

The Solution of Homework #1

3.1 What are the basic operations of warehouse?

- Inbound process
 - Receiving
 - Put-away
- Outbound process
 - Order-picking
 - Checking
 - Packing
 - Shipping

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

- Receiving
Product may be scanned to register its arrival so that ownership is assumed and to mark that it is available for shipping.
- Put-away
The storage location in which product is placed may be scanned to register where it is. This will be used to build efficient pick-lists to guide order-picking.
- Order-picking
Product may be scanned as it is picked to confirm that the right product was picked.
- Packing
Shipping containers may be scanned to register their departure from the warehouse, which gives downstream customers information on which to plan their subsequent use of the product.
- Shipping
The trailer may be scanned as they are sealed for departure from the warehouse.

3.3 What is “batch-picking” and what are its costs and benefits?

- Definition
Batch-picking is to have each worker retrieve many orders in one trip.
- Benefits
 - It decreases walking per pick, and therefore decreases work.
 - It increases pick density.
- Costs
 - We need to sort picked items into orders. So if the order picker does sorting while picking, the work process slows down and there could be error.
 - If the sorting is done downstream, we need extra labor and space.
 - Large items cannot be batch-picked easily.

3.4 What are the issues involved in determining an appropriate batch-size?

- First of all, we need to decide which batching mechanism we are going to use between sort-while-pick and downstream sorting. It might affect the number of batch-size.

- The batch-size should be determined so that the costs of work to separate the orders and the costs of additional space are less than the extra walking incurred if orders are not batched.
- Followings are some factors considered in the decision problem
 - Number of different orders: Picker must carry container for each order if sorting while picking.
 - Number of different pieces: Picker must carry them all.
 - Locations to be visited: Batching similar orders can reduce walking.

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

- Benefits
 - It reduces labor for unloading to make deliveries if trailer will make multiple stops.
- Costs
 - Either order must be sorted at shipping with consequent cost in labor and space.
 - Or orders must proceed through all warehouse processes in proper sequence, which forfeits opportunities to reduce labor by, for example, batching similar orders.

3.6 Explain the economic forces that are pushing more value-added processing on to the warehouses.

- Downstream
 - Postponement pushes final product differentiation downstream from manufacturers toward the warehouse.
- Upstream
 - The cost of space and labor in a retail store is high, which pushes value-added processing such as tagging and labeling back toward the warehouse.

4.1 Suppose that you have decided to configure pallet storage with lanes five pallet deep. What are the relative advantages and disadvantages of push-back rack, drive-in rack, and drive-through rack?

a. Push-back racks

- Benefits
 - Excellent load access and storage density
 - Independent accessibility of each lane at any level because each lane pulls out like a drawer
- Costs
 - Need to schedule time for picking and replenishment activities
 - More work is required to store and retrieve product

b. Drive-in racks: LIFO system

- Benefits
 - Above average load access since it allows the driver to enter the rack for picking product

- Costs
 - Increased safety concerns as drivers go deeper into the racks
 - Need to schedule pick/replenishment operations on the same aisle since the put-away and retrieval functions are performed on the same aisle
 - Degraded ability to house variable load sizes.
- c. Drive-through racks: FIFO system
 - Benefits
 - The ability to replenish and pick simultaneously
 - Above average load access.
 - The additional benefit of allowing FIFO product storage policies
 - Costs
 - Increased safety concerns as drivers go deeper into the racks
 - Degraded ability to house variable load sizes.

4.2 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.

- Small and slow-moving sku of small amount would be a candidate for shelving.
 - Since we have a small, slow-moving sku of small amount, we need to use inexpensive and shallow equipment. Simple shelving is the best storage mode in this situation.
- Small and fast-moving sku would be a good candidate for flow rack.
 - In flow rack, there is a high sku density, which increases pick-density and decreases flow time.
 - In flow rack, sku's are restocked from the back, independently of picking, so there is no any interference between restocking and picking.
 - So it can serve fast-moving sku of considerable amount efficiently.

4.3 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?

- Small ones: Carousels are shallow motorized aisles of shelving, and therefore, they cannot support the storage of large items.
- Relatively fast moving items: One of the main reasons for using the carousels is in order to increase the picking rate per picker, by automating the item fetching process, and executing it simultaneously for more than one item, by having many carousel units running in parallel. Hence, if the carousels are used for parts not that frequently requested, this advantage of theirs is not exploited, and therefore, their high cost would not be justifiable.

4.4 Conveyable sku's should be stored far from shipping; why?

Conveyable sku's can be moved at little labor cost from anywhere in the warehouse, so it is preferable to reserve the location that are physically close to shipping for the non-conveyable sku's.

4.5 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?

- Storing in carton flow rack would increase sku-density and therefore pick-density, which means that travel time would be reduced.
- If the sku's are in less-than-pallet quantities and they are likely handled as cases anyway, there would be no appreciable increase in labor to load them into flow rack.

4.7 Pallets are generally stored with there shorter side facing the aisle; why?

- By storing pallets with shorter side on the pick face, there can be more pallets facing along the aisle, which means opportunity for more sku's along the aisle(high sku-density), which means opportunity to pick more products within this aisle(high pick-density).
- This concentration of activity tends to reduce labor requirements.