Six Steps to Optimized Order Fulfillment

Special Report

Increase Throughput & Reduce Costs Associated with Order Fulfillment

AMH
AUTOMATED MATERIAL HANDLING

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Introduction

Although politicians may not be able to agree about whether or not the economy is improving, most companies are seeing business begin to pick up, and their customers are demanding faster deliveries than ever before. Distributors and e-commerce companies in particular are seeking ways to improve processes and cut costs without necessarily adding more labor to their existing workforce.

Yet, with warehouses filled with pallets, cases and pieces, filling orders can often be "the most labor-intensive and costly activity for almost every warehouse, where the cost of order picking is estimated to be as much as 55% of the total warehouse operating expense."[1] That's because travel time—the time it takes a picker to walk from the point where they receive a pick order to the stored SKU, select the required items, and transport them to the point of shipping—can account for as much as 60-65%[2] of a facility's direct labor activities.

The recognition of this time- and cost-savings opportunity has pushed optimized order fulfillment to the forefront.

This white paper proposes six steps designed to help warehouse and distribution center managers establish the foundation of an optimized order fulfillment system that enhances both productivity and accuracy. The six steps include:

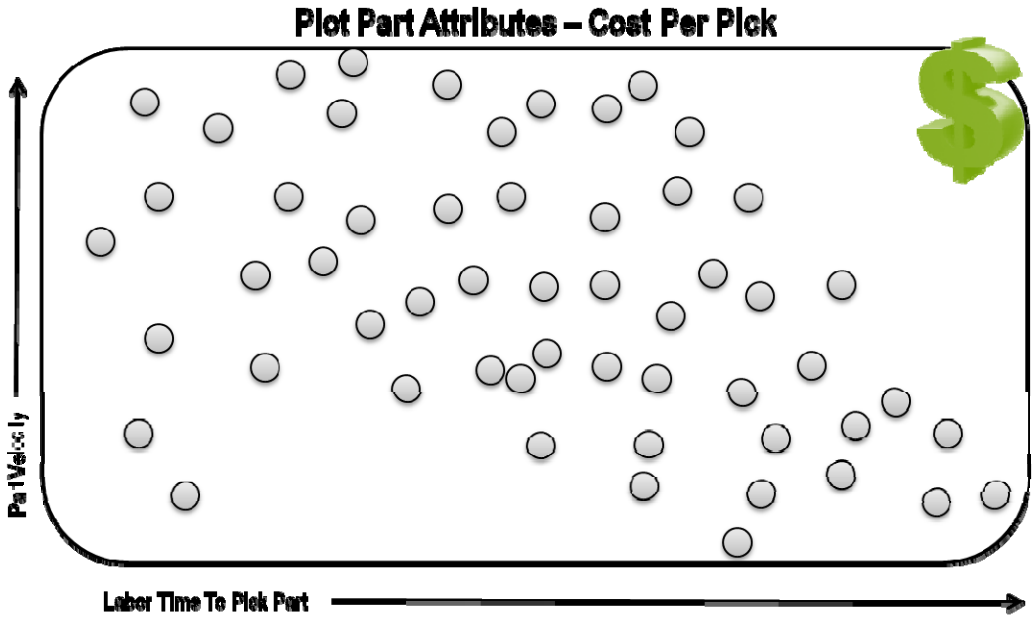
1. Classify inventory
2. Match inventory to storage technology
3. Automate to reduce cost
4. Slot inventory within the storage technology
5. Map processes and workflow to maximize throughput and reduce labor
6. Integrate business systems to maximize visibility

