Introduction

This paper will focus on order picking operations, in particular on order picking operations where items are selected in less than full case quantities. These "broken-case" or "each-picked" orders are among the most labor intensive of any type of common customer order. In this paper we focus on developing a methodology for evaluating changes to your existing operation. In my paper titled "Strategies for Optimizing Traditional Each Pick Operations –Part II – A Menu of Available Each Pick Equipment, Systems, and Materials" we will actually look at various equipment, systems, and materials that can be used in your operation.

There are a myriad of methods, potential equipment choices, and technologies that can be utilized to help in the selection of broken-case orders. This paper will develop a general methodology, which can be used to determine where particular methods, systems, and ideas that are great for one situation may be totally inappropriate for another.

We will try to look at a broad enough selection of ideas that the reader will be able to pick and choose those which may be of the most benefit to their operation. This paper focuses primarily on processes and procedures, also giving a plan for evaluating equipment and systems. Often the non-equipment process and procedure changes can create a substantial benefit even before the first significant capital dollars are spent.

Don't Already have an Existing Operation?

By the way, if you do not already have an existing operation, but instead are contemplating a new business initiative, many of the methods and procedures listed in this paper are still valid. The main difference is that with a "Green Field" business there is often only a limited amount of historical order data available.

While this definitely limits the amount of analysis that can be done, it is still possible to come up with reasonable business assumptions and then use those assumptions to compare various alternatives. The difference is that the solution needs to be designed with the knowledge and understanding that assumptions are not always perfect, and so the solution must be able to flexibly adapt to changes.

Opportunities Exist in Just about any Operation

In just about any order picking operation, opportunities for improvement exist. Sometimes these opportunities are like low-lying fruit, which is ready to be harvested. In other situations, the opportunities are not as clearly visible. If careful study has been done recently, it may be more difficult to find opportunities, but rest assured, there are still some to be found. Even the best and most thorough analyst will, after taking a break from his work, find additional opportunities that were not apparent in his first evaluation.

Change is the One Constant in Distribution Operations

One thing is certain – in any operation that has been around for a while, the fundamental characteristics of the operation will be experiencing a constant state of change. Systems and processes that may have worked well at one point in time may become cumbersome or inadequate as the operational parameters morph into a different set of operating assumptions.

If it's been more than two years since any focused analysis has been done, chances are that some significant changes have already taken place in your business. Changes may involve an increase or decrease in business orders, a change in order size, or a change in the types of items ordered. On the macro level there may be a need for a business consolidation or an expansion. When changes such as these occur, successful businesses will respond promptly to them, in order to adjust their operating procedures for optimal efficiency.

Why Consider Changes to the Way things are Today?

Labor Savings

In most operations, potential savings in labor costs are the number one reason to consider operational changes or enhancements. It is often possible to justify the expense of these changes solely based on the anticipated labor savings. We recommend this metric be used to compare systems, unless there are other factors that are overwhelmingly important – such as the desire to improve accuracy.

Improved Accuracy

Better organization, easier to read labels and lists, and a neater facility will all help reduce error rates. In addition, many computer-controlled systems simplify the picker's job, and in some cases they actually help verify that the proper work has been completed.

Improved accuracy reduces operational costs since customer returns are reduced, and orders do not have to be reprocessed. Also, in many businesses, customer goodwill is critical to the success of the business. Just one error can cost your company a customer.

Increased Sales

In some situations, it is possible to actually increase sales by having more capacity. Large Internet companies, like Amazon.com, provide a good example of this. These companies specify ordering deadlines for customers in the pre-Christmas rush. The more capacity that their facility has, the later the deadline can be pushed back.

Lower Cost Structure

Obviously, if you decrease your distribution costs, your company will be at a competitive advantage with those who have higher costs. Wal-Mart based their entire growth plan on this one fact, developing the lowest cost distribution network in the industry.

Postponing Expansion

Often smart use of storage methods and equipment can delay the need to open a new facility. Space can be compressed and the order-processing ceiling of the facility can be raised.

Use of a Less Educated Workforce

By simplifying procedures and using systems that direct and verify work, you may be able to hire less educated workers while still maintaining your order accuracy and facility performance levels.

Other Factors

Other factors include improved customer service, injury reduction, fewer damaged shipments, and reducing facility overhead costs. All of these items are generally less important than the ones given above, but collectively they can add to the case for updating your facility.

Opportunities vary from Simple and Low-Cost to Sophisticated and Expensive

When searching for opportunities, there are a range of possibilities from low or no-cost ideas to ideas requiring substantial capital expense.

On the low end are simple process and procedure changes that can result in substantial improvements in productivity. In the middle are low cost equipment changes, or perhaps changes to existing computer systems, that can result in improvements in efficiency.

At the high end are a variety of software systems and capital equipment, which may offer very significant benefits, but only with the expenditure of significant capital dollars.

"Tiers of Opportunity"

When considering changes to your operation, it is helpful to evaluate them by grouping them into "Tiers of Opportunity".

Tier 1 - The lowest tier involves changes only to procedures or methods. Examples of changes that would fit in Tier 1 are:

1. Changes to order selection methods that can be implemented with little or no cost
2. Changes that make the order picker's job easier (such as better labeling, location marking, or easier to read order lists)
3. Changes to product organization and slotting that improve the order picking efficiency. All of these items can be done at a relatively low cost.

