Maximizing Your Resources Through Warehouse Slotting

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Executive Summary

The efficient distribution of merchandise along the supply chain will be one of the factors that determine who commands the global market, now and in the future. In order to compete, corporations must determine the most efficient method of distributing their product to their customers, while increasing their customer satisfaction levels.

A typical warehouse operator spends up to 60 percent of his or her time traveling between locations. The placement of products in relation to their frequency and point of use is the most significant factor in the above statistic. Therefore, many consider slotting to be the underlying design element that determines warehouse productivity. With little investment, a warehouse can be re-slotted to allow for increased productivity and customer satisfaction levels.

This monograph will help you look at how to properly slot your warehouse. It provides an engineering-based, step-by-step methodology. This methodology will reduce the time required to re-slot your warehouse while at the same time, maximize your resources, reduce costs and make gains in your customer satisfaction with little or no capital investments.

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1.0 AN INTRODUCTION TO WAREHOUSE SLOTTING

In today's traditional warehouse, productive work such as actual unloading, stocking, picking, and loading, account for only 40 percent of all direct labor activities. Travel time accounts for the other 60 percent. The significance of this statistic increases when one considers that in a typical warehouse, direct labor can account for up to 40 to 50 percent of the total budget.

Can this be true? Is 30 percent of your warehouse budget actually being spent paying your personnel to travel back and forth across your warehouse floor? How long has it been since the product slotting in your warehouse has been assessed? If you cannot remember the last time your facility was re-slotted, you can probably fall into the category of a "typical" or "traditional" warehouse defined above.

Because the majority of warehouse work is spent traveling between locations, the largest target for reducing the expense of warehousing is to reduce travel distances. This is best accomplished with proper slotting. The main objective of slotting is to minimize, or in some instances even eliminate, travel and the amount of time that a stock keeping unit (SKU) is handled.

In a typical warehouse, direct labor can account for up to 40 to 50 percent of the total budget

1.1 Advantages of Proper Slotting

Slotting is defined as "the placement of product in a facility for the purpose of optimizing material handling and space efficiency." For example, it may appear to be beneficial to place the higher velocity product close to receiving to speed up the putaway process. However, the putaway process only requires one trip. The operators may need to visit that location several times for replenishment and picking requirements before the location is available again for a new receipt. In this case, placing the product closer to the shipping docks and pick area would be more beneficial.

Product slotting maintains or establishes the warehouse layout to an optimum condition. Because many managers do not fully understand all of the advantages of proper slotting, many distribution centers neglect to maintain a proper slotting layout until someone complains of being out of space and product is placed in the aisles. The advantages of proper product slotting are:

- Reduced picking labor requirements by locating product in the optimal pick sequence
- Reduced replenishment labor requirements by matching product unit loads with the appropriate size storage slot

- Reduced response time and improved flow by balancing workload between operators
- Increased picking accuracy by separating similar products to avoid proximity picking errors
- Reduced possibility of injuries by placing product in its ergonomically best location
- Reduced product damage by organizing heavier product first in the pick path, ahead of crushable product
- Increased palletizing productivity by arranging product by case height allowing the building of tighter pallets for better trailer utilization
- Deferred capital expansion by maintaining the optimum warehouse layout and cube utilization, reducing the need for the building expansion
- Increased store level productivity by organizing product in family groups, eliminating or reducing sorting of product for restocking at the store level

1.2 Importance of Slotting Maintenance

Slotting must occur for all warehouses during their initial start-up. Regardless of how well the product is slotted at this time, changing business environments will eventually lead to disorganization and improperly slotted product. What often begins as an efficient product placement plan, will soon be forgotten due to other priorities and fire-fighting management techniques. In these cases, the distribution center addresses the problem only when the facility has run out of space. This forces a massive re-slotting project to avoid unnecessary capital expansion. This scenario will often repeat itself on a routine basis.

The gradual degrading and requirement for massive re-slotting projects should never be allowed to occur. Ongoing product placement maintenance will prevent such a crisis. Regardless of whether you are implementing a new design or are looking for ways to improve the current layout, proper product placement will provide great enhancement to productivity at a low capital cost. Using simple database and spreadsheet applications, one can complete a new slotting scheme in just a few days. Specialized computer slotting software that works directly with warehouse management systems has been developed to allow for "on the fly" slotting that costs a fraction of its potential savings.