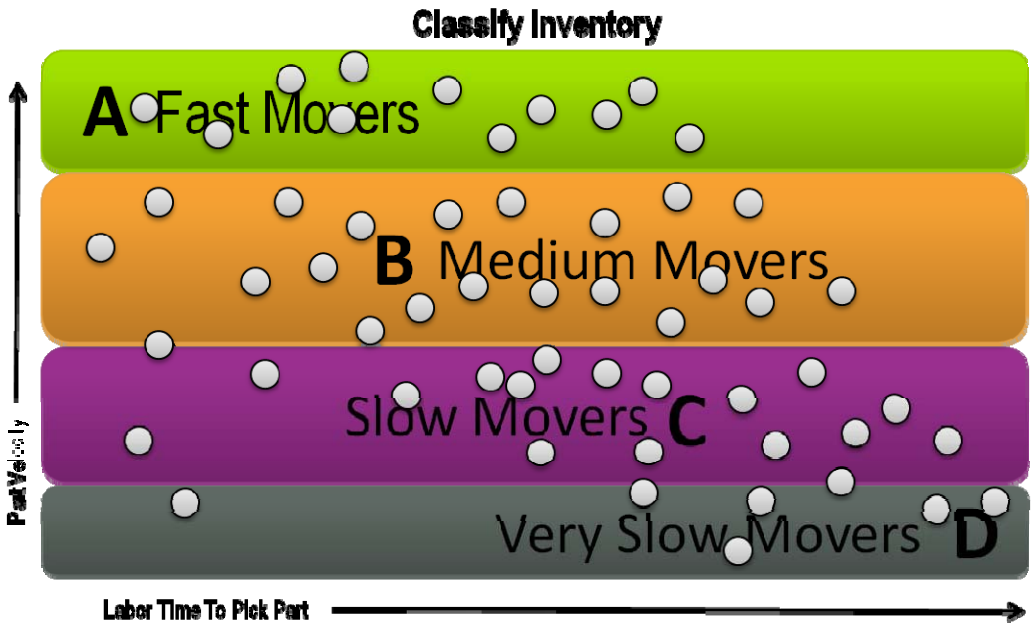
[1] Martin Murray, "Order Picking in the Warehouse," About.com Logistics and Supply Chain Guide, accessed October 28, 2012, http://logistics.about.com/od/operationalsupplychain/a/order_pick.htm.
[2] Lee Rector, "Warehouse Slotting," Toolbox.com SCM Blogs, accessed October 28, 2012, http://it.toolbox.com/blogs/warehouse-planning/warehouse-slotting-6655.

Step 1: Classify Inventory

Exactly how a facility's inventory should be categorized depends on many factors, including the types of products and picking sizes common to that business. At the highest level, classify inventory based on picking size (by pallet, case or piece) and by frequency of picking/velocity of movement (fast, medium, slow or very slow).

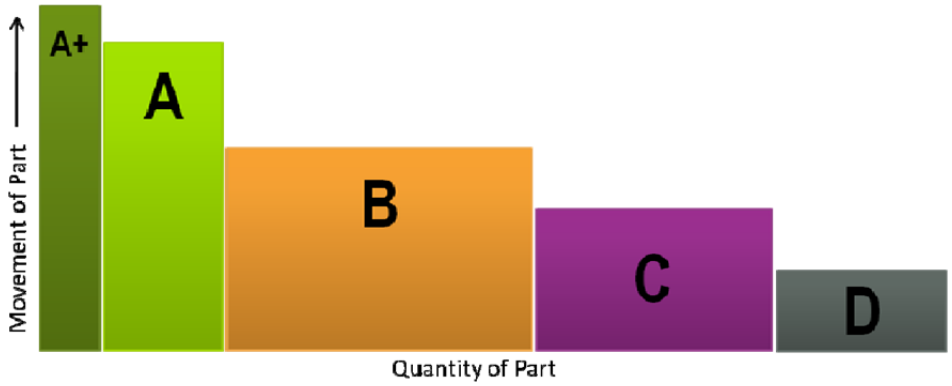
During the classification process, certain shared attributes will appear. For example, when comparing pick velocity, group fast, medium, slow and very slow movers together. By cross-referencing the time associated with picking each of these parts against their order frequency, a cost-to-pick graph can be created.





The most dramatic improvements in order fulfillment optimization will come from applying solutions to entire categories of products, as opposed to improving the movement of just a few SKUs. That's because of the Pareto Principle. Also known as the 80/20 rule, this principle observes that roughly 80 percent of effects come from 20 percent of causes—or, otherwise stated, "most things in life (effort, reward, output) are not distributed evenly; some contribute more than others."[3] For example, 80 percent of a company's sales often come from 20 percent of their customers, or, 80 percent of a warehouse's picks frequently come from 20 percent of its inventory (the fast movers).

Most companies focus their picking optimization efforts solely on their fast movers—which comprise just 20 percent of their inventory. Bear in mind, however, that tremendous gains in efficiency, throughput and cost savings remain to be exploited in medium and slow movers, which likely represent nearly 80 percent of a facility's floor space and picking labor demands.