Tier 2 – The intermediate tier focuses again on low cost procedures or methods, but we allow up to $2,500 to be spent per full time equivalent. In this tier, equipment such as carts and totes might be considered. Also, changes to existing computer systems might be contemplated to organize orders for a more efficient picking process.

Tier 3 – Just about everything else is in Tier 3. Here we consider major capital equipment expenditures, new software systems, and changes to building physical characteristics or layout. While Tier 3 items often provide the greatest opportunity for efficiency gains, they also have the highest cost and in some cases, the highest level of risk.

Computing the True Return on Investment

Most material handling salesmen focus their attention in Tier 3 solutions, because only Tier 3 solutions (large capital purchases) can provide the income to pay for their compensation. In many cases, Tier 3 solutions can bring substantial new benefits to your organization, but often the potential benefits from Tiers 1 and 2 are ignored.

It is not uncommon for a Tier 3 salesman to combine benefits from all three Tiers and offer them as a combined benefit of his system or equipment. It is often helpful to consider the Tier 1 and 2 solutions first, by separating them from the equipment or system offering. An example would be to reorganize small parts in storage totes. These totes might be proposed as part of a carousel system, but you don't have to buy a carousel to benefit from using them. After this separation has been done, compare the resulting optimized situation to one with Tier 3 solutions applied.

Very often, the differential between the application of the first two Tiers and the third is not nearly as large as the differential between the current situation and the result of purchasing the Tier 3 system or equipment. This is because the purchase includes implicitly the application of Tier 1 and 2 enhancements as well.

By objectively separating the easy wins from the expensive equipment, your company may be able to realize substantial benefits before the expenditure of large capital dollars. Any objective analysis of Tier 3 solutions should take into account all of the enhancements that are possible before the purchase system or equipment purchase. The roadmap outlined in this paper will point you toward those enhancements even before the equipment salesman arrives.

Optimization Strategies and Methods

In order to develop a roadmap of optimization strategies, we must first figure out how the map will be created. There are six very important steps in evaluating an existing operation.

Step 1: Observation Step

The first is to perform a careful and objective observation of the facility. Each process and procedure should be viewed and documented as it takes place.

An outside observer, rather than an internal employee, is likely to perform the observation task the best. An outsider is more likely to see all the details, and balance them more accurately than someone on the inside.

To make an analogy, a driver may barely be aware of his surroundings when driving home on a familiar route, and may not be able to give accurate turn-by-turn directions without thinking hard about his drive. Someone tasked with the job of providing directions, however, will be prepared with pencil and clipboard to detail every turn along the way.

An outside observer comes in with a different perspective, and will have a natural ability to see things that long-time employees do not. He will also detail processes which may seem unimportant, but which may have an effect on the overall efficiency of the organization.

A good approach is to observe the processes in the distribution facility in the same way that material flows through the facility. This can be done by having supervisory personnel briefly describe the overall flow first. Then the observer will observe and document the methods and procedures that support the daily material movement.

Step 2: Interview Step

The interview step includes speaking with those people that perform the work (done as part of the observation) as well as those managing the facility and the company. It is important to take into account changes that may be imposed by business initiatives or decisions taken on by company management. Senior management can also help to identify trends and concerns that may have an effect on the future operation.

Step 3: Data Analysis Step

A step, which can be particularly helpful in determining the choice of future methods, is the data analysis step. Data analysis normally reviews customer order information and inventory, and can analyze additional company data.

Customer order information consists of historical order data, which will describe the types of orders, quantities of orders, and composition of orders that are processed. Contained in the order data is information on order sizes, customer types, types of orders, and information about the most popular items.

Often customer order information can be used to determine the level of benefit realized by changing a process or adding a piece of equipment. In fact, historical data can be used to compare alternatives using the objective data. It is even possible to use this information to formally simulate a proposed solution using a real customer order stream.

Looking at product master file snapshots, seasonal peaks can be identified and documented, and optimal order quantities for each SKU can be determined. The "on-hand" quantities contained in the product master file can be combined with historical order information to provide rolling stock levels through a particular period of time. Alternately, several "snapshots" of the product master file can be taken.

The benefit of having a rolling history of stock levels is that storage may be sized for the worst-case situation. Comparing stock levels to actual order demand, it may be possible to adjust the stock levels of particular items so that they still meet the operational service goals but where overall stock levels are decreased.

Step 4: Current Situation Review Step

The review step is very important, no matter who does the observation and documentation of the operation. The reason is that any single observer is likely to miss things and not fully understand every aspect of the operation.

In the review step, key personnel from each functional area are brought together, normally in a group meeting, to review the information presented by the observer. The team will critique, correct, and add to the observer's information to develop a more complete and accurate picture of the operation.

In the review step, existing processes and procedures will be discussed, as well as areas where problems were observed. The team will respond with feedback with regard to the accuracy of the observations and the relative importance of the problems or challenges observed.

Step 5: Alternatives Evaluation Step

An individual or a team of material handling experts normally carries out the alternatives step. A variety of alternatives from each of the three Tiers described earlier will be considered. In particular, the identified challenges and problem areas will be focused upon to determine which alternatives might provide the most benefit.

If data analysis has been done, it will be possible to objectively compare the current situation to any proposed alternative situation by using actual data to determine the resultant labor utilization. In this way, the "best" labor solution can be identified.

