TECHNICAL NOTES

VASAN001

Process Optimization of a Sorter-Based Operation

Productivity of labor-intensive piece-picking operations often can be improved using batch processes where multiple orders are picked simultaneously. As the number of orders in the batch increases, the distance between picks is reduced, as well as the non-productive picker's walking time, allowing pickers to spend more time picking. Piece-sorter devices (tilt tray sorters, Bombay sorters, etc.) allow the batching of hundreds, and even thousands, of orders.

This paper describes how adaptive technology principles can be used in a sorter-based operation to achieve better customer satisfaction, increase processing capacity and reduce labor costs.

Traditional piece-sorter operations use waves to organize the work. For instance, if the sorter has 640 drop-points, 640 orders are selected for a wave to process. Each order is assigned to a drop-point. Pickers are dispatched to collect all items for the wave orders; the mixed items are brought to the sorter induction stations from all picking zones to be inducted into sorter trays. As orders complete in the drop-points, they can be packed under the sorter. Once all the 640 orders are packed, a new wave of 640 orders starts.

One serious disadvantage of the traditional process is that most orders complete near the end of the wave, making it very difficult for the packers to keep up with the work during these periods. As a result, the wave transition time, defined as the elapsed time from the last drop of a wave to the last packing of the same wave (or the beginning of the next wave) is very long. Unfortunately, from the sorter utilization point of view, wave transition time is also wasted time.

In order to address the above issue, some distribution centers use waves with fewer orders than the available drop-points. The next wave begins as soon as there are enough packed drop points to accommodate all the orders for the wave. In the extreme of this solution, wave orders are half the number of available drop-points, allowing uniform packing in half of the drop-points while the other half is used to sort the next wave. While this approach addresses the issue of wasted wave transition time, its disadvantage is that reduces the batch orders by half; consequently, the picking productivity is not as good as with the larger wave.

Other processes attempt to "optimize" the day, grouping orders in waves with like items. Normally, this approach has other problems. In order to find the optimum grouping, all possible combinations need to be evaluated, and the number of combinations is astronomic. Also, even if the issue of the very large number of combination could be solved, optimizing the waves at the beginning of the day prevents the addition of new orders during the day, making the process very inflexible.

Nevertheless, there are very effective and realistic ways to optimize a sorter-based process using adaptive technology principles. In order to do it, the process can be broken in 3 parts: order selection, picking, and packing.

Order Selection

There is no need for using waves. Orders can continuously being added for sortation as orders are packed and drop-points become available. Under this approach, the sorter pulls orders at the pace it can complete them, keeping the sorter as busy as possible. In order to minimize the time for the first item of an order to reach the sorter, a buffer of orders can be incorporated into the system. These buffer orders are queued in transit from the picking zones to the sorter in such a way that by the time that the order is assigned to a drop zone, its first item(s) are already on sorter trays. This process yields the largest possible batches, maximizing picking productivity.

The SOFT™ software keeps a pool of orders to sort. From this pool, the SOFT™ software selects the orders to be added to the sorter. Each order has a priority. The SOFT™ software always selects from the orders with the highest priority. Orders in the pool can be added, modified or deleted at any time of the process. Priority of orders that have been in the pool for a long time can automatically increase as time goes by. New orders can be added at any time during the day and still being processed in an optimum way. This process provides the maximum flexibility for accepting and managing new orders to process.

Considering that drop-points are a very valuable asset for the distribution center, when selecting new orders to add from the orders with the highest priority, the SOFT™ software selects the orders that will complete the fastest based on the current location of the pickers. This process is continuously executed multiple times per minute. Orders that have no items yet picked can be re-evaluated to validate that they are still among the best orders to select under new current conditions. Once the first item of an order is picked, the order is committed for sortation and is not re-evaluated by the selection process anymore. This process maximizes sorter utilization.

Picking

The distribution center can have one or several picking zones. For practical purposes, each zone is considered a loop where one or several pickers work. Each picker has a dynamic sub-zone assigned to him/her. That sub-zone starts at his/her current location and ends at the location of the picker in front of him/her along the loop. At any moment, the workload of each picker can be calculated as the pending picks in his/her sub-zone divided by his/her pick rate. The workload is expressed in minutes. As long as all picker workloads are balanced (the delta between the minimum workload and the maximum workload is within an acceptable value), the SOFT™ software will issue transactions, one at a time, to each picker in his/her sub-zone. As soon as the system becomes unbalanced, the SOFT™ software searches for pickers to move across sub-zones in order to re-balance the system. The SOFT™ software checks for system un-balancing every time that a transaction is completed. When considering movements, the SOFT™ software uses a move penalty to account for the wasted time of the picker moving from his current location to a new sub-zone. This process minimizes straggler orders under the sorter and also prevents congestion in the picking aisles. The SOFT™ software can move pickers within their picking zones or to other picking zones.

Exception handling of shorts only requires the picker who finds the short to report it. If more inventory of the shorted item exists in other location of any sub-zone, when the picker of that sub-zone goes by that location, the SOFT™ software will direct him/her to grab it from there. This process minimizes the negative effect of handling shorts.

Packing

Packers keep going around the drop-points packing the orders that they find completed. Each packer has a packing sub-zone defined in the same terms as the picking sub-zones. The workload for each packer is the pending orders to pack in his/her sub-zone divided by his/her packing rate. The SOFT™ software balances the workload for the packers the same way that balances the workload for the pickers.

As the workload for pickers and packers is expressed in the same units (minutes), the

SOFT™ software can move workers from picking to packing or from packing to picking if an imbalance between the 2 functions is detected.

Conclusion

Using SOFT™ software modules that adapt to the forever-changing conditions of the operation, the distribution center:

1. Increases customer satisfaction providing maximum flexibility to accept last-minute orders or modify existing ones at any time of the operation

2. Increases distribution center capacity maximizing sorter utilization

3. Reduces labor costs maximizing worker productivity and minimizing the effect of shorts handling