[3] Kalid Azad, "Understanding the Pareto Principle (the 80/20 Rule)," accessed October 28, 2012, http://betterexplained.com/articles/understanding-the-pareto-principle-the-8020-rule.

Step 2: Match Inventory to Storage Technology

After concluding Step 1, it should now be clear that all SKUs are not created equal. They vary in size, weight, order popularity, and in a host of other ways. The material handling industry as a whole recognizes these differences and supports them with a variety of different equipment and technologies for effective parts storage. These include:

- **Pallet Rack** - Single or multi-level storage that supports high stacking of single items or palletized loads.[4]
- **Shelving** – Storage for non-palletized loads made up of upright posts, formed steel sheet panels as horizontal shelves, and end and back braces or sheet steel back and side panels for support.[5]
- **Drawer Systems** - Storage drawers held in cabinets or within shelving systems that are ideal for smaller items.[6]
- **Pick Modules** – Gravity-based flow storage of pallets[7] or cartons[8] that use elevated rails and wheels or rollers within a rack-supported structure. Loaded from behind, contents move toward the pick face by the force of gravity for first-in/first-out (FIFO) inventory management.
- **Horizontal Carousels** – Consist of bins mounted on an oval track that rotate horizontally to deliver storage locations to an operator. These automated storage and retrieval systems eliminate unproductive travel and search time by delivering the product to an operator.[9]
- **Vertical Carousels** – Comprised of a series of shelves that rotate around a track—similar to a Ferris wheel—these automated storage and retrieval systems deliver stored items safely and quickly to an ergonomically positioned work counter at the operator's command, eliminating walk and item search time.[10]
- **Vertical Lift Modules (VLMs)** – An enclosed automated storage and retrieval system that consists of two columns of trays with an inserter/extractor in the center. The inserter/extractor automatically locates and retrieves stored trays from both columns and presents them to the operator at a waist-high pick window, eliminating travel and SKU search time.[11]

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[4] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Pallet Rack," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_palletRack.aspx.
[5] Material Handling Industry, "Glossary>Shelving," accessed October 28, 2012, http://mhia.org/learning/glossary/s#shelving.
[6] Material Handling Industry, "Glossary>Drawer Storage," accessed October 28, 2012, http://mhia.org/learning/glossary/d#drawer-storage.
[7] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Pallet Flow Rack," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_palletFlowRack.aspx.
[8] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Carton Flow," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_cartonFlow.aspx.
[9] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Horizontal Carousels," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_horizontal_carousels.aspx.
[10] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Vertical Carousels," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_vertical_carousels.aspx.
[11] Material Handling Industry, Order Fulfillment Solutions Industry Group, "Vertical Lift Modules," accessed October 28, 2012, http://mhia.org/industrygroups/ofs/solutions_vertical_lift_modules.aspx.

Each type of storage methodology offers different benefits, including the amount of space/footprint it requires, how easily it can be expanded, and the levels of throughput, productivity, accuracy, inventory control and ergonomics it supports, as shown in Table 1.

TABLE 1: Storage System Comparison Ranked by Their Benefits
Rankings: 5=Best, 4= Great, 3=Better, 2= Good, 1=Fair

Benefits	Drawer Systems	Shelving	Pallet Rack	Pick Modules	Horizontal Carousel	Vertical Carousel	VLM
Space/Footprint	3	1	2	2	4	5	5
Throughput	1	1	3	2	5	3	4
Productivity	1	1	1	2	5	3	4
Accuracy	2	2	3	2	5	4	5
Inventory Control	3	1	3	3	3	4	4
Ergonomics	1	1	1	2	4	5	5
Expandability	5	5	5	4	4	3	4

By correlating the specific benefits of each type of storage available with the inventory classified in Step 1, it should be relatively easy to determine which types of methods are most appropriate to meet the picking needs of each category. Using pick velocity (fast, medium, slow and very slow) again as an example, the ideal storage method for each type of pick size (pallet, case or piece) typically breaks down as follows:

TABLE 2: Storage Method By Pick Size
Pallet Picking
• Pallet Rack (fast and medium movers)
• Pallet Flow Rack (fast and medium movers)
Case Picking
• Carton Flow Rack (fast movers)
• Horizontal Carousels (medium and slow movers)
• Pallet Rack (slow and very slow movers)
• Shelving (slow and very slow movers)
Broken Case/Eaches Picking
• Carton Flow Rack (fast movers)
• Horizontal Carousels (fast and medium movers)
• Vertical Carousels (medium movers)
• Vertical Lift Modules (slow movers)
• Shelving (very slow movers)
• Drawer Storage (very slow movers)

Step 3: Automate to Reduce Cost

Automated storage and retrieval technologies can support further optimization of order fulfillment as a "next-step" component of slotting. As mentioned in Step 1 above, most companies focus the majority of their attention and equipment investments on handling their fast movers. But that leaves 80 percent of their remaining inventory—including medium and slow movers—unoptimized, and a prime area for additional labor, time and cost savings.

