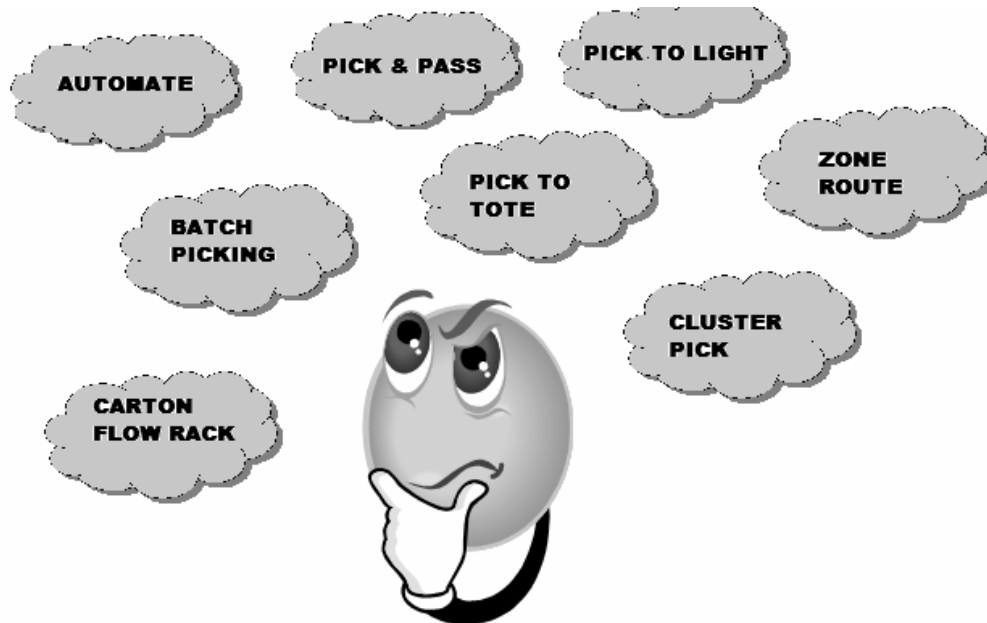


PIECE PICKING: WHICH METHOD IS BEST?



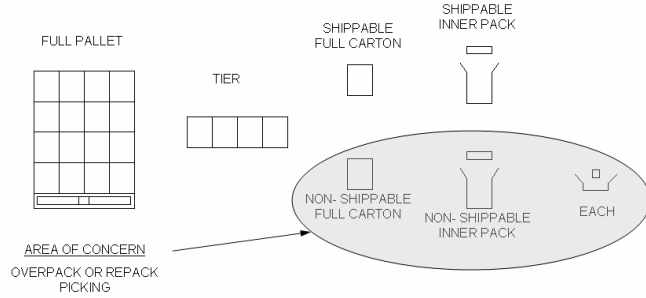
By Robert Muller

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This white paper shall lay out a 10 step plan for evaluating the multitude of alternatives available in designing a piece picking system.

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Variations of Picking



Area of Concern

Piece picking is one of the most labor intensive processes within a distribution center and as such, it is a major area of concern for operations professionals. As a result, operations professionals are often asked this question... "Which piece picking method is best?"

For the purposes of this paper, piece picking is defined as any order selection process that requires the product (units) picked to be individually handled and/or placed into an outer carton, tote, or other container before shipping.

In comparison to full-case or pallet picking operations, piece picking typically has lower unit volume, lower revenue, and higher labor costs. The higher labor costs are accrued due to the need to open vendor cartons, pick SKUs less densely, erect/pack/seal shipping cartons, and apply carton labels while picking less volume per item than full case or pallet picks. The movement towards just-in-time supply chains and the proliferation of direct-to-consumer catalog/internet fulfillment operations is driving a change in order profiles. Smaller orders (those with fewer line and piece counts) are being received more often in many industries and market channels.

