



White Paper

Profitable Distribution System Design – Part II

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This white paper is the second of a two-part series on designing profitable distribution systems. In the first part we demonstrated how performing SKU and order analyses provides the information you need to determine the appropriate storage options for your operation. Using inventory cube information, the optimal storage media types can be determined by SKU. This lays the foundation for an effective and efficient facility design. In this white paper, we will discuss the principles of facility design and special considerations related to order picking, automation, space allocation and technology.

A View to the Horizon

Once you've established the media counts for the current time period, your next step will be to validate the results. Comparing the recommended media counts to your existing media is a good way to understand the potential shifts in the media types, as well as confirm the assumptions made during the media selection process. After determining your present storage requirements, your next step is to predict your future requirements.

The planning horizon is usually 5 years, the length of the typical building lease. In the case of new construction, it would be very costly to have a follow-up construction phase within the first 5 years. While evaluating future storage needs, many variables come into play depending on your company, industry trends, and overall business conditions. It is vital to consider growth, in terms of projected sales and inventory turns (major capacity drivers), as well as SKU growth. If plans call for a rapid increase in new SKUs, increased media will be needed to provide additional "breadth" of pick faces. On the other hand, if it is anticipated that the SKU count will remain relatively flat during the planned time frame, then the "depth" of the inventory by SKU, and storage density, should be increased. For most clients, it is typically a combination of the two trends.

Ask Yourself:

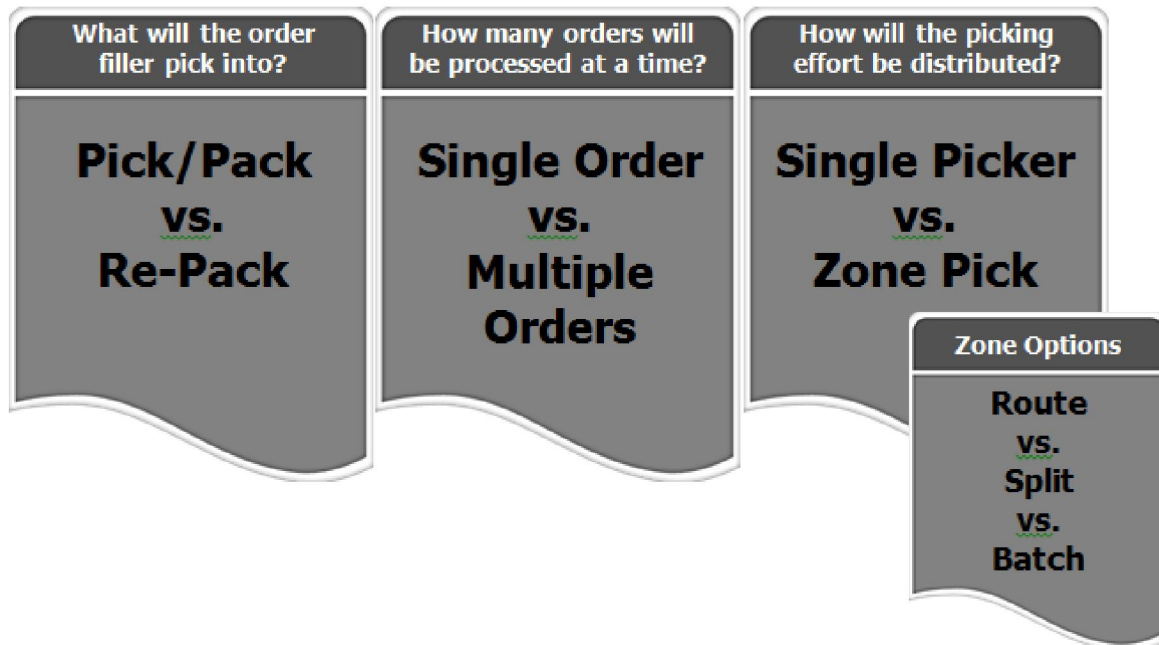
- *What is my projected growth in terms of sales and inventory turns?*
- *Is my SKU count expected to grow or remain steady?*
- *Is growth expected to take place rapidly, as in the case of acquisitions/mergers, or is more organic growth over time?*

Be Picky About Your Options

When considering what picking method to use, it is important to remember that the optimal, and most profitable approach, usually involves the use of multiple methods. This allows you to accommodate order and SKU characteristic differentials as previously discussed.

A summary of the main order picking methods is highlighted in the following illustration.

Order Picking Methodologies



STEP 1:

Consider what the order filler will pick into (Pick/Pack vs. Re-Pack)

Pick-Pack is commonly used in catalog/e-commerce and closed loop distribution operations, where the order filler picks directly into the shipping container. This process reduces product handling and shortens order cycle time, as the inventory is touched only once.

Re-Pack requires separate picking and packing operations. This allows for 100% manual checking of all orders. It also provides for product customization and use of various shipping container sizes, which may be necessary based on the SKU characteristics.

