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White Paper

Optimizing Picking Performance

Through Proper Sizing of Pick Locations

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Many industry professionals spend much of their time and money concentrating solely on implementing the newest technologies to improve efficiencies in their distribution operation. Technology can be a huge investment in time and money and also may not address more easily corrected factors affecting productivity. In some cases, the most effective means to increase efficiencies across both replenishment and picking operations is through the proper sizing of pick locations. Especially, in instances where an operation inherits equipment from either previous product lines or a leased distribution center, these operations are frequently equipped with unsubstantiated quantities of carton flow, bin shelving, and pallet pick locations. Regardless of the situation, an analysis and implementation of the proper size of pick and reserve media for your distribution center will yield information that can dramatically improve replenishment and pick productivity.

The multi-stage process begins by determining the average daily shipping volume of each SKU. It is best to have a year's worth of data to identify key seasonality trends and strengthen result accuracy. However, if a year's worth is not available, use the longest historical period possible. Also, if your business is consistent and has little fluctuation in demand, then three to four months of order data will be sufficient for this analysis.

Figure A:

Required Data	**Detail**
Historical shipping data	# of orders
	Lines per order
	Units per line
	SKU's in order
Dimensional data	Case length, width, height
	Pallet length, width, height
	SKU dimensions (if case not available)
Target Figures	**Detail**
Planning horizon	Months or Years
Estimated SKU growth	% for each year of planning horizon
Days on hand inventory	# of days inventory in forward pick locations
Estimated order growth	% for each year of planning horizon

Next, use accurate case dimensions for each SKU to convert the daily shipping averages to a cubic volume for each SKU. If case dimensions are unavailable, use accurate SKU dimensions instead. Furthermore, determine the average days on hand (DOH) inventory desired in each pick location. This is a key number affecting the efficiency of replenishment and picking. Placing excessive inventory levels in pick locations will help keep replenishment frequencies low but will also result in a pick area that utilizes too much warehouse space and creates more travel time for pickers. If a target is not known for days on hand in the forward pick locations, a good number to start with is 10 days. This number can be adjusted throughout the process, if necessary.

The space requirement for each SKU in a pick location can now be computed by multiplying the average daily cubic volume and the first pass of the DOH inventory in forward pick locations. It's a good idea to add a 10% operational buffer to account for any fluctuations due to new SKU's, seasonality, etc.

Figure B:

	Avg. daily volume	Target DOH inv.	Cubic volume (in) per case	Units per case	Cube (in) req'd in forward pick loc.	Cube (ft) req'd in forward pick loc.	Cubic req'd w/ 10% buffer
SKU A	489.9	10	144	12	58,788	34.02	37.42
SKU B	255.5	10	90	12	19,163	11.09	12.2
SKU C	151.1	10	52	24	3,274	1.89	2.08
SKU D	11.3	10	40	48	94	0.05	0.06

Next, factor in order growth over the planning horizon; If the distribution center will support an increasing percentage of customers over the planning horizon, the analysis must account for this volume growth. The increased output will mean the DOH inventory in each pick location will decrease over time. Since one of the primary goals is to increase replenishment's efficiency, don't allow DOH inventory in pick locations to become too small by the end of the planning horizon. This will negatively impact replenishment productivity by increasing the number of required replenishments each day.

Now, determine how these DOH cubic volumes fit best into the various types of pick media. The most common types of pick media include bin shelving, carton flow and wire deck, each with adjustable bin sizes. Vertical carousels, horizontal carousels, and all other types of pick media can also be included in the analysis. Determine the cubic capacity of each pick bin and match it with the appropriate SKUs in the analysis by not exceeding the SKU's cubic requirements.

Figure C:

Bin Shelving	**Cubic (in) Capacity**	**Cubic (ft) Capacity**	
6w x 14h x 24d	2016	1.2	*SKU D's recommended media type*
12w x 14h x 24d	4032	2.3	*SKU C's recommended media type*
24w x 14h x 24d	8064	4.7	
Carton Flow			
12w x 14h x 100d	16800	9.7	*SKU B's recommended media type*
24w x 14h x 100d	33600	19.4	
Wire Deck			
48w x 26h x 30d	37440	21.7	
Pallet Location			
48w x 40L x 60h	67200	38.9	*SKU A's recommended media type*

From Figure 2, SKU D's cubic requirement, at a 10 day DOH inventory goal, is 0.06 ft^3. Since the smallest pick face is a 6"x14"x24" bin location with 1.2 ft^3 of capacity, 10 days of inventory will easily fit into the smallest bin size. In fact, there is enough space to fit over 20 days of inventory into this forward pick location. However, since it is the smallest bin available, SKU D must go into this pick type.