In addition to pure labor savings, factors such as implementation risk and scalability must be considered. Some solutions work great for a steady state situation, but may not be able to handle high-end peaks as well as other alternatives.

The process of evaluating the various Tiered solutions as well as the various system and equipment solutions of Tier 3 can be a very substantial and involved undertaking. In this step, in particular, it is helpful to enlist the help of a material handling expert, already familiar with the various methods and equipment that may be utilized.

The output of this step is to create a set of alternative ideas, which might be combined together or used individually. The alternatives should be assembled and put into a report for feedback and review by the distribution team.

Step 6: Alternatives Review Step

In the alternative review, the same team that was used to review the current situation should be brought back together to review the proposed alternatives. In this meeting, many alternatives will be eliminated. Others will be enthusiastically supported. Still other new or morphed alternatives will be created as a result of the interactive discussion.

Once the alternatives have been worked through, the team should create a "short list" of the best and most promising of the alternatives discussed. This list can then be used for further follow up and evaluation.

For example, the team may wish to bring in prototype equipment or systems to try out. Various vendors may be contacted so that equipment can be compared and contrasted with other similar offerings. New methods and procedures can be experimented with and fine-tuned or eliminated.

Step 7 (not included): Implementation Step

This paper is focused on developing the road map for successful optimization, not on the final implementation of the solution. Obviously, the implementation is a very important portion of any project and should be undertaken with great care. A subsequent paper will discuss the various objectives and areas of concern for the implementation and startup phases of an optimization project.

Order Picking Opportunities

The remainder of this paper will discuss and evaluate various methods, equipment, and procedures which can be used to support and enhance an order picking, in particular in the broken-case picking environment. These solutions will be roughly divided into investment Tiers as described earlier in this paper:

Tier 1: Ideas requiring little or no investment

Tier 2: Ideas involving an investment of $2,500 per full time equivalent or less

Tier 3: All other ideas

As mentioned previously, Tiers 1 & 2 will often provide substantial benefit to an operation before any significant capital dollars are spent. When considering Tier 3 alternatives, be certain to make the comparison between a situation where all Tier 1 & 2 ideas have been fully implemented first, and then comparing the optimized situation to the Tier 3 alternative, rather than comparing the Tier 3 alternative directly to the current situation.

Physical Organization, Flow, and Product Slotting Opportunities (Tiers 1 & 2)

The location of a product and the way that items with different movement velocities are organized can have a direct impact on the overall efficiency of an operation. In an operation of any significant size, the attention should be paid to the flow of product through the facility, from the time it is received, until it is shipped out the door.

Locate Fast Movers Near the Dock

Your fastest movers should be located nearest to the pack and ship area. For example, if 20% of your business involves shipping a particular type of first aid kit, the kit should be located so that it will not interfere with other picking operations, but yet where it can be picked and added to any order easily. One way to do this is to locate these types of items at the end of a picking circuit. Another way is to actually have the fastest moving items adjacent to the pack stations themselves.

If you have an automatic take away device, like a conveyor, you can locate the items at the very start of your picking circuit, so that orders requesting only the fast movers can be pushed off, eliminating handling of the order by the folks downstream.

Use Storage Methods Appropriate for the Item's Velocity

When storing items, choose storage mediums that are appropriate for the velocity of the item being selected. For example, in the case of a first aid kit (object a little smaller than a toaster), you would not want this item in shelving if it were a fast mover. The item would probably be better suited to be on a pallet.

Similarly, if you have a slow moving item, you would not want to waste the storage position of a pallet or flow rack lane. Instead, profile faster moving items into these locations.

Minimize Restocking Time

In an each-pick environment restocking is usually a substantially smaller component than order picking. This is because, on average, several trips to the stock location are required to consume the contents of one restocking visit.

By selecting an appropriate sized storage location, the restocking time spent for that item will be minimized. If you are constantly restocking a location, chances are that you should consider upgrading that item to a larger basic storage slot. For example, if you are constantly replenishing a flow rack lane, consider leaving the item on a pallet and picking directly from the pallet instead.

Cubic Velocity - A formal analysis can be done by obtaining the cube of each product, and then multiplying the product's cube by the number of units moved in a time period. This metric is known as "cubic velocity". Products with the highest cubic velocity should be slotted in the largest storage mechanisms (such as full-pallets); the items with the lowest velocity should be stored in small storage systems (such as shelving).

Equalizing On-Hand Stock Values

Using the cubic analysis, it is possible to determine how many days of on-hand material are available in each slot location. If the number of on-hand days is excessive, consider re-slotting the item to a slower storage medium. If the number is too low, consider upgrading it.

Consider Material Flow in Slotting your Forward Stock and Reserve Storage

Flow is critical to maintaining an efficient operating environment. Be sure to consider where your fastest and slowest movers are located with respect to your pack and ship operation. Also consider how items will be replenished when the forward pick location is exhausted.

Generally speaking, slow moving items should be located farthest away from your pack and ship operation, since in general, less material will be flowing into and back out of this area. Faster moving items should be located closest to the pack and ship.

In some facilities, it is possible to develop a material flow from the receiving dock to the shipping dock. This is particularly true in facilities that have shipping and receiving docks on opposite ends or sides of the building.