STEP 2:

Determine how many orders a single operator will process at a time (Single vs. Multiple)

Single Order (processing one order at a time) provides for a higher degree of accuracy and is conducive to low-tech environments.

Multiple Orders (processing multiple orders at one time) will help reduce unproductive travel time while reducing order cycle time. It is important to note that this is most conducive to a high-tech environment, to ensure accuracy and speed.

STEP 3:

Plan how the picking effort will be distributed (Single Picker vs. Zone Pick)

Single Picker in which one order filler is responsible for processing the complete order, thereby traveling the entire facility if necessary, does still have application in small Distribution Centers (DCs). Typically, this method is applicable in facilities with less than 20-30,000 square feet. This option has the added benefit of providing total accountability for the order accuracy.

Zone Pick is a more common method that divides the facility into areas or “zones”, with staff assigned to picking and other duties within a specific zone. This approach, when implemented properly, helps increase picking productivity while reducing time to complete an order, as multiple people can be processing parts of the order concurrently. Usually some level of mechanization/ automation, such as conveyor systems, is used to help facilitate this process.

When using a zoned system, there are additional options to consider:

Zone Routing is a process whereby orders can be rerouted from zone-to-zone via cart, conveyor or other means. In this process, order fillers pick the order in their respective zone, then the order is routed to the next zone for processing. Once complete, the order flows to the next appropriate function (i.e. customization, assembly, shipping, etc.).

Split Order allows the picking workload to be split among the various zones, allowing pickers to process the order simultaneously. This requires the order to be consolidated prior to shipping.

Batch Picking allow a picker to make one pass through a particular zone, making one stop at a SKU location to retrieve the quantity needed for all orders in that batch. The product is then transported to a re-sorting area, where the quantity, by SKU, is sorted and accumulated by order, then packed for shipping.

Often a combination of these techniques is used to optimize overall efficiencies.

Labor vs. Machine Dependency

When considering your storage strategies, it is important to recognize the difference between labor and machine dependency. Labor dependency provides a variable level of system throughput, based on the number of staff working at any given time. This provides flexibility in manual work zones as the labor can be adjusted to meet demand. An example would be having an order filler work a full zone of pallet flow racks during slow periods, but during seasonal peaks, divide the workload by adding extra help and splitting the zone into smaller areas.

Machine dependent strategies provide a fixed throughput, given a specific amount of equipment, while typically providing fixed work zones. A good example is the implementation of carousels. A pod of carousels usually consists of a set of three carousels. Only one operator can work a pod at a time. The carousels can rotate “x” rotations/hour (based on slotting, software rules), thereby establishing a fixed throughput for a given time period.

Space Considerations

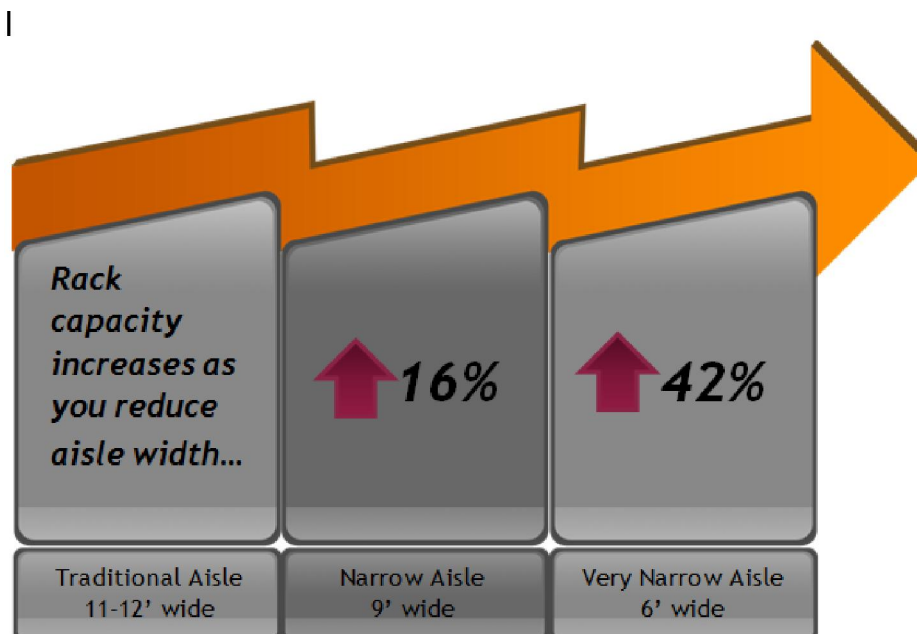
You will need to assess your facility-specific operational data to determine which strategy, or a combination of the two, will yield optimal results.

