CASE STUDY

HIGH SPEED BOTTLING LINE THROUGHPUT SIMULATION

PROJECT SUMMARY

A bottle manufacturing plant wanted to explore multiple investment options for configuring its new manufacturing line. They also wanted to analyze the sensitivity of the throughput to the capacity of a hopper (bottle accumulator) and the speed of the unscrambling machine that is used to feed bottles from the hopper back into the main line.

SYSTEM DESCRIPTION

The base configuration of the proposed manufacturing line consists of an intricate system of air-conveyor lanes that move the bottles to and from pieces of equipment. A set of Mass transfers are used for ensuring correct log (pairs of bottles temporarily joined at the neck) orientation. Logs from the blow molder (manufacturing at over 40k bottles per hour) are tested for leaks at a high-speed leak tester. Passed bottles are sent to a demoiler where the logs are split and sent to packaging. A hopper is used to decouple the blow molder in case there is downstream downtime on any of the conveyors or demoilers. The unscrambler is used to re-circulate bottles back to the main line.

The alternate configuration involves elimination of a number of the mass transfers and the use of an inline hopper and high speed unscramble that feeds the demoiler through a pair of cleated conveyors.

OPPORTUNITY

It was hard for the plant management to predict the magnitude of impact of each of the configurations on expected throughput levels. Blocking at the blow molder needs to be avoided given that the machine has long start-stop times and inherent stop-start quality issues. The ROI of each configuration hinges on the system's capability to absorb production fluctuations and uncertainties.

APPROACH

Given the importance of modeling variability, simulation was used as a tool (Software: Enterprise Dynamics®) to build models of the proposed configurations. Each configuration model was verified and validated against theoretical expectations and historical data from other plants. An efficient interface was set up for running automated experiments by varying speeds and capacities. KPIs such as throughput, equipment utilization, blocking percentage and hopper utilizations were collected and analyzed.

SOLUTION

The simulation results showed that the second configuration yielded a more balanced throughput time series. The throughput from the second configuration was also 23% higher when compared with the first configuration running at similar speeds even through the lead time to manufacture was slightly higher and a larger hopper was required. The plant decided to employ the second configuration given the relatively stable throughput time series and better ROI. Optimal hopper capacity was estimated based on the blow molder blocking percentage indicated by simulation experiments.

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