Slot Reserve Stock for Easy Replenishment

One way to slot reserve stock is to try and locate it nearby the forward pick location. For example, placing overflow cases or pallets above the forward pick location permits rapid replenishment when necessary. In the event that you are replenishing full pallets, try to locate the pallets so that they are in the same aisle as the primary pick location.

Limit Overflow Locations for Slow Movers

Don't waste your time replenishing slow mover locations. Generally speaking, slow movers should not require reserve stock locations, except in unusual situations. Try to establish rules so that all of the stock for a slow moving item is stored in a single forward stock location.

In the event that this is not possible, (because the slow mover is particularly bulky item), keep full unit loads or cases of the item nearby for replenishment when necessary. Often reserve stock can be placed directly overhead the slow mover location for the exception items.

If you find that a number of your slow mover locations require overflow reserve stock, consider changing the size of the storage location, or re-categorizing those items so that they are no longer in the slow mover area.

Organize Products Commonly Picked Together

If you find that certain items are commonly ordered together, then consider slotting them near one another. Alternately, you may even consider kitting these items together so that they are selected as a single combined item. Electronic Data analysis can help you to identify products or family groups that are commonly selected together.

Be Aware of Picking Ergonomics

When slotting items, pay attention to both the product's unit movement velocity and the physical characteristics of the product.

In general, items that move quickly with respect to other items should be in the easiest to reach locations – known as the "Golden Zone". For example, if shelving or flow-rack were used as a storage medium, the areas between the picker's shoulders and waist would be the locations easiest to select from. Slower movers could be located up high or down at the picker's feet. Very slow movers could be located where a ladder or set of stairs was required.

Pay attention also to the product's weight. For example heavy products may be promoted to the "Golden Zone" even if they are not otherwise suited for the faster moving slots. This is because the benefit of not having to bend and reach for the product may outweigh the efficiency advantage of having another product stored there.

Front End Load Products in Shelving

Slot faster moving products nearest the main travel aisle in a shelf pick environment. This way, the picker does not have to travel as far, on average, to get to the next selection. You should also consider placing "end cap" units on the end of back-to-back shelving rows so that the very fastest items are slotted in the end cap unit. This permits picking of the fastest items without even having to turn into the selection aisle.

A word of warning:

Be careful when trying to front end load storage, especially using a conveyor picking methodology. If you force too many picks into a particular area, you may actually cause congestion in an area, particularly at peak demand periods. Always consider worst-case demand periods when re-slotting products for efficiency. This can also apply to cart or "foot" pick environments if a disproportionate number of fast moving products are located in one area of the floor.

Consider "Reaches" per Square Foot of Pick Face

When slotting product, consider how many reaches a picker will make per square foot of pick face rather than just the unit movement.

For example, when using flow rack, the picker's selection area is the front face of each flow rack bay. Suppose you have a set of items that all have the same daily unit pick velocity, but with different physical dimensions.

If you were able to take the items with the smaller front face dimensions and slot them into one bay, and take the items with the largest front face dimensions and slot them into a different bay, which bay would move the most units in a day? The answer is that the smaller items would permit more units to be picked out of the same physical area.

To apply this principal in slotting, it is necessary to take the daily unit movement velocity and divide it by the size (in square inches) of the front face of the product's container. While it may not be immediately obvious, taking this extra analysis step will improve the overall efficiency of a pick line, particularly one where products are slotted in flow rack.

Note that since this method will in general require more levels and lanes, the cost of the flow rack bay will increase. The same strategy can be used to front end load shelving bays.

Physical Organization, Flow, and Product Slotting Opportunities (Tiers 1 & 2)

Use a "Pick Fence" when Dealing with Widely Varying Order Quantities:

If you have a situation where some customers order only one or two units, while others order large quantities, consider creating a "pick fence" where there is both a "broken-case" and a separate "full-case" selection area for the same item. In this scenario, less than full case quantities are selected from one area, while the full case portion of a customer demand are selected from another.

Using a pick fence has a couple of advantages. First, it reduces replenishment requirements for your broken case area. Second, it permits full cases to be shipped as full cases (normally cases are cut open in advance in the broken case area).

The disadvantage of a pick fence is that you will have to consolidate the full and broken case components of the order somehow, either by having one picker visit both locations or by having the order consolidated at the dock.

One final pick fence strategy is to have both the full and broken case items for the same SKU physically slotted next to one another. If you do this, make sure that your picking paperwork or system clearly distinguishes cases from eaches.

Consider Dynamic Slotting

"Dynamic slotting" refers to the process of determining which items are the fastest moving items of the day, and placing them into a location where they may be selected with the least amount of labor. Dynamic slots are normally located as permanent physical positions that can then contain a variety of different products, depending upon which items are fast movers of the day. In order to implement this type of methodology, your computer system must be capable of recording the dynamic location reassignments, and stock must be moved to the dynamic pick location.

Dynamic slotting is a natural if you are picking fast moving items from pallet, since pallet movements are relatively easy. It is less well suited to static storage methods such as flow rack and shelving, although it can work for these areas as well.

If used in a shelving or flow rack area, it is often reasonable to replenish the anticipated requirements for the day or week, and then permit the location to be "picked clean". This way, stock only needs to move from reserve to the forward dynamic slot once, and then the dynamic slot becomes available for the next dynamic item of the day as soon as the slot is emptied.