For example, in the pharmaceutical industry it is common to store and dispense prescription medication via an A-Frame, which is a highly automated and accurate picking system. This is a separate pick zone, and as order information is downloaded to the system, product is automatically dispensed into a carton, tote or onto a belt which "dumps" the order into the shipping container. The balance of the order, typically called Over-The-Counter or OTC SKUs, is split into a separate zone(s). OTC product can be batch picked to a tote, then sent to a sortation area to be sorted by individual order, or multiple orders are picked to a cart, which are then consolidated on the shipping dock at load out. The result is to apply the proper methodology in a cost effective manner in order to achieve the desired results.

Space, Space, Space

Think of space as the "Achilles heel" of distribution operations, because without the proper amount of space, even simple tasks can become difficult to accomplish. When evaluating space needs of an existing operation or a facility to be constructed, you need to consider both the square footage and cube available.

Total Operating Space (TOS) is the sum of the available building footprint plus any mezzanine/platforms that are used. If your operation requires a significant amount of conveyable storage media types (i.e. Bin Shelving, Carton Flow, Pallet Flow, etc.), then be sure to consider using the building cube by implementing mezzanine systems. Significant storage capacity can be achieved when incorporating two, three, or four level high pick modules. Likewise, reserve storage can be maximized by using forklift equipment capable of servicing properly sized racks, given the clear height of the building.



Sample data analysis used for this illustration. Results may vary.

Another option to increase reserve storage is to shrink the rack access aisles from traditional 11'-12' (used with traditional sit-down counter balance trucks) down to a 9' aisle. This is commonly referred to as a narrow aisle system, which requires the use of readily available stand-up reach truck equipment. Based on an analysis completed for this article, rack capacity increased 16% as a result of a reduced rack-to-aisle ratio. Going from a traditional aisle system to a very narrow aisle (VNA), which uses a nominal 6' aisle width, produced a net capacity increase of 42%. That's a big difference! Keep in mind though, this rack system requires a specialized turret truck or wire guided lifts, which are more expensive to purchase and harder to rent. More importantly, different types of truck equipment, with varied throughput capacity, are required for each application.

It is also important to note that before making final storage media and layout decisions, you will need to analyze the equipment rate capacities versus the expected volume of activity out of each area of the DC, both for present and future volumes. You don't want to be in position to not be able to access the inventory during peak periods.

Facility Layout is Key

When the space and media types have been determined, and operating methodologies identified, then it is time to start the facility layout process. The layout of the facility is an art as much as it is a science, requiring the ability to focus on specific areas, while maintaining sight of the overall operation. During this phase, be sure to provide a smooth flow of product from the inbound operations all the way through the outbound processes, and avoid the criss-crossing of traffic flows in the building. To achieve good material flow, as well as operational flexibility, be sure to incorporate into the design ample aisles for stocking and replenishment functions, as well as picking activities. Most often, it is best to provide separate stocking and picking aisles, as this allows the operations to occur simultaneously, without interfering with one another. Be sure there are sufficient traffic aisles to allow for the movement of product from receiving to the storage locations and value-add areas (if applicable).

The most common problem areas are undersized areas for receiving and shipping functions. This usually occurs over time as the inventory size increases beyond the planned estimates and/or due to poor cube utilization in the building. It's also important to keep in mind how the building and the material handling system will expand in the future. It's wise to place "fixed assets" such as docks, offices and picking modules away from the expansion wall, so as to avoid costly relocation efforts in the future.

The Role of Technology

Given the advancements in technology, and specifically those advancements in paperless technologies, warehouse control systems (WCS), and warehouse management systems (WMS), technology plays an ever increasing role in improving the operational performance in the distribution environment. When applied correctly, the benefits of technology include improved system throughput, order and inventory accuracy, and overall productivity, as a result of properly applied, real-time information processing. Some examples of the more commonly used technologies include: radio frequency (RF), bar codes, pick-to-light, pre-cubing, pick-to-label, voice activated picking, automated manifesting, inline scales, inline print and apply, RFID and electronic bundling. To effectively implement these technologies you must take the time to understand each one and how they could be used to help improve your operations. Automating a process for automation sake, or avoiding automation altogether are common but avoidable mistakes.

Summary: Data-driven Design for a Better Bottom Line

When done correctly, designing profitable distribution systems requires a lot of work to develop a data-driven design that is right for your organization. Be sure to involve team members from various disciplines, including Operations, IT, Marketing and Finance, as well as outside partners. Improvements in service to your customers and a better work environment for your staff, are by-products of data-driven design, which can affect your bottom line. Fortna has the experience in both data analysis and design to help you get started. For more information on this topic, please contact John Giangrande at johngiangrande@fortna.com.

About Fortna

Fortna helps companies with distribution-intensive supply chains keep pace with intense customer demands and competitive challenges. We deliver a broad range of professional services that span supply chain strategy, distribution center design and operations, materials handling, organizational excellence and supply chain systems. Working alongside our clients, we build a solid business case for change and hold ourselves accountable for results. We understand the pressures our clients face to remain leaders in their markets. With Fortna, they can make bold promises and confidently deliver on them.

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