Automation offers the following benefits:

- **Increased Productivity** – Boosts picking rates by as much as 600 percent while reducing labor costs
- **Space Savings** – Saves between 30 to 85 percent of floor space by utilizing the vertical cube of a facility
- **Improved Throughput** – Speeds order turnover and lengthen cut-off time
- **Better Accuracy** – Utilization of supporting technologies, such as pick-to-light systems, reduces errors with up to 99.9%+ picking accuracy
- **Enhanced Inventory Control** – Improves the quality of information about current inventory status, as well as locations
- **Improved Ergonomics** – Significantly reduces bending and reaching by presenting items to the operator at the correct ergonomic work height, called the "Golden Zone" (waist-high to eliminate bending down to retrieve an item stored low, or stretching up to grab an item stored high)

Step 4: Slot Inventory within the Storage Technology

The slotting process determines the most appropriate place to store each SKU in a warehouse, and further within a storage technology, to meet a variety of goals, typically seeking to achieve maximum efficiency and storage capacity. Common goals can include:

- Improve Space Utilization
- Minimize Handling Of Parts
- Increase Productivity
- Balance Workflow
- Improve Inventory & Accuracy
- Enhance Worker Ergonomics
- Minimize Travel Time To Product
- Reduce Search Time

Slotting, however, is widely recognized as a "thankless job."[12] That's because slotting requires inventory data. Lots of data—at least a full year's worth, including any seasonality and projected inventory growth. For companies with a warehouse management system (WMS), slotting software or functionality is often included or can be added-on as an additional module. For companies without a WMS, a standalone slotting software application can be purchased, or, in certain cases, a spreadsheet program like Excel may be all that's needed. Alternatively, a third-party consultant can be engaged to perform the data analysis and make slotting recommendations.[13]

[12] Bob Trebilcock, "Should you reslot your warehouse?" Modern Materials Handling, May 11, 2011, accessed October 28, 2012, http://www.mmh.com/article/resolve_to_reslot_your_warehouse.

[13] Ibid.

Collected inventory data should encompass:

- SKU picking methodology
- Number of pallets, cartons and broken case eaches of each SKU
- SKU hits (the number of times a product is picked)
- SKU numbers and descriptions
- Pick quantities (number of SKUs picked per order)
- SKUs that are frequently picked together
- SKU sizes and weights
- Total SKU quantity, reorder point and reorder quantity

Armed with inventory data that was previously classified by velocity, it's time to create a slotting plan. First, slot each SKU in the proper equipment (outlined in Step 2) based on pick velocity. This means fast and medium movers should be located in the most accessible areas, while slow and very slow movers should be stored in areas that are less accessible, or farther away.