Use Mirrored Slots for Very Fast Movers

If an item moves at an extremely fast velocity, it may be helpful to "mirror" the item in two or more alternate locations. There are three major advantages of mirroring stock. First, work is spread out into 2 or more different picking processes, reducing the bottlenecking an on the fast moving item(s). Second, if stock runs out at one mirror location, orders can be directed to the other mirror until replenishment is complete. Third, it may be physically impossible to meet the demands of the faster moving products with a single picking slot due to congestion and traffic occurring around the faster moving items. This can be particularly true if a number of non-mirrored fast moving items are next to one another.

Software must be able to support the creation of more than one primary location, and be able to assign orders in a balanced manner to each of the mirrored lines. Note that mirroring can be done dynamically as well, using the dynamic slotting method described in the previous section.

Balancing Picking Areas

As was mentioned earlier, it is not a good idea to put too many fast moving items in the same place. What can happen is that all of your people end up bumping into each other, or waiting on each other, trying to get at the fast moving items. While fast movers can be grouped together in one area, the fastest of the fast should be spread out enough so that the picking operation can operate without inefficiency during peak order demand periods.

If you see pickers waiting upon one another at particular areas of your operation, try to determine why the wait is happening. It may be that moving some fast movers to locations spread a little farther apart will solve the problem.

Changes to Order Processing (Tiers 1, 2 & 3)

Changes to order processing can be accomplished with either manual methods or with the help of a computer system. Many of the methods described are much easier to implement with the help of computer system changes, but most can be implemented on a limited scale using only the resources of the picker.

Batch Picking of Orders

In slow moving areas, the most significant time component in the picker's filling of the order is the time it takes him to walk to each location. A method that can be used to reduce the overall walking time is that of "batching" multiple orders together.

In this method, two or more orders are selected together with one trip through a storage area. Often either special paper lists are created or software is used to direct the picking in location sequence and the putting of each pick to one of the several different orders.

However, batching can also be done in a completely manual fashion, where the picker has multiple individual order pick lists, and he manually sorts the picks from the various lists as he travels through the storage area. While this admittedly is not something you would want just any order selector to do, there are individuals who can effectively batch up to 8 or 10 small orders at once through a large storage area. Obviously, the time taken to mentally sort the picks in a manual system will take away from the travel time savings.

Batching of One-Line Orders

A special form of order batching is the batching of one-line orders. In this situation, all customer orders requiring exactly one item (any unit quantity) are picked together into a picking tote or cart. Here again, the picker makes one trip and picks multiple orders. The advantage with single line orders is that it takes only one of the items to complete the customer order, and so the assignment of item to order can be done in a free-form fashion after a batch of items is selected.

In a completely manual system, once the items are selected, they are brought back to an area where items are matched to pick lists, and then packed out. Note that this method can be used for orders with more than one line as well, except that it becomes more difficult with larger orders since now a temporary staging location must be created for partial orders as the individual components are consolidated together.

Software systems can make the process exceptionally easy, especially if all items have a bar code label. In this situation, items are simply scanned and packed under control of the software.

Zoning Orders to Fill as Quickly as Possible

In low line environments, it is sometimes useful to define zones that the orders will visit. In many cases, the order will only need to visit a single zone, and then be complete. If an order needs to visit two or more zones, there must be a way to get the order from one zone to the next (usually cart or conveyor). By breaking orders up into zones, each zone will have to process only a portion of all of the orders, and this leads to a higher overall efficiency since it can cut down on overall travel time and reduce order handling.

It is important to choose zones wisely, usually based on historical order data, so that you don't end up with the situation where almost every order visits every zone.

Using zoning, orders can be started in the furthest downstream zone possible, avoiding being handled by anyone in upstream zones. When the order is complete, it can be sent directly to pack, rather than having to be handled by other downstream zones.

Sequential vs. Parallel Picking

In most of the scenarios described up to this point, we have described a sequential pick scenario. Another method of picking can be implemented, where components of the order are picked at multiple areas at the same time. This is known as parallel picking.

Sequential Picking - In sequential picking, the customer order is built as it is selected, usually into a cart location, tote, or shipping container. All components of the order are consolidated as the picking process continues, and the order is complete when all picks are done. Sequential picking is easy to coordinate and always results in a complete order (assuming all items are available).

Parallel Picking - An alternate method of picking is parallel picking. In parallel picking, the order is broken up into component orders usually by a physical area or zone of the facility. Orders are released and picking takes place in each zone independently, and the same order may be picked in parallel at several different areas at the same time.

The advantage of parallel picking is similar to the idea of having several people help moving a pile of dirt. With more shovels, the pile is moved more rapidly. The downside to parallel picking is that, unlike in the dirt pile analogy, the items being picked are being picked separately into separate transport devices.

When the order is complete, it could be shipped as a bunch of separate orders, but this is generally not done due to package shipping costs and due to the desire to give the customer as few shipping containers as possible. So, at the end of the parallel pick, the order components are sent to a consolidation area where the component pieces of the order are brought together and combined for shipment.

This consolidation step is an additional labor step, but with larger orders, it can generally be done faster than having the entire order be sequentially picked. Note that if the travel between zones is minimal or handled by an automated method (such as conveyor) sequential picking almost always takes less labor than parallel picking. The main advantage of parallel picking is that it can complete an order faster.