To design or re-design a picking operation, one needs to develop a cost versus benefit analysis to include the systems to be considered. In order to fully analyze the nearly innumerable alternatives available, one can follow a 10 step plan to narrow down to the feasible options as illustrated below:

Step 1: Selection of Possible Storage/Picking Modules

Mine available historical operational data, apply design year projections, and profile item inventory, movement, & unique characteristics to determine the alternative pick modules available (cubic velocity by SKU).

In an over-pack picking system high density drawers, bin shelving, carton flow rack, vertical lift module, and carousels may be among the candidate infrastructure to be considered.

Systemic support and overall capital budget constraints may eliminate some of the more mechanized alternatives.

The matrix at right provides some high-level rules of thumb for pick module selection.

PICK MODULE SELECTION MATRIX

	Manual - Conventional					Mechanized - Automated					
	High Density Drawers	Bin Shelving	Decked Rack	Carton Flow Rack	Pallet Rack Position	Pallet Flow Rack	Automated Dispensing System	Vertical Lift Module or Carousel	Horizontal Carousel	Mini-Load AS/RS	Pallet Load AS/RS
Picking Type											
Piece	+	+	0	+	0	0	+	+	+	+	0
Inner Pack	0	+	+	+	0	0	+	+	+	+	0
Full Case		0	0	0	+	+	0	0	0	+	+
Full Pallet					0	+					+
Security											
High	0							+	0	+	+
Medium	+	+					+	+	+	+	+
Low	+	+	+	+	+	+	+	+	+	+	+
Pick Unit Size											
< 0.0005 Cubic Ft.	+	0	0	0	0	0	+	+	0	+	0
0.0005 - 0.015 Cubic Ft.	0	+	+	+	+	0	+	+	0	+	0
0.015 - 0.125 Cubic Ft.		0	+	+	+	+	0	0	0	+	+
0.125 - 1 Cubic Ft.				+	0					+	+
1 - 5 Cubic Ft.										0	+
5 - 10 Cubic Ft.											+
> 10 Cubic Ft.											+
Daily Hits											
< 0.05	+	+	+		+			0	0	0	0
0.05 - 0.2	+	+	+					0	0	0	0
0.2 - 1	+	+	+	0	+	0		+	+	+	+
1 - 5	0	+	+	0	+	+		0	0	+	+
5 - 10		+	+	+	+	+				0	0
10 - 50		+	+	+	+	+	0				
> 50		+	0	+	+	+					
Daily Cubic Velocity											
< 0.005 Cubic Ft.		+		0				+	+	0	
0.005 - 0.1 Cubic Ft.		+	+	0	0			+	+	0	
0.1 - 0.5 Cubic Ft.		0	+	+	+	+	0	+	0	+	
0.5 - 5 Cubic Ft.			+	+	+	0	+			+	
5 - 10 Cubic Ft.			0	0	+	0	+			0	0
10 - 25 Cubic Ft.					0	+	+				0
25 - 100						+	0				+
> 100							+				+
Average Inventory Cube											
< 0.125 Cubic Ft.	+	+						+	+	0	
0.125 - 2 Cubic Ft.		+	0	0			0	+	+	+	
2 - 5 Cubic Ft.		0	+	+				0	0	+	
5 - 10 Cubic Ft.			+	+				+		+	
10 - 25 Cubic Ft.			0	+	0					0	
25 - 250 Cubic Ft.				+	+	0	+				+
> 250 Cubic Ft.				+	+	+	+				+

+ OPTIMAL
 0 FEASIBLE

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Step 2: Mode of Order Transportation

There are two common options in selecting the method used to transport the order to and from each pick location:

1. Pick to cart
2. Pick to conveyor

A decision is typically made based on the overall size of the piece picking area (travel requirement). SKU velocity, pick density, and related considerations often define the appropriate method.

A combination or hybrid of the pick to cart/pick to conveyor option is commonly used, in which, fast pick items would be picked to conveyor and slow picks would utilize a cart. Conveyor could be used to transport orders to and from each cart pick zone. The picker may load the cart at the beginning the zone and unload to cartons or totes to conveyor at the end of the zone.