2.0 GETTING STARTED

Well before product can be assigned to locations, several steps must be taken to ensure optimal efficiency gains. These steps include the identification of slotting strategies and goals, data collection, and a demand analysis. Without the proper analysis early in the process, the full potential of effective product placement will not be achieved.

2.1 Goal Identification

Goal identification is always the first step in any product relocation program. The proper homework up front will save considerable

time running multiple iterations. Even worse, errors will not be uncovered until the re-slot is already in progress. Goals break down into two categories, objectives and constraints. Objectives are defined as the efficiencies you wish to gain by re-slotting products. These often include minimizing travel distance, reducing replenishments, balancing the workload among operators, and increasing pick rates. Constraints are defined as barriers that must be taken into account when slotting, usually requiring some of the efficiencies to be forfeited. These include weight of the product, size of the locations, picking accuracy, and store level productivity.

Once identified, these objectives must be prioritized. The most common slotting goal allocates product based solely on the products velocity and the proximity of its location to the shipping doors. However, this should not always be given the highest priority. Although this minimizes travel distance of the picker, other pertinent criteria must be considered. If such criteria as the capacity of the location, weight of the product, family groupings, and size are not considered, many of the efficiencies gained in minimizing travel distance will be lost due to congestion, product damage, replenishment labor, and injuries. Therefore, prioritization of the objectives must consider the effects of the other operations within the facility.

For example, an office supply distributor must take extreme caution when palletizing orders. Product crushability is considered a constraint and must be considered above all other goals. They will always want to place heavy, bulky products such as chair mats on the bottom of a pallet even though they are probably slow movers. This can be followed by items such as paper products or other full case items. Crushable products such as paper trays and calculators can then be placed on the top of the pallet even though they are probably much faster moving products. The pick path should follow this order so that a picker will always pick the chair mats first and the calculators last. However, within the light, crushable items, the product's velocity can be used to determine its placement.

Objectives are defined as the efficiencies you wish to gain by re-slotting products

2.2 Data Collection

Following the goal identification and prioritization, the next step is to identify and collect the data necessary to perform the slotting analysis. The goals of the product placement directly effect the data requirements. The data will need to be collected on the location characteristics, the product demand and the product characteristics. The following is a list of possible information needed for the location analysis:

- Location Identification
- Location Type (reserve or forward pick)

- Storage Equipment Type (pallet, drive-in, bulk, etc.)
- Pick Equipment Type (pallet flow, carton flow, carousel, etc.)
- Pick Type (full pallet, full case, broken case, etc.)
- Location Height
- Location Width
- Location Depth
- Weight Capacity

The product demand information can be collected by directly downloading actual order and/or shipping information from the order management system (host). A minimum of several months up to a year's worth of data will be necessary in order to capture a product's sales seasonality, as well as growth or declines in SKUs. This information will also be useful in separating product movements into full pallet picks versus cases or each picks. The following is a list of possible product characteristic information needed:

- Product Identification
- Product Family Group
- Product Height
- Product Width
- Product Depth
- Product Weight
- Product Growth
- Unit of Measurement
- Units per Innerpack/Case
- Units per Pallet
- Growth Projections
- Average Inventory