Optimize Picker Travel

A computer program can be used to help optimize an individual picker's travel. Consider sequencing a "zigzag" pick path through a shelf or rack area rather than having picks presented one side at a time. In environments where picks might come from high or low storage area, it may be helpful to sort them into batches of "high" picks, then "low" picks, if a lift table, truck, or ladder is being used for the high picks.

Look at Ways to Even out Activity

In environments where bottlenecks occur at particular points in the day, think of ways to try to even out the load more. For example, in situations where packers are being swamped later in the day with a large volume of orders, try to determine if it would be possible to sequence a set of small orders early by directing these orders to be picked first.

This may help even out conveyor or cart traffic throughout the day and reduce the demand on the packing area late in the day. Another advantage of sequencing orders, with the small first, is that the packers can focus on like sized orders with similar box size and dunnage requirements at one time.

Consider a "Put" System

A "Put" System, as opposed to a traditional "Pick" system, puts requirements from a particular SKU to multiple orders, rather than bringing multiple orders past that SKU. Put systems are effective with relatively fast moving products that tend to be distributed to a large percentage of orders. It is possible to combine a put system for fast movers with a pick system for the remainder of the items.

Environments where put systems have been successfully used are:

1) Cross docking of materials which are common to many orders
2) Distribution of "Push" merchandise for retailers that want to get a specified quantity of a particular item to every store.
3) Distribution of very fast moving items that are common to a large percentage of orders (usually 15% of the orders or more)

In a put system, single SKUs are brought by one at a time, and then distributed to the orders demanding the SKU. The orders must be somehow staged. Common methods of staging are conveyor, shelving, flow rack, or carousels. Items are normally placed directly into a shipping container. When the container is full, it is sent to shipping and a new container is put in its place if necessary.

Put systems can be implemented even in manual paper environments. In certain specific situations, it is even possible to pick and distribute slow moving items using put systems.

Physical Improvements and Work Simplifications (Tiers 1 & 2)

Organize so a Five Year Old Can Find his Way Around the Facility

Organize your storage areas so that "a five year old can find his way around the facility". Major areas, aisle designators, bay locations, shelf levels, and product locations should all be easy to see and read. Numbering schemes should be logical and easy to understand. I recently saw a facility where rack aisles were names of streets (like "Maple Avenue") and rack areas were names of "neighborhoods".

Make sure that Lighting is Adequate

Lighting is important to worker efficiency. In poor lighting, pickers will take longer to process picks and identify locations. They will also become more fatigued, limiting their efficiency.

Consider painting walls and/or floors with white or bright colors to improve the overall light levels in the facility. Be sure to use lighting that makes reading of pick documents and rack locations easy.

Adequate lighting will help create a brighter work environment, encourage a clean work environment, and improve picker performance.

Keep the Facility Clean and Neatly Organized

A clean facility makes work easier and sets a "psychological tone" for the facility. A clean facility encourages orderliness and good organization. With product locations well maintained, especially on shelving, it is easier to find products and it is less likely that errors will be made in selecting them.

Summarize Order Requirements by Zone

In a zoned picking environment, where orders are passed from zone to zone, it is helpful to give the order selector a visual indication if he has a pick. This can be done by printing pick zones on order paperwork or on the order label that travels around with the order.

The summarized list is much easier for a picker to process than a long pick list, and he can very quickly either pick his requirements or pass the order to the next zone. Even in situations where only one picker works on the order, the summarized zone information can help the picker determine if a particular order has requirements in a certain area before he travels on to the next area.

Scrutinize "Touches" to Products

Look at how many "touches" occur to a product from the time of receipt to the time it is shipped. What are the intermediate steps (receiving, inspection, put away, replenishment, cycle counting, picking, consolidation, packing, shipping)? Are there any areas where work steps could be simplified, combined, or eliminated?

Minimize Lifting and Movement

Look at existing work areas. When must products be lifted from one location to another? Would it be possible to design a system that would permit the item to be transferred without lifting? Look for methods that encourage straight-line continuous flow.

Does it make sense to pick products into a tote (and repack to a box) or would it make more sense to pick directly into a shipping container? In some situations a tote is desirable when a large variety of shipping containers are used.

Ask if software can be used to pre-cube orders so that they can be picked directly to a properly sized shipping container? Are there any disadvantages to this from a packing and product damage point of view?

Motivating Labor (Tier 1)

Your people are the single most important factor in the overall success of your operation. Efficiency and accuracy are both impacted by the general attitude of your work force. Always be looking for ways to create a positive work environment for your people.

Empower your People

Let your people know you care about them and you want to hear from them when they have ideas on how to do their job better. No one knows better what the problems are with a job than the person who does it every day. Encourage employees to discuss concerns and problems with their supervisors, and make certain to encourage supervisors to really listen and provide constructive feedback. Create a reward program for ideas that save the company money.

Encourage Teamwork and Team Goals

Encourage your people to work together as a team by setting team goals rather than individual performance objectives. Tie bonuses or perks to overall performance levels of the team. You will find that the hard working team members will encourage those who are not pulling their weight try harder, or find something else to do.

Give 'Em a T-Shirt or Team Jacket

Encourage individual departments by giving them something that identifies their department and its importance to the facility. Activities like a department dinner or picnic can be used as a means for thanking your employees for a job well done, and providing them a thank you gift.