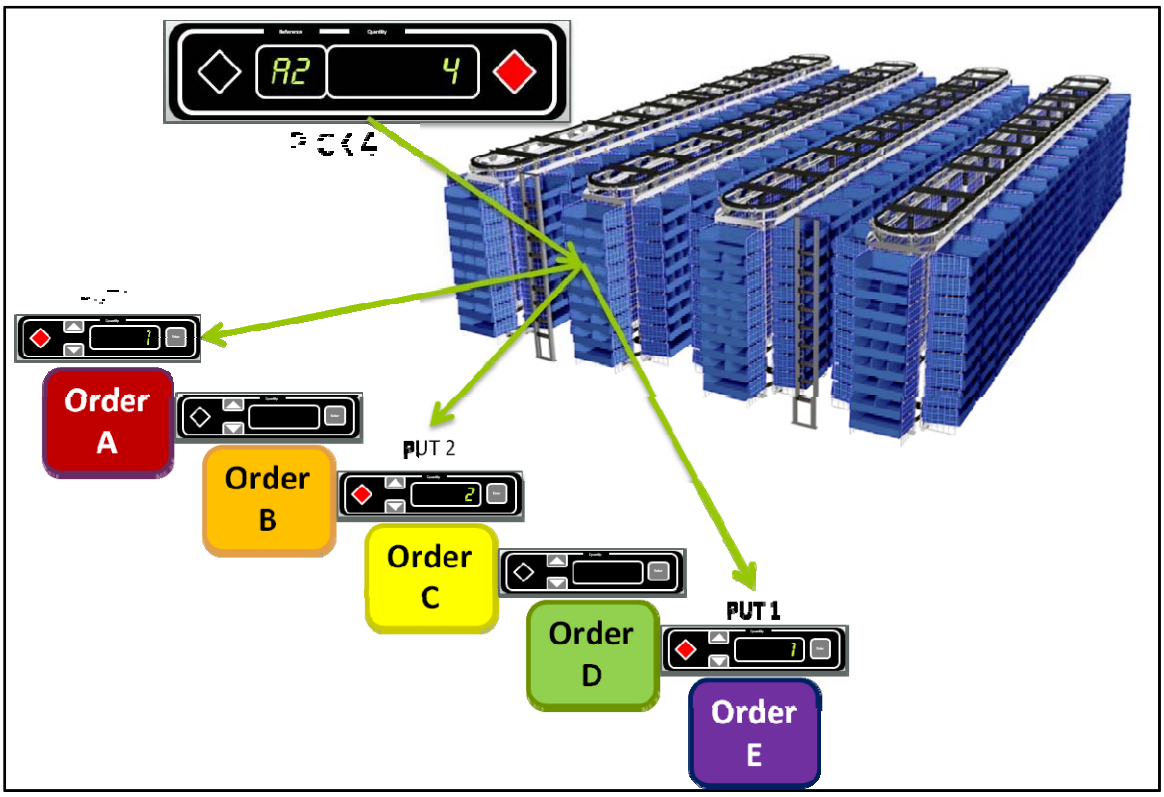
Then, determine where within each storage equipment or technology each SKU should be placed. Certain constraints may factor into the slotting plan. This is where the information about SKU size and weight particularly comes into play, for example, if the product's dimensions or volume make it impossible to store it in the ideal equipment. Also consider how the product is accessed—by hand, ladder, fork truck or scissor lift, for example)—and whether there are opportunities to group SKUs that are commonly picked together in close physical proximity, known as kitting.

For medium movers, a general rule of thumb is to maintain a 20 day supply. Less than a 20 day supply requires excessive time for replenishment. More than a 20 day indicates the space could be better utilized for other SKUs.

Step 5: Map Processes and Workflow to Maximize Throughput and Reduce Labor

Now that inventory has been slotted, it's important to look for potential alternative picking methodologies for further enhancing order fulfillment workflow. These could include:

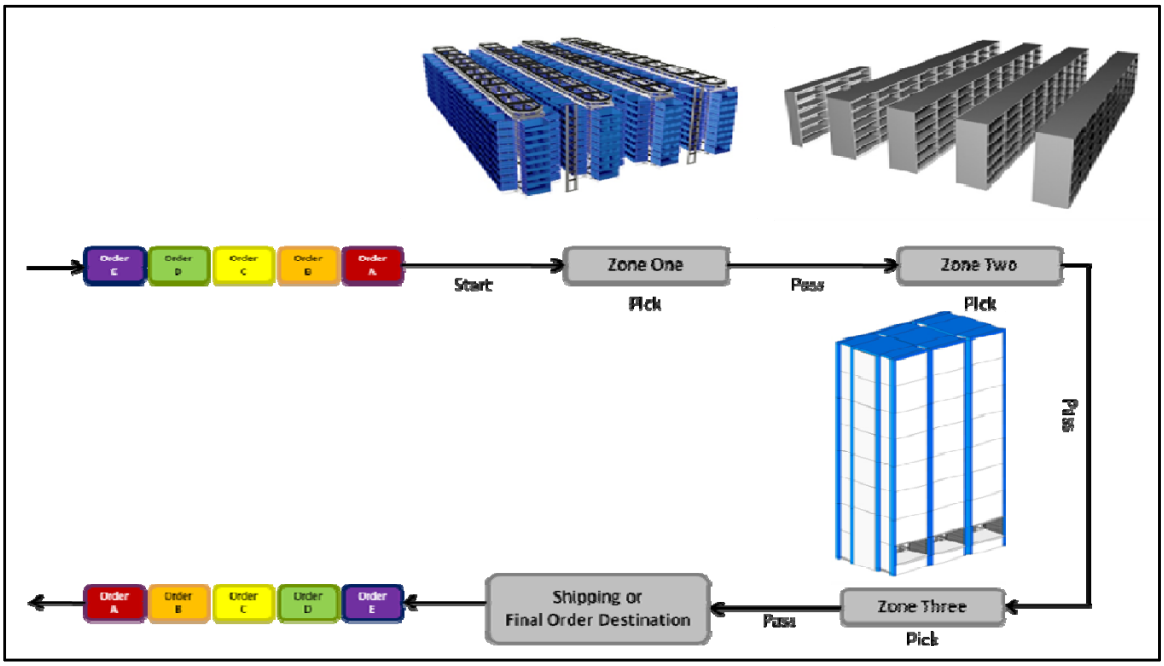
- Batch Picking – Grouping multiple orders into small batches, typically including 4 to 12 orders. Order pickers pick all orders in the batch at the same time, working from a consolidated pick list. "Batch picking systems may use extensive logic programmed to consolidate orders with the same items. In operations with low picks per order, batch picking can greatly reduce travel time by allowing the picker to make additional picks while in the same area."[14]



