

IMPROVING DISTRIBUTION CENTER OPERATIONS USING A FLEXIBLE CONVEYOR MODEL

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ABSTRACT

A Fortune 100 retailer (The Company) is using a configurable conveyor model to improve operations in their distribution centers. As their business grows, some of this company's material handling automation is being pushed to the limits of its initial design capacity. This case study describes a case conveyor merge-sort model built by Roar Simulation. The Company uses simulation to develop plans and evaluate operational strategies at their Distribution Centers (DC). The model can be used to analyze the operations of their DCs across North America. Analytics Professionals at the Company use this model to perform their own analysis through a customized user interface and AutoMod's analysis tool AutoStat. The model has helped the Company make operational and equipment update decisions prior to seasonal peak demands on their facilities.

1 INTRODUCTION

The Company is a large U.S. based retailer with over 90 distribution centers serving over 2,000 stores. Many of the distribution centers employ cross docking of products received from suppliers and sorted directly to store-bound trucks. These distribution centers use case conveyor equipment to move boxes of various sizes between the receiving and shipping areas. As the products are received, they are labeled for routing to the individual stores. As part of the 2019 peak season planning process, The Company contracted with Roar Simulation to build a detailed, configurable simulation model to assist The Company in testing equipment changes and to better understand system capabilities.

2 MODEL DESCRIPTION

2.1 Flow of Operations

An overall view of the model is shown in Figure 1 on the next page. The model is built to accommodate up to ten (10) input lanes to the conveyor merge. These conveyors come from the receiving area of the facility. The flow rate and case size on each lane is configurable to represent products coming from multiple suppliers. Once a merge lane is full based on photoeye status, the lane is released to the sortation system.

Cartons entering the high speed sorter are diverted down one of over 100 shipping lanes, also configurable. Operators are assigned to unload from multiple shipping lanes. In addition to testing new automation equipment and controls ideas, the model has been used to evaluate staffing plans.

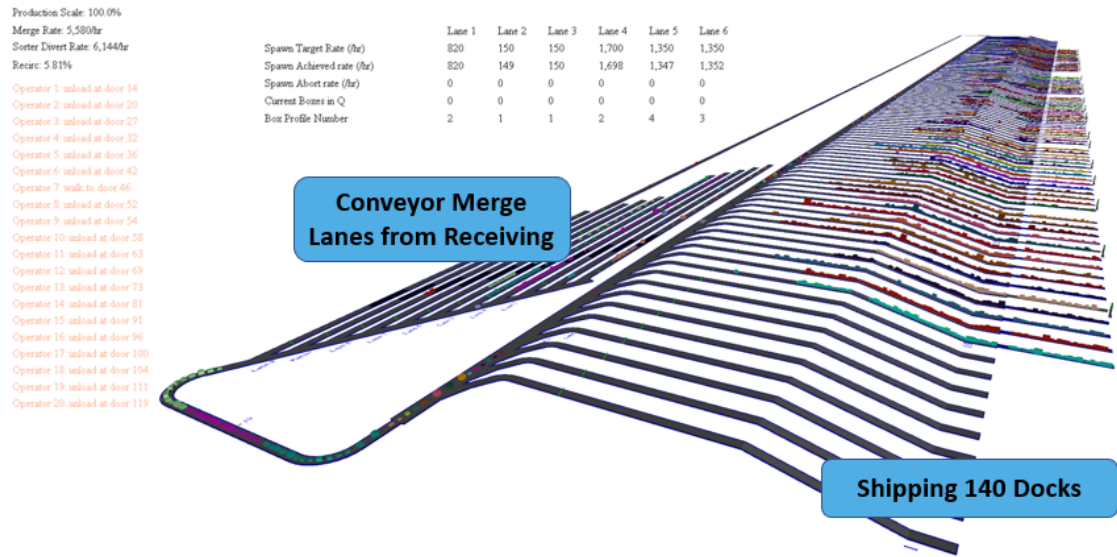


Figure 1: Model 3D view.

Outputs from the model include the number of cartons merged and sorted each hour and the recirculation rate. When the back end of the conveyor backs up, the next carton to divert into a full lane will recirculate and return to the conveyor merge to be sorted again. When the front end of the conveyor backs up prior to the merge, missed inductions are also recorded as lost capacity.

3 CONCLUSIONS

For the 2019 planning year, the model was used to develop a strategy to increase capacity at a facility in Georgia. The team learned that optimal throughput occurs when the number of induction lines feeding into the wedge is minimized, reducing wait times for full slugs ready to be released onto the sorter. This unfortunately reduces accumulation space and increases the frequency of blocked inductions. Therefore, another key takeaway was that optimal throughput also happens when the induction lines are evenly balanced. This was not how the DC was running in its current state given that the mix of products had changed significantly since these DCs first opened. The model was critical to developing and testing these strategies prior to the 2019 peak period. The actual facility results tracked closely with the results of the model.

In preparation for the 2020 peak season, The Company is using the model to evaluate ideas for grouping its outbound labor. With improved grouping, The Company hopes to better balance its labor force required for loading trucks, and at the same time increase the maximum capacity of the facility. This work will continue through 2019.

4 NEXT STEPS

The Company will continue to use the configurable conveyor model as a tool to test DC strategies and remove constraints. As The Company builds new facilities and/or retrofits existing DCs, this simulation tool will be used to test concepts before money is spent on improvements. The model framework is flexible and can be applied easily to other automation equipment designs.