	Commonly Used Operations	Benefits	“Draw Backs”
Pick to Cart	<ul style="list-style-type: none"> ▪ Large number of items with low movement per item ▪ Full case and piece picks operations with little system support to split out the orders 	<ul style="list-style-type: none"> ▪ No conveyor cost ▪ Highly flexible ▪ Multiple pickers per zone, if required 	<ul style="list-style-type: none"> ▪ Low pick rate due to typically long travel paths
Pick to Conveyor	<ul style="list-style-type: none"> ▪ Low number of items ▪ High volume items ▪ Large number of very small items (i.e. jewelry) 	<ul style="list-style-type: none"> ▪ High pick rate due to small pick zones 	<ul style="list-style-type: none"> ▪ Typically only one picker per zone ▪ Conveyor cost

Step 3: Selection of Picking Technology

Operations with a large number of picks in a small area benefit the most from pick to light technology, while operations with picks spread across a large pick area (many pick facings) are better suited for either RF or voice picking.

The benefits of voice versus RF is that voice is “hands free”, the picker never has to put down (or holster) an RF device (scan gun) to either pick or open cartons. In a voice system, picking time can be reduced by the picker listening to the voice directive while traveling to the next location instead of stopping to read the RF device.

The RF device, however, has the ability to capture detailed item information, typically a production batch or serial number, quickly by scanning item barcode labels. Voice may be more cumbersome in these applications.

	Commonly Used Operations	Benefits	“Draw Backs”
Paper Picking	<ul style="list-style-type: none"> ▪ Small operations with little systemic support 	<ul style="list-style-type: none"> ▪ Low technology cost ▪ Low risk 	<ul style="list-style-type: none"> ▪ Low pick rate ▪ Low pick accuracy ▪ Long order cycle time
Radio Frequency Picking	<ul style="list-style-type: none"> ▪ All types of operations 	<ul style="list-style-type: none"> ▪ High accuracy ▪ Paperless ▪ Ability to capture item specific information (i.e. serial numbers) 	<ul style="list-style-type: none"> ▪ Low pick rate (often the same as paper picking)
Pick to Light	<ul style="list-style-type: none"> ▪ Low # of items with high volumes 	<ul style="list-style-type: none"> ▪ High accuracy ▪ High pick rate ▪ “Hands Free” 	<ul style="list-style-type: none"> ▪ High hardware costs
Voice Picking	<ul style="list-style-type: none"> ▪ Large # of items spread across a large area 	<ul style="list-style-type: none"> ▪ Medium pick rate ▪ Medium to High accuracy ▪ “Hands Free” 	<ul style="list-style-type: none"> ▪ Medium to high capital costs for systems & headsets

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Step 4: Order Batching

Order batch picking is the process of grouping orders together to create a larger pick order, which reduces the overall pick lines in an operation versus a discrete order pick (picking of one order at a time). Since multiple orders are being picked into one container, in most cases this will result in the requirement for an order sortation station, an area designed to split the pick order into the individual customer orders (discrete orders). If the order batch contains all single unit orders or all orders of the same item, the batch will typically not require a separate sortation station, the items are allocated to a specific order at the time of packing or manifesting. Hardware costs based on number of users, not locations Hardware costs based on number of users, not locations Hardware costs based on number of users, not locations