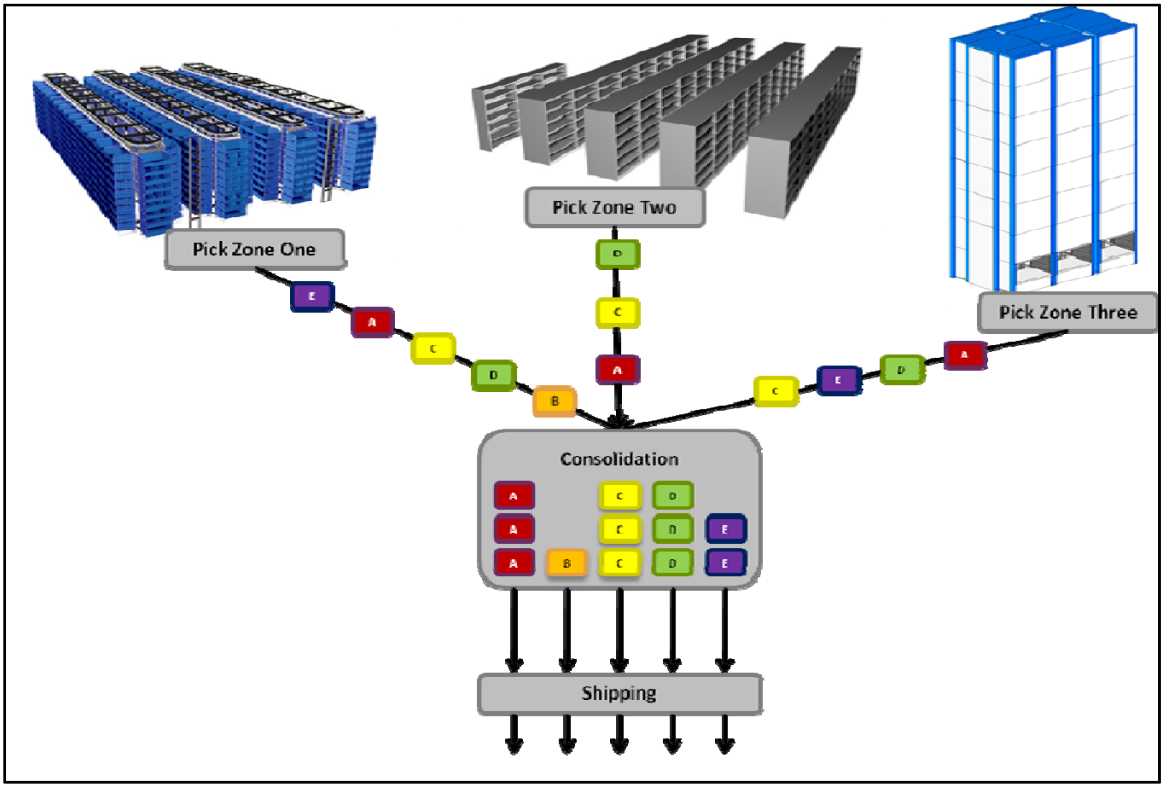
- **Zone Picking** – Breaking up the picking area into individual sections, or zones. Order pickers are assigned to a unique zone and only pick items located in that area. Orders move from one zone to another, which is why this method is also known as "pick and pass." This approach "is most effective in large operations with high total numbers of SKUs, high total numbers of orders, and low to moderate picks per order. Separate zones also provide for specialization of picking techniques such as having automated material handling systems in one zone and manual handling in the next."[15]

[14] Dave Piasecki, "Order Picking: Methods and Equipment for Piece Pick, Case Pick, and Pallet Pick Operations," accessed October 29, 2012, http://www.inventoryops.com/order_picking.htm.