Allow your Best People to Grow

Set up a system where your best people have an opportunity to move into progressively more responsible positions. Don't get stuck in the idea that because they are good at one job, they should do that job forever. You best people will provide a greater benefit to the organization if they are free to move into different areas when opportunities arise. The exposure to different areas of the facility will give them a broader perspective of the entire operation, and eventually, make them candidates for senior management responsibility.

Computer System Enhancements (Tier 3)

Computer systems have probably had the greatest impact on the distribution center of any technological change. Computers, by virtue of their ability to store, sort, and organize information, can provide a wealth of benefits to the distribution center.

These benefits may be provided in the form of a sophisticated Warehouse Management System (WMS), vendor order picking systems, or even in the form of company created distribution software.

Note that some of the items mentioned in this section may be Tier 1 or 2 items, but the majority of items will require either a capital outlay or substantial in-house programming expense.

Improve Efficiency

Probably at the top of the list, perhaps with the exception of accuracy in some facilities, is that of labor efficiency. A computer assisted system can help to improve operations by providing easier to understand and quicker direction to distribution personnel.

Computers can sort orders any number of ways, can improve receiving and put-away, and track individual productivity. All of these things combine to provide a higher level of efficiency for the operation.

Improve Accuracy

Computer systems can help improve accuracy by providing clear instructions, giving one instruction to an operator at a time, and through technologies such as voice and bar code verification.

Automate Exceptions

Computer systems help to automate exception processing. Situations such as shortages or product overflows to a new location can be entered at the time the work is requested, rather than written on a paper document for keying at a later time.

By reporting exceptions in real time, other workers in the facility may have access to the updated information, preventing them from performing tasks that cannot be completed. By entering information about exceptions directly, clerical labor to do this task is eliminated, and the opportunity to lose that information between discovery and entry time is eliminated.

Simplify Training

Computer driven systems can simplify training by providing simple and easy to understand interfaces. For example technologies such as RF bar code terminals, voice terminals, and pick-to-light systems reduce picker training time and help teach a picker when an error is made (instead of after the fact at the QA station).

Permit a Multi-Lingual Labor Force

Computers driven systems can easily be designed for use by multi-lingual labor forces. Instructions can be coded in the operator's native language. Voice systems are now available that work in the operator's native language. Since training is simpler in general, this means that speakers of other languages will have fewer questions for their supervisor.

Organization of Work Requirements

Computers are masters at organizing batches of work according to instructions. A computer can organize a set of picks much more rapidly than a person, and can direct picking of multiple orders at one time. The same can be said for receiving and put-away operators. Order batching, zoning of picks, consolidating of picks, and deconsolidating of batched waves of picks can all be accomplished under the control of a computer system.

By organizing work, operator travel can be reduced, and in some cases, multiple steps can be reduced to a single step.

Ready Access to Information

Computers and hand held RF (Radio Frequency) devices permit information to be obtained anywhere on the warehouse floor. They also permit information or exceptions to be entered from anywhere, at any time.

Better Control over Picking and Replenishment

A computer-based system can generate replenishment requirements in advance based on analysis of the next day's orders. This can reduce or eliminate stock outs and multiple replenishment trips for fast moving items. Using dynamic slotting, faster moving items can be put into special areas or mirrored to permit faster picking of the item without running out of stock.

Assistance with Labeling

Computer systems make it easy to label totes, orders, and products as needed. Labels can be printed in advance, on the fly as items are being received, put-away, picked, or shipped.

Permit Tracking of Employee Productivity

Many computer systems can help managers track their employee's productivity. Systems such as voice directed picking, pick-to-light, and RF terminal based systems all permit tracking of individual activity. Many other computer systems can also track work accomplished and provide various reports to managers.

Help with Order and Inventory QA

Computers can help cycle count inventory locations with an automatic regimen. They can also help QA inspectors randomly inspect orders using information the system collects about order containers as the orders are being selected.

Assistance with Shipping Methods

Modern manifest systems can determine the most economical transportation based on a product's size, weight, and destination. This determination can be made on the fly after the order container has been finalized for shipping.

Recommend Changes based on Historical Information

Many WMS systems and some order picking systems will provide recommendations for product re-slotting based on daily demand, or based on changes in historical product movement. Computers can also help with determining product min-max's and product reorder quantities.

Points to Think About when Evaluating Alternatives

Historical Data can Yield A Wealth of Information

If it is available, use historical order data to evaluate the solutions being proposed. There is nothing more valuable than performing a "show me" analysis with real orders and real products to confirm that a proposed system will give the benefits that are advertised. If you don't have someone who can do data analysis in house, see if the vendor will do this for you, or consider hiring an outside consultant.

Implement Manual Changes First

If your situation permits, we recommend taking on the easy manual changes first, before contemplating involved capital equipment purchases. By following this course, you will be able to achieve immediate benefits without facing substantial risk and expense. Just make sure that your manual optimizations fit with the path of your anticipated capital enhancements.

It is always easier to automate a well-tuned facility than one with lots of operational problems. This also simplifies the transition process when you do decide to turn on the automation, since part of the transition has already been put in place ahead of time.

ROI of Capital Systems will Change

Once the manual optimizations have been accomplished, you are in a better situation to evaluate the true ROI of the automated systems. Understand that the projected ROI will be longer if you first optimize your manual systems.

In some cases, you may decide that the capital equipment is no longer justified to obtain the new ROI benefit. In this case, you can make a conscious decision to postpone the capital expense due to the savings you've already realized with low cost modifications.