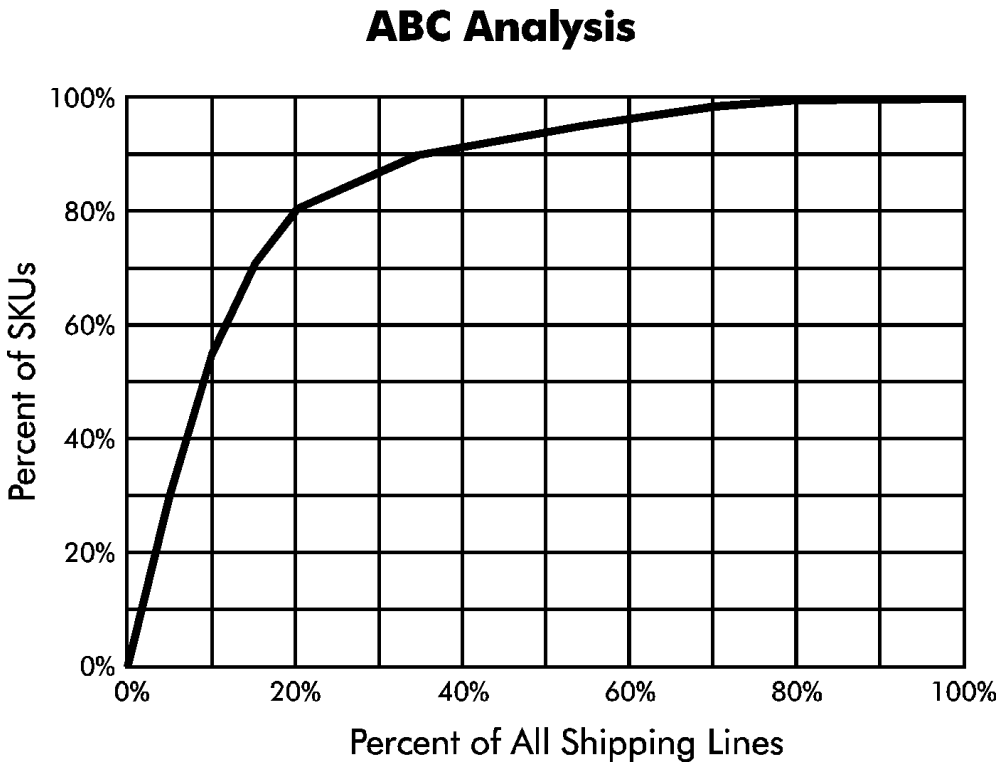

Figure 1

OBJECTIVE	STRATEGY
Reduce stockouts within the pick line	Level the replenishment requirements over all SKUs. Assign SKUs with higher cubic throughput to locations with more capacity. If necessary, assign multiple adjacent locations for the fastest moving SKUs.
Balance picker workload between zones	Spread the workload between each zone. Using the "hits" per day for each SKU, distribute the As, Bs, and Cs equally amongst each zone.
Travel distance	Minimize travel distance by placing the fastest moving SKUs closest to the point of exit or the shipping doors.
Increase pick rates	Place the fastest moving SKUs in the locations that are easiest to retrieve the product. For example, place the heaviest product at a height at or near the waist of the pickers.

Table 1

2.3 Demand Analysis

Once the data collection phase is complete, the demand analysis can begin. The purpose of the demand analysis is to determine the picking and replenishment attributes of each product. The first step in the demand analysis is to determine how much product is shipped and how that product is picked. To accomplish this, break each line of the shipping file into its full pallet picks, full case picks, and each pick components. At this point, assign each SKU to an A, B, or C classification, with your As being the fastest movers and your Cs being the slowest movers. Usually, only 10 to 20 percent of all items are As, yet they account for 70 to 90 percent of all of the shipping lines.

The next step is to assign product to its appropriate pick equipment. First, determine the product turnover rate by converting the previous information into its replenishment units. This information is valuable in determining the proper picking equipment. A product that requires two replenishment units per day is better suited for a larger capacity location than a product that requires only one replenishment unit per day. Next, determine the product "hit" by calculating the total number of times that product was ordered. This information is valuable in determining its location within the assigned pick equipment. Products with higher "hit" rates are better suited for locations with higher pick rates.

3.0 SLOTTING STRATEGIES

Upon completion of the demand analysis, the task of assigning products to locations can begin. For facilities with multiple areas or equipment for picking, product slotting is a two step process. First, the item must be assigned to the area or equipment type, then the item is assigned an actual location. Product is assigned to locations in accordance to the objectives identified during the goal iden-

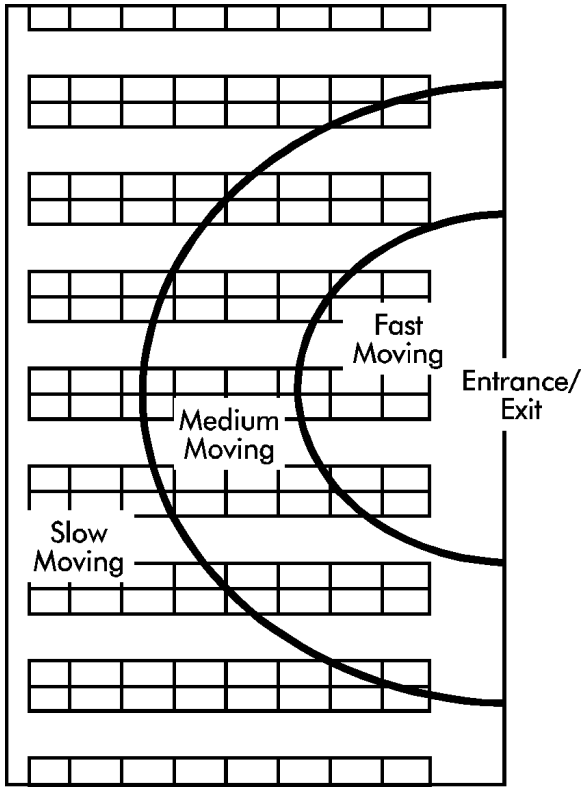

Figure 2

tification phase. Table 1 details the most common slotting objectives and a brief description of their associated strategies.