[15] Ibid.



- **Wave Picking** – Also known as parallel picking, zone picking is a variation of the previous two methods where all zones are picked simultaneously and the items from each zone are later matched, or consolidated, to make complete orders. "Operations with high total number of SKUs and moderate to high picks per order may benefit from wave picking. Wave picking may be used to isolate orders by specific carriers, routes, or zones."[16]



[16] Ibid.

Slotting can also be used to eliminate bottlenecks in work zones and throughout a facility. Although it might appear on paper to be a good idea to consolidate all of the fast movers in a single aisle in one pick zone, in practice it might produce time-wasting congestion. Instead, it might be wiser to spread the fast movers throughout the facility, not only for improved throughput but also to maximize usage of low activity areas, or "dead zones."

Step 6: Integrate Business Systems to Maximize Visibility

To the extent possible, integrate any business systems already in place—such as enterprise resource planning (ERP), warehouse management systems (WMS), warehouse control systems (WCS) and workforce performance management (WPM) or labor management systems (LMS)—with the slotting software to better streamline picking processes and inventory management. This can result in extended order cut-off times and increase visibility to key business partners, including suppliers and shippers.

Additionally, integrating these systems yields tremendous time savings in managing the inventory data so necessary to optimizing order fulfillment (as outlined above in Step 4). By ensuring that these software systems are inter-connected for ongoing communication, repetitive—and potentially error-prone—data entry can be avoided, while enabling broader inventory visibility. Integrated business systems aggregate information to create a single report with the click of a mouse, avoiding manual retrieval and assembly of pertinent datasets.

Finally, this integration will enable the software to facilitate routine reslotting as needed to accommodate changes in inventory, special promotions or seasonal peaks.

> *Regardless of how often a facility reslots, slotting software is often integrated with a warehouse management system and a labor management system to get the most out of the tool. The labor management system can calculate the cost of the labor associated with the slotting plan based on the labor standards used for that facility. That process provides for an accurate cost/benefit analysis before deciding whether the gains from reslotting are worth the effort. If a warehouse accepts the slotting plan, the warehouse management system executes the plan by interweaving the reslotting tasks with other putaway, picking and replenishment tasks that have to be performed during a shift.*[17]

By implementing automated storage and retrieval systems—such as horizontal carousels, vertical carousels and VLMs—to handle fast, medium and slow movers as part of an overall order fulfillment optimization process, a warehouse or distribution center can achieve tremendous gains in throughput while simultaneously reducing costs associated with processing customer orders. To learn more about how automated storage and retrieval technologies can help your facility achieve optimized order fulfillment, contact your AMH representative today.

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[17] Bob Trebilcock, "Should you reslot your warehouse?" Modern Materials Handling, May 11, 2011, accessed October 28, 2012, http://www.mmh.com/article/resolve_to_reslot_your_warehouse.

SIDEBAR A

Optimized Order Fulfillment in Action: Aftermarket Parts Picking Gains Boost in Speed, Accuracy with Profiled Inventory, Zone Picking and Horizontal Carousels

Located in Kansas City, Kansas, American Crane & Tractor Company manufactures and distributes aftermarket parts for Caterpillar® equipment, often using overnight or two-day shipping service. Previously, the company used standard mezzanine shelving, pick carts and paper pick tickets to fill orders. Order pickers crisscrossed the warehouse, moving from location to location searching for parts to fill an order. When complete, they would bring the order to shipping and start on another one, often retracing steps repeatedly.

To keep up with growing demand, the company implemented zone picking, dividing the warehouse into nine zones and assigning pickers to each zone instead of to individual orders. However, American Crane wanted to find a more efficient storage solution for picking the most popular, faster moving SKUs.