Types of Order Batches

	Description	Commonly Used Operations	Benefits	“Draw Backs”
Batch By Order Commonality	Process of grouping orders together containing similar items	<ul style="list-style-type: none"> ▪ All types 	<ul style="list-style-type: none"> ▪ Reduces the picking labor requirement by reducing hits ▪ Reduces congestion on pick line conveyor 	<ul style="list-style-type: none"> ▪ Systemic support of advanced batching logic ▪ Requires a batch sortation area
Batch By Pick Zone	Process of splitting orders by pick zone, then grouping within that zone	<ul style="list-style-type: none"> ▪ Operations with multiple pick zones 	<ul style="list-style-type: none"> ▪ Reduces congestion on pick line conveyor ▪ No need to pass totes between zones ▪ Could be used in conjunction with commonality batching 	<ul style="list-style-type: none"> ▪ Systemic support of simple batching logic ▪ Requires a batch sortation & order merging area
Batch By Single Line Orders	Process of grouping single line orders of the same SKU together	<ul style="list-style-type: none"> ▪ Internet & catalog fulfillment operations 	<ul style="list-style-type: none"> ▪ Reduces congestion on pick line conveyor ▪ No need to pass totes between zones ▪ No need for a batch sortation area 	<ul style="list-style-type: none"> ▪ Systemic support of simple batching logic ▪ Systemic support of assigning orders at packing
Batch By Single Unit Orders	Process of grouping single unit orders together	<ul style="list-style-type: none"> ▪ Internet & catalog fulfillment operations 	<ul style="list-style-type: none"> ▪ Reduces congestion on pick line conveyor ▪ No need to pass totes between zones ▪ No need for a batch sortation area 	<ul style="list-style-type: none"> ▪ Systemic support of simple batching logic ▪ Systemic support of assigning orders at packing

Step 5: Batch Sortation Technologies

Much like the picking technologies, batch sortation can be performed utilizing paper, RF, voice, or a put-to-light system (which is a reverse of a pick-to-light system). Since a piece pick batch sortation is typically in a condensed area, usually consisting of sections of carton flow rack or shelving, the methods that are most commonly used and are the most effective are RF and put-to-light. Put-to-light is more expensive, but the productivity rates are considerably higher, 100-150 lines/hr for RF versus 200-over 250 lines/hr for put-to-light (broad industry estimates).

Step 6: Cluster Picking

Cluster picking is a methodology of picking into multiple order containers at one time. The containers could either be either totes containing order batches, discrete order shippers, or discrete order totes. There are two main piece picking systems that benefit from the use of cluster picking:

1. Pick to cart operations, in which, a cart would be loaded with multiple totes or shippers and the picker will make one pass through the pick zone and sort to the pick containers, thereby avoiding unproductive travel.

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2. Vertical lift modules (VLM) or carousel operations utilizing the independent zone picking technique, the picker would setup the pick container batch, this would initiate the mechanized pick modules, and the items would be sorted to the proper pick container. This technique is used to optimize the VLM & carousel pods by limiting the number of machine cycles.

Step 7: Cluster Picking Sortation Technologies

The same options and reasoning that applied to batch sortation applies here. The same task is being performed on a smaller level, typically sorting into two to four pick containers. The most common cluster picking system contains a put-to-light cart, whereas the picker utilizes RF or voice picking technology.

Step 8: Select a Picking Container

	Commonly Used Operations	Benefits	“Draw Backs”
Pick into a Tote	<ul style="list-style-type: none"> ▪ Batch picking ▪ 100% inspection required ▪ Special packaging requirements 	<ul style="list-style-type: none"> ▪ Allows for an additional check on orders ▪ Allows for the potential to batch orders 	<ul style="list-style-type: none"> ▪ Requires additional handling at packing
Pick Directly to a Shipper	<ul style="list-style-type: none"> ▪ Discrete order picking 	<ul style="list-style-type: none"> ▪ Reduces overall handling of the order by eliminating the packing requirement 	<ul style="list-style-type: none"> ▪ No secondary order check ▪ May result in additional cartons being shipped due to imperfect cartonizing

Pick to tote operations typically utilize order batching & sorting techniques that reduce the picking labor greater than the additional labor required for packaging and sorting.

Pick to shipper operations are executed in one of three ways

1. Picker erects the cartons at time of picking. Requires the replenishment of cartons to multiple areas.
2. Cartons are erected and transported to the pickers via separate conveyance system (i.e. monorail). Requires added capital equipment expenditure.
3. Cartons are erected and inducted directly into the system with the contents pre-allocated. Requires extensive systems support.