These strategies will vary according to the type of equipment being used and the size of the pick unit (pallet, carton, eaches, etc.). The following sections contain a more detailed discussion of strategies based on the storage and picking requirement.

3.1 Full Pallet Pick Area

This area is used to store and pick product in full pallet quantities. Product may be picked from these locations to fulfill orders as well as replenish the full carton or broken carton pick areas. Common storage equipment used in this area includes selective pallet rack, drive in rack, and bulk storage. Pallets are stored and retrieved using a unit load lift truck. Usually, minimizing travel distance is the primary objective when slotting this area.

Instead of a random putaway or a fixed location putaway scheme, this area is better suited for a zoned location scheme. In a zoned location scheme, a set of zones are determined and each product is assigned to a specific zone such as A, B, or C based on the product velocity. However, a pallet is stored randomly with its respective zone. Zones are based on both the storage type and the location in re-

RANDOM PUTAWAY			
Percent of Activity	**Location of Zone**	**Average with Zone**	**Subtotal**
100	1	.5	50
		Total	**50**
ZONED PUTAWAY			
Percent of Activity	**Location of Zone**	**Average with Zone**	**Subtotal**
80	.33	.5	13.3
15	.67	.5	5
5	1	.5	2.5
		Total	**20.8**

Table 2

spect to the pallet's origin and destination. In this area, product should be assigned to a zone based on its pallet turnover. Product with the highest pallet turnover should be assigned to the most advantageous zones. Pallet turnover is determined by dividing the total number of pallets of a SKU used during a period of time by its average inventory level.

Consider a typical full pallet storage area using a purely random putaway scheme. On average, a warehouse associate must travel half the distance of the warehouse to store or retreive a pallet. Using a zoned putaway scheme, the average travel distance is greatly reduced. The front 1/3 of the area is used to store A products which account for 80 percent of the activity. The middle 1/3 of the area is used to store B products which account for 15 percent of the activity. The rear 1/3 of the area is used to store C products which account for 5 percent of the activity. Table 2 gives the average travel distance calculations.

In this example the average travel distance has been reduced from 50 to 20.8, by simply using a zoned putaway scheme over a random putaway scheme. This reduces travel time by 58.4 percent. Similar savings can be acheived in other areas of the warehouse using the same methodology.

3.2 Full Case Pick Area

Full case picking can be broken down into two basic methods. The first method uses an operator and lift equipment picking to a pallet from pallet rack. The other method does not require lift equipment and the operator will commonly pick from carton flow, pallet flow rack, or shelving to a cart or a conveyor. Both require the SKU to be dedicated to one or more pick locations. When assigning the products to the pick equipment, remember to properly balance the objectives and the constraints.

Products may be assigned to a location which requires the access of lift equipment for a variety of reasons. These reasons include less frequent replenishments, they are lighter weight or they may be rarely ordered. Now that the SKU pool has been determined, the location assignment is ready to begin. It is time to prioritize the SKUs based on the primary objective within this area. Assign the highest priority SKUs to the most advantageous locations. Remember, in this area it is often easier to travel horizontally than vertically. Also, it is often easier to pick from floor level locations as well. Commonly, weight, increasing pick rates and reducing travel time are the main objectives. If so, place the highest priority product in locations near the floor as well as the entrances and exits to the pick area.

Slotting is more complex in areas that do not require lift equipment. This is due to a higher variety of equipment types and capacities available in carton flow and pallet flow rack. In pallet flow rack assign the SKUs with higher replenishment throughput to the deeper locations. The faster movers may require multiple locations. These locations should be adjacent to reduce operator confusion. To reduce travel distance, product should be sequenced according to their "hit" rate, beginning with highest velocity SKUs at the front of the pick zone and the slowest moving SKUs at the end

of the pick zone. In doing this, the likelihood that the operator will need to travel the entire distance of the pick zones every wave is reduced.