Consider Hybrid Solutions – One Size Does not Fit All

Whenever developing solutions for material handling problems, keep in mind that each system or piece of equipment has a range of usefulness where the equipment is most valuable. Don't try to fit all of your products into the same system.

For example, it wouldn't make sense to use pick-to-light for all 25,000 SKUs in a facility, since there are many systems that are just as fast, but much less expensive for slow moving products. Pick-to-light might be the best technology, however, for your fastest moving items.

The most efficient facilities combine technologies together and focus each technology on those areas where it is most effective. Of course, you also need to make sure you don't bring in so many systems as to make controlling them all together too difficult.

Maintain Flexibility

Flexibility is a very important concept in choosing material handling solutions. Unless you have a very unusual business, chances are that it can change significantly in volume in a relatively short period of time. Some equipment and systems are better at handling changes in volume or order mix than others.

Always ask the question what will happen if my order volumes or my order composition changes significantly. For example, what if my order line count average drops from 10 lines to 5 lines. How will the system perform?

If my order level increases, how will the system handle it? Can I add labor or will I need to extend shifts using the planned equipment?

If I reach the limit of the existing system, what are my options? Can the system be expanded or will I have to find a new mousetrap at that point?

Consider Peak Periods

One rule, which is very important in material handling, is ***never***, ***never***, ***never*** plan systems and equipment based on averages. You must always consider the peak periods (of the day, week, month, and year). Be sure to evaluate the proposed system's performance at your busiest time. Consider seasonal spikes and anomalies based on historical experience.

In peak periods, some systems permit you to add labor, while others require you to run longer shifts. Generally speaking, automated systems (such as conveyor based pick systems, carousels, and other automated equipment) are more likely to be sensitive to peak periods. Manual systems, such as cart picking systems can generally be augmented with more labor (assuming that the computer system can handle it and that any necessary extra terminals are available).

Always consider peak periods before deciding to purchase any type of equipment. Whether you choose to add labor, or extend shifts, just make sure that you have answered the question.

Permit room for Growth

Never box yourself in. Whenever possible, leave room to expand systems if, heaven forbid, your business grows faster than you anticipated.

This is particularly true when purchasing automated equipment. It is much easier to plan for expansion, and develop an expansion plan before the equipment is installed. Often the plan can use an area for a floor operation (where all equipment is easily movable), and then relocate the floor operation to a mezzanine or other area when expansion is required. The automated equipment can then be expanded into the open space.

Consider Future Plans

You should always consider strategic business plans in determining choices. If your business future has a lot of uncertainty, you may want to choose a less automated solution in the short term.

Fight the Urge to Do Everything at Once

Wherever possible, try to phase in changes gradually. This is particularly true for manual system changes or changes to your company's host software. If it is possible to test and operate these changes independently, do this first.

Always look at ways to phase in changes in logical incremental steps. By phasing changes, your organization has an opportunity to assimilate the changes at a more reasonable pace and make minor adjustments as experience dictates. If too many changes occur at the same time, it becomes difficult to evaluate where the problems are and how they should be corrected.

Summary:

I'll close this paper by summarizing the points just made. Managers of the most cost-efficient distribution centers are constantly on the lookout for new opportunities, and change is the one constant in their life.

The first step in figuring out what to do is to establish a distribution team. Once the team is established, an independent party should be used to interview, observe and present findings to the team. Based on the team feedback, various alternatives can be considered and prioritized. From this, chosen alternatives can be selected, and an action plan developed.

Improvements can be categorized into one of three Tiers based on investment cost. Tier 1 improvements are simple and low or no cost. Tier 2 improvements are low risk and have a cost of $2,500 or less per worker. Tier 3 improvements include everything else, and can involve substantial expense and some increased risk.

In evaluating alternatives, it is important to consider risk, flexibility, cost, and capability of the various choices. Often, it makes sense to combine several different systems together to produce the best overall result.

This paper covers a series of non-capital improvements that can provide substantial benefit to your operation. Review and consider each option carefully. This paper has mentioned the existence of capital-intensive equipment, but has not gone into detail about potential solutions. My paper "Strategies for Optimizing Traditional Each Pick Operations – Available Order Picking Systems, Material Handling Equipment, and Storage Devices" will go into detail concerning available capital alternatives.

When considering capital-intensive equipment, always try to separate the manual optimizations recommended with the equipment from the advantages of the equipment itself. Often the manual optimizations by themselves will provide a substantial benefit to your operation. By implementing manual improvements first, you have a better benchmark for the true ROI of the capital equipment.

Be sure to consider your end game carefully when going forward with a transition plan. Make sure that you train, test, and debug everything that can be tested before you live date. Be sure you can operate your facility without serious inconvenience while the installation is occurring. Plan your live date around a slow period, and have a backup plan if problems occur. Consider running the operation in parallel if space permits.

About the Author:

Sam Flanders is President of **Warehouse Management Consultants**. In the past Mr. Flanders has worked for Kingway Material Handling (Pick-to-Light), White Systems (Carousels AS/RS) and St Onge Company (Consulting). He is a national authority in the area of broken case or "each pick" order selection. Mr. Flanders has 15 years of experience in distribution. He also has a degree in Computer Science and is an expert at applying computer driven systems in the warehouse.