

Chapter 3

1. What are the basic inbound operations of a warehouse? What are the outbound operations? What is likely to be more labor intensive and why?

Receiving and put away are the inbound processes. Processing customer orders, order picking, checking, packing, and shipping are the outbound processes. Outbound processes are more labor intensive than the inbound processes. Especially, order picking is the most labor intensive of these inbound processes because for each sku, the worker has to travel to the storage location, search for it and extract it. Also, the items to be handled are smaller units; e.g. cases or pieces.

2. At what points in the path of a product through a warehouse is scanning likely to be used and why?

During the receiving process, each item is scanned in order to make its entry to the system so that ownership is assumed. When the sku's are put away, the storage locations are scanned to guide order picking. During order picking, again the product and the location are scanned in order to confirm that the product was picked. Shipping containers are scanned in order to register their departure from the warehouse.

3. What is batch picking and what are its costs and benefits?

Have each worker retrieve many orders in one trip.

Benefits: Increases pick density, lowers deadheading.

Costs: Items must be sorted into orders either while picking or else downstream. If sortation is done during picking, the pickers are slowed down because they must carry an extra container for each order. If sortation is done downstream, space and labor must be devoted to this additional process.

4. What are issues involved in determining an appropriate batch-size?

For each order, the picker must carry an extra container; thus, the number of different orders to be picked up must be considered. How many pick lines each order includes is also important. It determines the number of the locations to be visited by the picker. Batching similar orders can reduce walking. Also, the total number of items to be picked up must be considered because it determines the load that will be carried by the picker all around the warehouse.

5. What are costs and benefits of ensuring that orders arrive at the trailers in reverse sequence of delivery?

Trailers go to several customers in one travel. For ease of convenience, the order that will be unloaded first must be loaded last to the trailer. If orders do not arrive at the trailer in reverse sequence of delivery, they must wait for each other to be loaded, with consequent cost in labor and space. As a remedy, we can process the orders in the warehouse according to this loading sequence, which causes us not to utilize the opportunities like batch picking, parallel picking, etc.

6. Explain the economic forces that are pushing more value-added processing onto the warehouse.

Final product differentiation is pushed down to the warehouses so that manufacturers face only aggregate demand of generic items. This reduces their forecast errors, inventory levels, and safety stocks. Retail stores push value added processing, such as tagging and labeling back toward the warehouse because of the high cost of space and labor in a retail store.

7. Why the receiving staff in most warehouses is much smaller than the staff of order pickers?

Receivers usually handle products in larger units, such as pallets or cases; however, order pickers handle them in smaller units, such as cases or pieces. As we have said before order picking is much more labor intensive and resistant to automation.

Chapter 4

1. Which types of pallet storage generally provide the most efficient use of floor space: floor storage or pallet rack? Explain.

Pallet racks are much more efficient than floor storage. Because of the rack supports in a pallet rack, levels are independent of each other and only the empty pallet locations in front of a pallet are unavailable. However, in floor storage, any unoccupied pallet location in front of or above a pallet is unavailable for use.

2. What are the relative advantages and disadvantages of push back rack compared to pallet rack? How do both compare to gravity flow rack?

Pallet racks have lanes of at most two pallet positions depth; however, push back racks have 3-5 pallet positions in a lane. Thus, space utilization is higher in push back racks (less aisle space is needed); however, less pallet locations are dedicated to a single sku in pallet racks.

Gravity flow racks have deeper lanes than push back racks; thus, they

are preferred for high quantity, popular sku's. Otherwise, there would be so many unavailable, unoccupied pallet location in the warehouse. Since gravity flow racks are loaded from the back, they enforce FIFO sequence of pallet movement but they require more aisle space than the push back racks.

3. Which type of pallet storage generally makes pallets more accessible: Pallet flow rack or drive-in rack? Explain.

In pallet flow racks, pallets are more accessible because pallets move forward to the pick face as the front pallet is retrieved. However, in drive-in racks you have to drive in the rack to pick up the pallet.

4. Consider two sku's: One a small, slow-moving sku of which the warehouse has only a small amount; and the other a small, fast-moving sku of which the warehouse has considerable quantity. Which is a candidate for shelving and which for flow rack? Explain.

Since both sku's are small, they are stored in bin-shelving or gravity flow rack. In flow racks, the lanes are deep and each lane is dedicated to a single sku. Thus, the high quantity, fast-moving items are preferably stored in these racks to increase the pick density. Besides, in flow racks put away and retrieval are done from different ends, which is necessary for items with high turnover rates. Slow-moving, small sku's, which cannot fill the deep lanes of flow rack, are stored in bin-shelving.

5. (Open ended) Roughly speaking, what types of sku's should be stored in carousels: Large ones or small ones? Ones that move few cases or ones that move many cases? Ones that are infrequently requested or ones that are frequently requested?

Carousels are expensive, motorized equipments, and they are preferred for storage of small, valuable items. If there are a few cases of these small items, it is much more efficient to store them in static rack instead of carousels. Items that move in medium velocities are stored in carousels because usually 2-3 carousels are served by one operator, and there is only one point for picking and restocking. So, the pick rate cannot be increased so much in case of surge in demand. If slow-moving items are stored, then the carousel will rarely be used.

6. Conveyable sku's should be stored far from shipping. Why?

For transferring conveyable sku's from one place to another we need little labor force; thus, locations close to the shipping docks are used for non-conveyable ones.

7. Suppose you have many slow-moving sku's in less-than-pallet quantities and these are shipped as cases. What arguments are there for storing them in carton flow rack?
 Since we have many of them, storing them in flow racks will increase the sku density, and therefore the pick density.
8. What are the dimensions of a standard pallet? Go to the web and see how many other "standards" you can find.
 48 inches x 40 inches
9. Under what conditions might you prefer to store pallets with the shorter side on the pick face (that is, along the aisle)? When might you want to store pallets with the longer side facing the aisle?
 By storing pallets with shorter side on the pick face, there can be more pallet facings along the aisle, which means opportunity for more sku's along the aisle. This concentration of activity tends to reduce labor requirements. By storing pallets with the longer side facing the aisle, case-pickers do not have to lean over so far to retrieve the last cases from a pallet. Accordingly, store with short side on the pick face if space is tight, especially if this is a pallet out warehouse. Store with long side on the pick face if there are many cases on the pallet and they will be picked individually.
10. In each case explain why the warehouse action described below is probably unwise.
 - Picking product from a single carousel.
 Carousels do not rotate much faster than a human can walk along the aisle. It is efficient to use carousels, if there are 2-3 of them located next to each other and they are served by one operator.
 - Storing cases in a gravity flow rack that 0.5 meter deep.
 In such a shallow rack probably you will not need items to move forward to the pick face.
 - Picking fast-moving product from static shelving.
 Fast-moving products are stored in high quantities. If they are stored in static shelves, which are convenient for shallow storage, they will occupy so much space in the pick face reducing the sku and the pick density.
 - Storing pallets in an aisle of single-deep rack that is free-standing (there is an aisle on either side of it)

No need to be able to reach a single-deep rack from either side.
One of the aisle space is wasted.

- Storing product as free-standing eaches, with every piece lined up neatly.

The product must have been handled as eaches in both put away and in picking, which is double handling.