Step 9: Multiple Pick Zone Order Routing Methodology

Pick to tote operations with order batching lends itself to the independent zone pick method, a process in which segments of each order are picked independently in various zones and directed to a consolidation area where the elements of the order are combined to the shipper (batch sortation area).

Pick to shipper or discrete order pick to tote operations are typically most effective in either a pick and pass or zone routed system. This routing method will reduce the overall number of totes or cartons in the system. A zone routed system although more complex and costly, will significantly improve productivity and work flow especially in operations in which an order requires picks from multiple zones. Unlike a pick and pass system, zone routed totes or shippers are only touched by those people in zones where product needs to be picked. All touches are productive as a result.

	Commonly Used Operations	Benefits	“Draw Backs”
None	<ul style="list-style-type: none"> ▪ Independent zone picking, order is merged later. 	<ul style="list-style-type: none"> ▪ No order accumulation per zone required 	<ul style="list-style-type: none"> ▪ Order merge area is required.
Pick & Pass	<ul style="list-style-type: none"> ▪ Pick to conveyor operations 	<ul style="list-style-type: none"> ▪ Low capital investment 	<ul style="list-style-type: none"> ▪ Every picker needs to touch an order until complete
Zone Routing	<ul style="list-style-type: none"> ▪ Larger pick to conveyor operations 	<ul style="list-style-type: none"> ▪ High productivity 	<ul style="list-style-type: none"> ▪ Cost of controls and diverting equipment



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Step 10: Order Consolidation Methodology

There are several methods with which to consolidate an order before shipping. If your operation is shipping only parcel orders, this might not apply if each carton is shipped independently of each other and no physical consolidation is necessary. For operations that must keep order integrity at the shipping dock, the common techniques are as follows:

1. Consolidate the order before packing occurs when either pre-picking orders before all items are available or discrete order picking to a tote with a 100% order check or to reduce outbound cartons.
 - a. Manual sortation on conveyors – human sortation system, a person is assigned the task of sorting the totes to gravity conveyor lanes typically directed by RF scan
 - b. Automated sortation on conveyors – requiring controls and diverts
 - c. Tote mini-load system AS/RS (Automated Storage & Retrieval System) – stores all totes until order is complete then releases entire order to packing in a “slug” or “train”.
2. Sortation is commonly required after packing, typically for LTL or TL shipments.
 - a. Manual sortation on conveyors – human sortation system, a person is assigned the task of sorting the totes to gravity conveyor lanes typically directed by RF scan
 - b. Automated sortation on conveyors – requiring controls and diverts

Conclusion

Once the options available for your operation are narrowed down a cost versus benefit analysis must be performed for each remaining alternative. Some questions that need to be answered are:

1. What is the projected labor cost?
2. Does the alternative meet the projected throughput requirements?
3. What are the initial capital costs?
4. Are there any on-going costs & expenses?
5. How much space does this system consume?
6. Does it meet order accuracy goals requirements?
7. Does the alternative meet the required packaging standards and that of your customers?
8. Is the system flexible and scalable?
9. What are the risks associated with deploying such a system?

The chart on the page which follows, depicts 100 different combinations of infrastructure, systems, and methods for piece picking which may be considered.

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ABOUT THE AUTHOR:

Robert Muller is an Engineer - Consultant with OPSdesign Consulting™, an independent (Category A, Tier 1) supply chain consulting organization specializing in the design of warehousing, distribution, and fulfillment operations.

Muller has engineered and managed projects in a variety of industries and market channels including automotive, food, electronics, pharmaceuticals, media, construction materials, government, retail, consumer products, internet, & apparel.

Muller has a bachelor's of science in Industrial Engineering from Rutgers University. He is currently an active member in APICS The Association for Operations Management and the Warehouse Engineering Research Council (WERC).

Contact:
rmuller@OPSdesign.com
1-856-797-1933 Ext. 105
1-866-OPS-DESIGN