The company installed six Kardex Remstar horizontal carousels configured as two zones (called pods) of three double stacked carousels to handle these items. Two pickers—one per pod—pick SKUs for as many as eight orders simultaneously, directed by pick-to-light bars on both the carousels and at a batch station where items are put to a separate tote for each order. While the operator picks from one carousel, the other carousels pre-position the item needed for the next pick, eliminating dwell time. The carousels store more than 47% of the facility's total SKUs (about 11,000 part numbers), with more than 60% of the parts picked for an order coming from these two zones.

In order to accommodate those volumes, inventory in the horizontal carousels has been slotted using a banding approach. Parts that are picked most frequently are stored in the golden zone area of the carousels; less frequently picked parts reside in the upper levels. When new SKUs are introduced to the warehouse, management reviews their profiles to determine if they are carousel eligible—that is, high volume, small- to medium-sized parts. To improve operational efficiency, the company tries to concentrate the highest number of picks in every zone on one shelf or group of shelves.

Pickers in the seven non-automated zones use RF guns that direct them to parts in their assigned area. Once all parts from a specific zone are picked, the order totes are sent to the consolidation area via conveyor where the completed order items are matched up and then sent to packing and shipping. The new zone picking system only requires 22 order pickers, 25% fewer than the previous system that required 29 order pickers. Even with only one picker per carousel zone, the non-automated zones have trouble keeping pace with their pick rates. Overall, the optimized inventory and picking process have decreased overall order pick time to an average of 20 minutes per order.

SIDEBAR B

Optimized Order Fulfillment in Action: Same-Day Shipping of CNC Parts from OEM Gains 95% Increase in Storage Capacity and 99.67% Jump in Accuracy with Inventory Profiling, VLMs, and Pick-and-Pass Techniques

Mazak Corp.'s 45,000 square foot parts center in Florence, Kentucky is home to an inventory of more than $65 million in parts. More than 46,000 different SKUs, including ball screws, linear guides, motors, spindles and more, are maintained to stock and handle parts distribution for every Mazak CNC sold in the Western Hemisphere. Previously, the stockroom consisted of pallet racks and small, manually operated vertical lift modules (VLMs). Orders printed out in the stockroom, and workers used forklifts, skyjacks, ladders and manual VLMs to pick parts for individual orders; they then carried completed orders to the packing area for shipping.

Because part orders typically arrive in the afternoon and required same-day shipping, nine workers struggled to fill just 95 percent of up to 1,200 orders in what amounted to a 6-hour window. Because it was not feasible to increase manpower, the company elected to automate the parts center and transition to a pick-and-pass batch picking process. Their complete system includes 13 Kardex Remstar Shuttle VLMs grouped in four zones (called pods). It also incorporates parts identification with bar coding, pick-to-light, inventory management software, and computerized order monitoring and tracking.

The new system assigns each order to a tote with a fixed license plate, and routes the tote via conveyor to one of four pick workstations. Upon arrival, the operator scans the tote and a corresponding light on a batch station capable of holding up to eight totes for simultaneous order picking. The VLMs move to deliver the product to the operator, lighting pick-to-light bars that direct the appropriate SKU and

quantity to be selected. Upon completion of an order, the lights direct the operator to return the tote to the conveyor, where it is routed either to packing or to another workstation for further fulfillment.

Because each VLM tray can hold up to 1,100 pounds, the company was able to profile its inventory and now places heavier parts that previously had to be stored on pallet rack in the VLMs. This transition enabled an increase in storage capacity by 95 percent. The old, manually operated VLMs handled 20,000 individual part numbers; the Shuttle VLMs now hold 39,000 parts, while just 7,000 oversized part numbers are stored on racking in the warehouse.

Additionally, because parts are now presented ergonomically to operators who work in stations and batch process orders, the new system requires only five workers (instead of the previous nine). Orders picked per person per hour have increased by 80 percent (13.9 picks per labor hour before, and 25 picks per labor hour now). Further, thanks to enhanced inventory monitoring and tracking—as well as the pick-to-light technology employed throughout the picking process—picking accuracy has increased from 98 to 99.67 percent. Finally, same-day shipping is no longer a challenge, with 97.5 percent of orders easily shipping same-day.

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About AMH, Inc.

AMH, Inc., a certified distributor of the KardexRemstar, is a leading provider of automated storage and retrieval systems for manufacturing, distribution, warehousing, offices and institutions. For information about the company's dynamic storage solutions, call 800-838-3473 or visit www.AutomatedMH.com.