If the facility maintains carton flow rack or shelving for full case picking, it is typically reserved for the C items due to the complexity involved with breaking pallets down during replenishment. Again, assign the faster SKUs in terms of replenishment unit throughput to the deeper locations. If all locations are the same size, assign them to multiple locations.

Carton flow rack and shelf picking operations require additional attention to be placed on the level of the pick shelf. The shelves can be broken into three zones. The primary zone is referred to as the "golden" or "hot" zone. This zone can be single or multiple levels located between the operator's waist and shoulders. The picker is not required to bend or reach above the shoulders to access product. The fastest or heaviest product is assigned to these locations. The "medium" zone is the level or levels above or below the "golden" zone. Some bending and reaching is required. Finally, the "slow" zone is the lowest and highest levels. Considerable reaching is required to retrieve cases from this area. When slotting this area, pay careful attention to ensure that all of the objectives are taken into account. If reducing travel distance is the main concern, the faster moving items should be placed near the beginning of the pick zone. If increasing pick rates is the main concern, the heaviest and fastest items should be placed in the "golden" zone. In most cases, however, these two objectives must be balanced and must be looked at on a case-by-case basis.

3.3 Broken Case Pick Area

Broken case picking is the process of breaking a full case into less-than-case quantities for orders. Several types of equipment are used to facilitate this process. They include carton flow rack, shelving, and vertical and horizontal carousels. Carton flow rack is typically used for the A items. Shelving or carousels are used for the B items. The C items are then assigned to carousels or high bay shelving. High bay shelving is accessed using an order picker. The carton flow rack and shelving for broken case picking should be slotted using the same methodology as used in slotting the full case pick area.

Unlike static picking operations, a carousel's productivity cannot be increased by adding additional operators. Therefore, the only technique available to increase productivity in a carousel pod is to slot them such that the pick rate is maximized. Three strategies can be used that will affect the pick rates within a carousel pod. The first strategy is to split the SKUs over all of the carousels within a pod so that each carousel will contain an equal number of picks. This can be done by placing an equal number of As, Bs, and Cs in each carousel. This reduces the frequency that an operator will be required to wait for one carousel to index during a pick. Instead, the operator can pick from one carousel while the

others are indexing to the next pick. Furthermore, any SKUs that are often shipped together should be placed in separate carousels. The second strategy is used to reduce the indexing of each carousel within the pod. Efficiencies in indexing can be gained by assigning the fastest moving SKUs close together, thereby reducing the indexing required between picks. The final strategy uses the zone concept discussed for carton flow rack and shelf slotting. Again, the heaviest and fastest moving product is placed in the "golden" zone to avoid reaching and bending. Obviously, this must be balanced with the previous strategy in order to properly balance efficiencies.

4.0 SUMMARY

Proper product placement is essential in any warehousing and distribution operation attempting to compete is today's marketplace. Not only will it reduce labor and material handling costs, but it will also increase response time, reduce picking errors, reduce product damage, and possibly defer capitol expansion. It is also important to note that unless the product placement is properly maintained, these gains will be quickly lost.

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Following the outlined methodology, any warehouse can develop a slotting strategy that will maximize the use of the available resources in just a few days. The first step is to identify the objectives and constraints that will provide the best results. This is followed by the data collection and demand analysis. Once completed, the product placement can begin and your operation will be on its ways to success.

APPENDIX
Background Information

TOMPKINS ASSOCIATES: Supply Chain Excellence

Tompkins Associates is the global leader in Total Supply Chain Solutions for operations consulting, technology implementation, and integration. For nearly three decades, Tompkins has provided expertise in warehousing, logistics, procurement, inventory, manufacturing, organizational excellence, quality, and maintenance.

Tompkins Associates is headquartered in Raleigh, N.C., and has offices throughout the United States and in the UK, continental Europe, Mexico, and Australia. Worldwide, Tompkins helps clients succeed through a combination of focused knowledge of best practices and tailored solutions. Tompkins prepares businesses to harness the energy of continuous change to achieve Supply Chain Excellence.

Tompkins Associates understands your unique needs. Tompkins' supply chain expertise helps clients work seamlessly with their supply chain partners to provide the service they need to satisfy their customers. No other firm has the capability to melt the links in your supply chain-taking you from business as usual to collaboration to velocity.

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