Additionally, SKU B has a cubic requirement, at a 10-day inventory goal, of 2.08ft^3. Since the smallest bin size, a 6"x14"x24" bin location, can only accommodate 1.2ft^3 of inventory, SKU B will have to be located in the next larger size bin location – a 12"x14"x24" bin location. Always place SKUs in a pick bin capable of handling its cubic velocity requirements, hence ensuring the desired efficiency improvements by not jeopardizing the forward pick DOH goals. Proceed with this process for every SKU until each SKU has been placed in its appropriate sized media type.

Finally, ensure each SKU is capable of fitting into the selected media type. For example, if the case dimensions for SKU D are 40" x 1" x 1", it will not fit easily into any bin shelving locations. There are not any bin shelf locations capable of handling a 40" long item. For such circumstances, SKU D will have to move into the first type of media capable of handling its dimensions, 12" x 14" x 100" carton flow rack.

After placing each SKU in a specific media type, the total quantity required of each media type is known. Now is a good time to factor in SKU growth. Assuming future SKUs are going to be similar in size and volume to current SKU's, increase the specific media types equal to the expected annual SKU growth levels. If no SKU growth is expected throughout the planning horizon, then no adjustments need to be made to the quantities of pick media.

Figure D:

Annual SKU growth = 2%			
	Base Yr Qty	**Base Yr+1 Qty**	**Base Yr+2 Qty**
Bin Shelving			
6w x 14h x 24d	310	316	323
12w x 14h x 24d	300	306	312
24w x 14h x 24d	223	227	232
Carton Flow			
12w x 14h x 100d	245	250	255
24w x 14h x 100d	150	153	156
Wire Deck			
48w x 26h x 30d	175	179	182
Pallet Location			
48w x 40L x 60h	24	24	25

The final step in the process is to plot the new pick media in the current warehouse configuration. Whether the media is going into new warehouse or a current facility, it is important to remember the goal of this analysis – to increase the replenishment and pick efficiency of warehouse operations. If your targeted media levels do not fit into a specific area, don't sacrifice your forward pick DOH inventory goals. First, try to expand the picking area or make any necessary adjustments to maintain your targeted forward pick DOH inventory levels. Even an adjustment from 6 days of forward DOH inventory to 3 days of forward DOH inventory can equate to a doubling of replenishment requirements and replenishment personnel. Therefore, only reduce forward pick DOH inventory goals as a last resort and only if it is imperative to reduce the amount of space required by the picking area.

Possible Results

After implementing the changes to pick media types and sizes, efficiencies will be gained across replenishment and picking due to:

- Fewer replenishment requirements since pick locations are appropriately sized
- Increased replenishment rates since replenishment personnel moves larger quantities of units for each replenishment
- Fewer empty pick locations reduces time required by the picker to conduct contingency actions for empty locations (notifying picking supervisors, completing empty slot paperwork, notifying replenishment personnel, etc.)
- Reduced travel times for pickers
- Reduced likelihood of empty pick faces will increase order fill rates.

Proper Sizing in Practice

A customer recently completed an analysis of their pick face sizes and estimated dramatic improvements to their labor costs. The customer's warehouse was filled entirely with reserve rack. Pick locations were at the bottom level of the reserve rack and were primarily constructed of carton flow, bin shelving and wire deck locations. The various media types were:

Old Pick Media Types:	**qty**	**% of total**
Bin Shelving	4946	41.30%
Wire Decking	2091	17.40%
Carton Flow	4898	40.90%
Pallet Picking	48	0.40%
Total	**11983**	**100.00%**

Completion of the pick face analysis determined the customer had far too many slow cubic velocity SKUs in large pick locations – primarily carton flow locations. The analysis determined a more efficient setup included a near doubling of their bin shelving and a reduction in their carton flow and wire deck locations.

New Pick Media Types:	**qty**	**% of total**
Bin Shelving	9410	78.50%
Wire Decking	482	4.00%
Carton Flow	1960	16.40%
Pallet Picking	131	1.10%
Total	**11983**	**100.00%**

Moving the customer's slow cubic velocity product to bin shelving significantly decreased pickers' travel times and freed-up some warehouse space. Moving the customer's high-velocity product into pallet locations and carton flow dramatically reduced the amount of replenishments required throughout the day. The result was a 38% reduction in picking personnel and just over a 20% reduction in replenishment personnel due to many of the aforementioned efficiency factors associated with the proper sizing of pick media.

The pick face sizing analysis described above works well for distribution centers that have a single pick location for each SKU. Distribution centers having separate picking areas for cases and units need a slightly more complex algorithm for determining appropriate sizing of case pick and each pick locations. However, it is possible to gain equal efficiency improvements under both scenarios. Additionally, robust software programs exist to help simplify the process.

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