TECHNICAL NOTES

VASFT005

Managing Equipment For Article Sorter Delivery

Most systems using article sorters to process orders also use automated equipment for product delivery. The automated equipment includes devices such as carousels, stackers, conveyance, sortation, queues, buffers, induction stations etc. Article sorters themselves are a batch-picking device that allows delivered product to fill multiple orders. VAS has a great deal of experience in the management of both the sorter and the equipment that is responsible for the delivering of product to the sorter. This paper identifies and discusses some of the interesting non-intuitive factors and concepts that should be addressed in article sortation systems.

When designing a delivery system for an article sorter there is one design factor that needs initial definition and consideration that will influence nearly all future decisions. That factor is the ability of the delivery system to control the sequence of the product arrival. The degree of sequence control will impact future decisions. This does not imply that either sequenced delivery systems or non-sequenced delivery systems are better or worse, it just identifies that many other design implications will be based on that factor.

Another factor is the determination if the sorter is to operate using a virtual wave and a related issue of the expected order completion rate. Sorters that are to operate using a virtual wave are more dependent upon product delivery sequence while sorters operating using multiple waves have some interesting order completion rate issues that need to be addressed.

Another factor is the determination if the sorter has a "drop station" and a separate "completed order queue". This factor has significant sorter (and system) throughput implications.

A factor that many designs address is to "organize orders" – to group orders together that have similar SKU requirements to improve efficiency.

A final factor discussed is the consideration of sort rate and its relationship to the number of induction zones, product routing to the induction zones and tray rate.

Product Arrival Sequencing

This factor is primarily determined by the type of equipment that is used for product retrieval i.e. a manual selection process, a carousel, or a stacker. If a manual product selection process is used, the ability to sequence product arrival is inversely proportional to the retrieval efficiency. The same is true when using a carousel, however the inefficiency is normally expressed in a reduction of delivery throughput. Using a stacker, the throughput is not as adversely affected by product delivery sequencing and VAS Engineers have designed and installed systems using stackers that exceeded stacker manufacturers throughput rates by 30% or more while maintaining the same travel speed. The sequencing of delivery of product to a sorter allows a sorter to easily operate in a virtual wave mode. This mode increases sorter productivity and evens out the flow of completed orders.

Operation of a Sorter using a Virtual Wave

To operate a sorter in a virtual wave, if the product delivery system is capable of delivering product in sequence, the management of product delivery should be controlled by only one rule – the fastest completion of orders. This rule dynamically selects product for delivery that will complete the most orders. Of course, when the product is delivered, it is used for any and all orders that have a requirement filling the most complete first. If the delivery system is not capable or has limited product delivery sequencing ability, more complex rules are applied. The result of the application of these rules will lead to orders completing in bunches, with an initial period of time with no orders completing and then a group complete together. Picking without virtual waves and with limited product delivery sequencing the bunching of order completion is most significant.

Operating using Separate Drop Stations and Completed Order Queues

Sorters operating with a separate “Completed Order Queue” will have a significant throughput advantage over a sorter without such a queue. This is because the sorter is not able to start filling a new order until the previous order is removed from the drop station. The order completion bunching further impacts this situation further reducing the system capacity. To understand this, consider a sorter that picks static waves. Imagine that each delivered product (SKU) will normally be used for 3 orders. As the last SKU in the order arrives, the last 3 orders would be completed according to the example. The next to the last SKU arrival would also be used for 3 orders, however if the delivery sequence were not precisely controlled those three orders were not the same 3 as were completed by the previous SKU. That would mean that the next to the last SKU delivered also completed 3 orders that were most likely not the subsequent orders. The thought process goes on to the final 10 SKUs delivered. If the sorter had 300 drop stations (orders), the chances would be that nearly 30 orders would be completed with those 10 SKUs. Order completion is “bunched” at the end of the wave, resources for packing or completion of orders are thus backlogged due to the bunching and the sorter drop stations are not available for new orders, induction must stop and sorter efficiency limited.

Organization of Orders

Many sortation designs consider or attempt to “organize” orders grouping orders together that have similar SKU requirements to improve efficiency. VAS engineers have successfully implemented designs where groups or “categories” of product have been delivered to a sorter filling stock category orders. However, we have had no success in devising a means of grouping a particular group of orders together for picking. This type of a problem requires a technique called “linear programming”. In addition to requiring great computing resources, our experience is that the efficiency gained by “cherry picking” good orders to group together is short lived. You wind up with a bunch of bad orders and their pick efficiency is even worse together. The resulting net overall gain is absolutely nothing.

Sort Rate

The sort rate of a sortation system is determined by many factors, however realistic estimates can be made if the proper consideration is given. Probably the single most elusive factor to consider is the non-productive time. The sorter tray rate, the number of induction and corresponding drop zones, and the ability to select the induction zone for each SKU arrival will determine the resulting sort rate. VAS engineers are experts in the calculation of the sort rate.

Distinction between a WMS and a WCS

A note should be made on the distinction between warehouse control, and warehouse management. In the MHE industry, there has been somewhat of an inclination to create a layer between equipment control and warehouse management systems. Some call this layer a “Warehouse Control System” or a WCS. VAS feels that such a layer is not a good idea. Today’s systems are driven by data. This is particularly true with automatic article sorters and their associated delivery system. Good equipment control needs good data in order to make real-time decisions. The availability of the data necessary to make these decisions is embodied in the WMS. We feel that the WCS concept has arisen out inadequacies in software provider's offerings and "software product packing". Packaging of a WMS does not require that the WMS have all the features of any or all other WMS but only that it have all the features necessary for it's intended application current requirements and a means to address future improvements. The Mandate® AWMS™ with its adaptive real-time nature is a WMS that is ideally suited for a facility that intends to use article sorters for order fulfillment.