to the receiving clerk. This informs the warehouse on what merchandise is on order, how much, and the approximate delivery date.

When cooperation exists between the purchasing department and the warehouse manager, the warehouse may be operated more as a distribution center than as a storage depot. This results in lower warehouse operating costs, which are only increased as the merchandise is moved.

CHAPTER VII

SUMMARY AND CONCLUSIONS

To be able to secure lower operating costs, the food industry has been moving from multistory to one-story warehouses. This is true regardless of the volume of business a company does. How large should these warehouses be? This study has tried to point out some of the things that need to be considered in answering this question. It is apparent that a company having a yearly volume of sixty million dollars does not require the same size warehouse as one doing two hundred million dollars. Volume, however, is not the sole determinant since these companies differ in their method of handling merchandise, laying out the warehouse, type of merchandise handled, functions performed, size of retail outlets, and purchasing policies.

The method used to handle merchandise in the warehouse is one of the factors that determines the amount of space required for the structure. This can be seen in Chapters II and III. When hand trucks are employed, the four-wheelers accumulate

in large numbers on the receiving platforms. To reduce this traffic jam, either more space is required for the receiving dock, or more labor has to be used in clearing the platform. The merchandise cannot be tiered higher than 6 or 7 feet in the storage area, which limits the ceiling height to 9 or 10 feet. Once the merchandise has been placed in a tier, it usually is not moved again until selected for an order. This results in several tiers being only partially filled. Since it is uneconomical to take advantage of the "air rights," this results in wasted space. Even though the main aisles are less than 10 feet wide and the feeder aisles range in width from 2 feet to 5 feet, which provides more square feet of floor space for storing merchandise, this loss of space is not overcome. The shipping platform also accumulates a large number of hand trucks filled with outgoing merchandise.

A conveyor system reduces the amount of space needed for receiving docks, since only one truck or one railroad car can be unloaded at any given time. It eliminates the space required for hand trucks and the men that would be needed to keep the docks clear. A conveyor does not change the amount of air space that can be used for tiering merchandise. The

width of the main and feeder aisles depends upon the conveyor, which requires 12 or 18 inches. These aisles are from 3 to 5 feet wide. When "crew" picking is used with a conveyor system, the shipping platform may be limited to space for one truck, since this is all that can be loaded at one time.

The pallet system is usually combined with one of the above two methods to achieve their particular advantages in certain cases. The receiving platform requires more space than the other two methods. This is due to the number of trucks and railroad cars that can be unloaded at one time. The storage area is usually divided between a selection line and space for reserve stock. The selection line occupies approximately 60 percent of the warehouse. Merchandise can be tiered to heights of 20 feet throughout the building. The main aisles are from 10 to 20 feet wide and the feeder aisles are from 6 to 12 feet. Even with the wider aisles, a pallet system utilizes the space more effectively, by increased efficiency and complete use of "air rights." Where angle stacking is employed in an attempt to reduce the width of the aisles, fewer pallets can be placed in a given area. More pallets can be put in a given area when the short side faces the aisle.

When assembling is performed in a separate area, merchandise is limited to two pallets high. To utilize the "air rights" over the selection line, pallet racks, mezzanines, or a combination of these are employed. The addition of pallet racks is more economical than the construction of new warehouse space. However, when space is abundant, they are not justified. The combination that provides the greatest degree of flexibility is a mezzanine and a single-step pallet rack.

The construction of doors leading into the warehouse should be such that the space behind them can be used for tiering merchandise. This problem usually occurs only in the warmer climates. Such overhead obstructions as lights, steam pipes, sprinkler systems, ventilators, and heating ducts should be kept above the maximum stacking height.

A layout should be made showing the aisles, column spacing, and the pallets. This assures that the pallets will fit between the columns without wasting space.

The amount of space devoted to receiving and shipping driveways varies between warehouses. This is due to the method of handling the merchandise and the services performed for the retail outlets.

The type of merchandise handled affects the space requirements in various ways. If it is light and fragile, it cannot be stacked high. Bulky items may require two different pallet sizes. Fresh produce, meats, frozen foods, dairy products, drug items, housewares, and many other types of merchandise may be handled besides dry groceries. Each of these have special problems and require special equipment and additional space.

Every additional function performed in the warehouse requires added space. Room for egg-candling, salvage, offices, a cafeteria, lavatories, garages, a sign shop, and many other facilities can be provided in the warehouse. Examples of these are shown in Chapter III.

The amount of space required for a warehouse can be reduced by storing merchandise in the retail outlets. Two factors determine if this can be done. They are: the availability of storage space in the retail units, and the number of deliveries each receives. The amount of space that can be used varies from practically nothing, as in the case of Wrigley's Stores, Incorporated, to a month's supply of merchandise, as in the case of Hillman's Pure Foods, Incorporated. In the first

situation, it would be uneconomical to change, while in the latter case the company can reverse its policy. Both of these companies have daily delivery service to their retail outlets. By increasing the number of deliveries, the amount of merchandise going into the order is reduced. This can lead to increased warehouse operating costs.

