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Simulation Model of the Sorting Syst

Warehouse Operations

Overview

DHL Supply Chain is a division of Deutsche Post DHL Group, which operates globally. DHL Supply Chain is the world's leading contract logistics provider. Their integrated logistics solutions drive efficiency and improve quality.
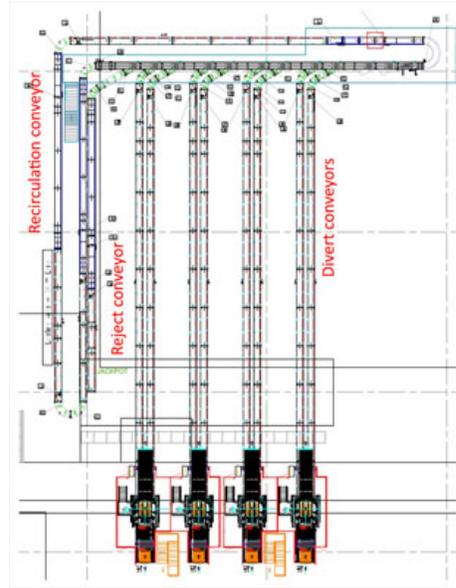
To learn more about DHL warehouse modeling in

Problem

DHL Supply Chain wanted to install a box sorting system for the new facility. Compared to the previous cases, there would be much larger orders. Thus, DHL needed automation to support the sorting process.

The sorting system (click to enlarge)

This system was supposed to include a reject conveyor, eight divert conveyors, and a recirculation conveyor.

Orders would be sorted and palletized by a narrow belt sorter. DHL planned to sort boxes by their weight. It was essential that the heaviest packages go to the bottom of the pallet. In doing so, they would not damage the medium and light boxes. A screen at the entry point would notify operators about available lines and boxes on the recirculation conveyor.
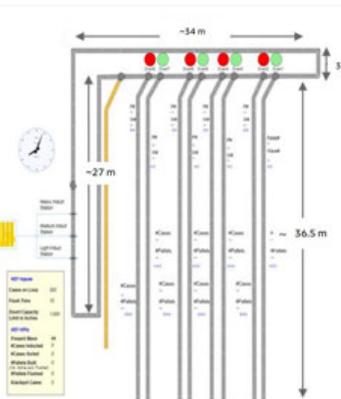
There were four palletizers at the end of divert conveyors. Each had two sorters. The feeding conveyor would be switched after every pallet completion.

DHL required a simulation method implemented in their planning strategy. They needed to define the following:

- If the system can handle peak day volume

Library for the simulation model. The developers used historical data as inputs. This data provided the arrival sequence of boxes, their order numbers, and their dimensions.


Input data for the simulation (click to enlarge)

They decided to have three entry points for weight classes: heavy, medium, and light. Three employees would sort the boxes and drop them on the conveyor.

There were two variable parameters X and Y, which DHL engineers were not sure about: capacity of the recirculation conveyor (X), and the time after which orders were flushed from the sorter (Y).
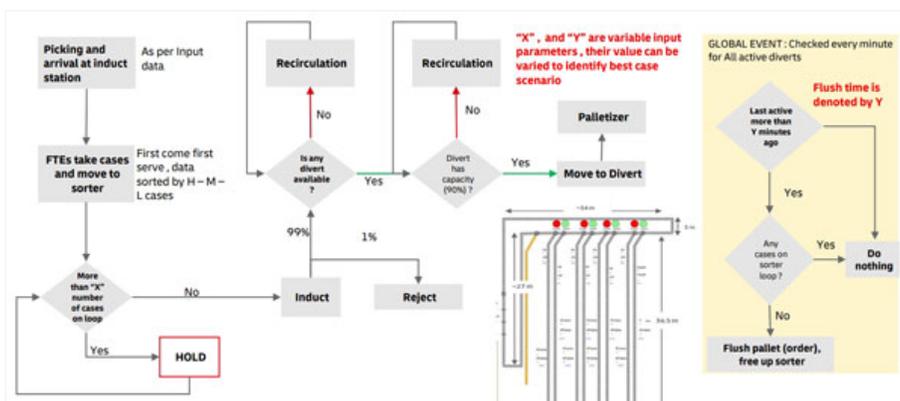
More cases are allowed to be inducted on loop	↑ High	↓ Low		↑ High
Flush time – Low System waits lesser before flushing idle diverts	↓ Low	↑ High		
Cases On Loop – Low Lesser cases are allowed to be inducted on loop	↓ Low	↑ High		↓ Low
Flush Time – High System waits longer before flushing idle diverts	↑ High	↓ Low		

The spreadsheet identifying how the value of X and Y affected the outputs (click to enlarge)

Results

DHL developers made sensitivity analysis while varying input parameters for several scenarios.

Parameter:		Min value	Max value	Step Size
X : Cases on loop		100	320	10
Y : Flush Time		5	30	2

Scenario	Cases Available	Arrival Pattern	Cases inducted	Cases Sorted	Cases on loop	Flush Time
Minimum extra pallets	17,199	Regular	17,199	17,020 [98.96%]	140	20
Minimum recirculation	17,199	Regular	17,199	16,976 [98.7%]	165	14
Maximum cases sorted	34,398	All at once	20,557	19,977 [97.18%]	140	10
Stress test – maximum case sorted , 1 divert down	17,199	Regular	16,724	16186 [96.78%]	140	10
Stress test – maximum case sorted , 1 divert down	17,199	All at once	17,199	17,028 [99.01%]	140	10

Analysis outputs (click to enlarge)

At the end of the simulation, engineers shared the results of different scenarios with their management and operation team. They decided to use it as a reference for future operations.

Watch the video about the case study presented by DHL at the AnyLogic Conference 2021:
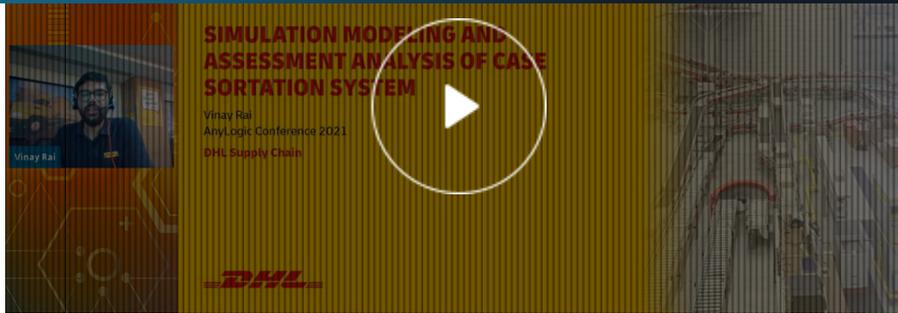
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