The companies that have some latitude in deciding whether or not to warehouse more merchandise in their retail outlets lie in between these two extremes. There are several ways these companies can employ their retail outlets as miniature warehouses. A store can receive a large order twice a week, and by working a night crew to stock the shelves, the back room can be kept cleared. This leaves space available for storing four to eight weeks' supply of several fast-moving items. Merchandise that is to be advertised two weeks hence can be shipped to the retail outlets early. This eliminates the need for additional space in the warehouse, or it can be used for some other purpose. In some cases, merchandise must be purchased for the entire year, with the vendee providing the storage space. Where this occurs, the merchandise can be shipped directly from the railroad cars to the retail units. The number of cases

each outlet receives is determined by the amount of storage area it has. Any method resulting in more merchandise being stored in the retail outlets decreases the amount of warehouse space required. One way of accomplishing this is to separate the order form into slow- and fast-moving items and ship each once instead of twice a week.

There are several formulas available to aid in estimating the amount of warehouse space that is required. Since these are for estimates, the results are not accurate, but indicate some of the factors that must be considered in determining space requirements. Before deciding on a new one-story warehouse, certain points should first be checked, such as cost of a good location, reduction in insurance costs, reduction in maintenance labor costs, costs of inbound and outbound shipments, availability of materials and equipment, cost of the building and equipment, and an estimate of the savings in man-hours should be converted to dollars. This gives an indication of whether or not it is profitable to construct a new warehouse.[1]

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[1] National Association of Food Chains Summary Report on The Warehouse and Delivery Clinic, National Association of Food Chains (Washington, D. C., January 15-17, 1951), p. 11.

Another formula which estimates the area for a new warehouse, including platforms, aisles, locker rooms, lavatories, shipping office, battery-charging room, and boiler room is: "twenty-five square feet times the average tons shipped weekly times the average number of weeks supply carried in the warehouse."[2] This is for a building with a clear ceiling height of 16 feet, with a column spacing of 21 feet on center.

Still another method of estimating warehouse space requirements includes making a pallet layout for the proposed building. This consists of listing all the different brands, grades, and sizes of each type of merchandise. An estimate is made of the total amount of each of these items that is required for the year. This estimate is then reduced to the average inventory needed for each month. For each item carried, the average inventory is converted into pallet loads. The pallet loads are converted into tiers, which multiplied by the amount of floor space required for each stack, including overhang, gives the total square feet of floor space required for the year. A percentage estimate is made of the probable increase

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[2] Ibid., p. 12.

in business during the next five years and applied to the total area required. This gives the amount of warehouse space that will be required five years hence.

The above formulas provide a rough estimate of what is required in warehouse space. The building should be constructed on a tract of land that allows room for further expansion.

If space is being rented in public warehouses, this amount must be included in plans for a new building.

Purchasing policies have a decided effect on warehouse capacity. The amount of merchandise carried in stock varies between companies; but the larger the inventory, the greater the space needed to store it. In determining the inventory figure, minimum and maximum order points are used. The location of the vendor, the length of time it takes for an order to be placed and received, and a small reserve sets the minimum order point. The maximum order point reflects the buying policy of the company and may be two weeks' supply or more. If a company buys in large enough quantities to receive a discount, this policy is reflected in the maximum order point. When the quantity discount is not reflected in the maximum order point, additional space is required in the warehouse. The

extent to which the storage function can be passed back to the supplier reduces the need for warehouse capacity. In some cases, a supply of merchandise is contracted for on an annual basis. This may require the vendee to take immediate possession, periodic delivery, or it can be ordered as needed. Immediate possession requires added warehouse space, while the other two methods might not. Sometimes, the merchandise is ordered as needed and delivered by the vendor to the vendee's retail units. This completely bypasses the warehouse. Merchandise purchased for premiums and coupons, weekly specials at a favorable price, a private brand, and speculating on a rising market create a need for additional space.

The purchasing department can cooperate with the warehouse manager to secure the best possible use of existing capacity by ordering in even pallet loads; notifying him, through a copy of the purchase order, of the merchandise ordered, the quantity, and the expected arrival date; and by working with suppliers to secure palletized shipments of merchandise.

With new methods and procedures being made available almost daily, the use of materials-handling equipment and, in particular, fork lift trucks, can be used by almost any warehouse

regardless of its size. Palletized shipments from vendors can reduce the man-hours required to receive merchandise and result in savings for everyone concerned. The future holds the key to greater utilization of warehouse capacity, with resulting lower costs for the retail food industry, and ultimately, the consumer.

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