

SIMULATION MODELING AND ASSESSMENT ANALYSIS OF CASE SORTATION SYSTEM

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DHL Supply Chain





Agenda

- 0 About us
- 1 Background and objective of study
- 2 Simulation Parameters
- 3 Simulation Logic
- 4 AnyLogic Simulation Model
- 5 Interpretation of Variable Parameters
- 6 Analysis outputs

About Us



DHL Supply Chain is a division of Deutsche Post DHL Group with a global network and an extensive logistics portfolio, deals with warehousing, transport and VAS

**Deutsche Post DHL
Group**

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eCommerce
Solutions

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Background , and Objective

Sorter system to be studied and simulated has 8 diverts, 1 reject conveyor, and 1 recirculation conveyor loop.

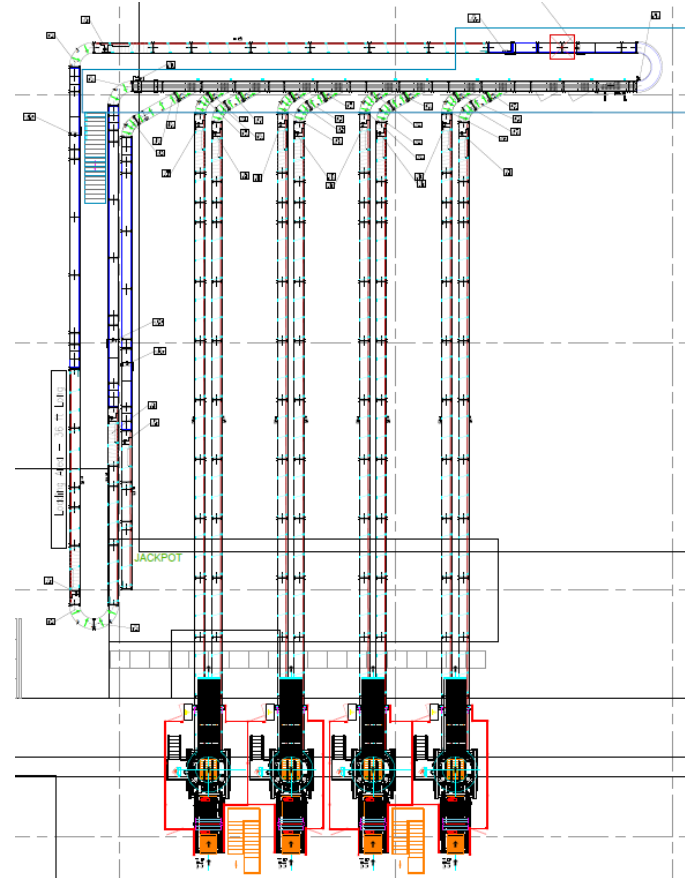
Operation

- Cartons picked in batches and 8 orders waved in each wave.
- Orders will be sorted and palletized via Narrow Belt Sorter
- Cases to be inducted by their weight categories to ensure that heavy cases are at bottom of pallet
- A screen at induct station will notify operators about available diverts and cases on recirculation conveyor
- Each palletizer has two input sorter conveyors, one will feed divert and other will accumulate cases. Feeding conveyor will be switched after every pallet completion .

Objective

Simulate case sortation system to determine :

- If system can handle peak day volume
- If yes, then what are the optimum operating parameters for system.



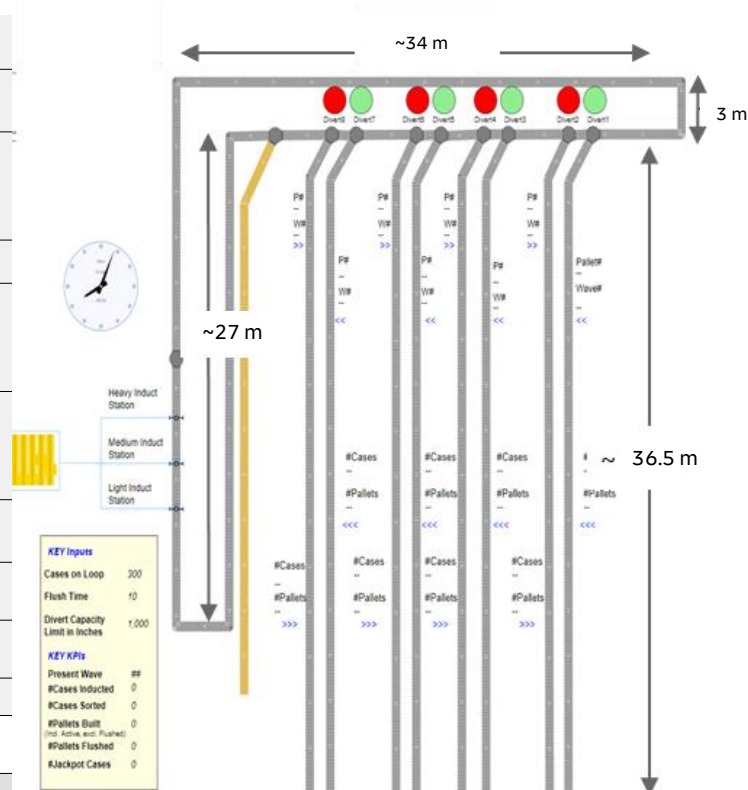
Simulation Parameters

| Criteria | Value |
|--|--|
| Cases arrival rate at induct station | From Input Data |
| Induct Station to Induct Conveyor: Distance and time of travel | H – 6.7m, 6 sec M – 4.3 m, 4 sec L – 6.7m, 6 sec |
| Induction FTEs | 3 |
| Heavy , Medium , Light SKUs | Light < 2.2 kg Medium : 2.2 – 3.6 kg Heavy > 3.6 kg |
| Conveyor Speed | Min : 0.3 m/sec Max : 1.1 m/sec Acceleration : 0.3 m/ sec ² |
| Divert speed | 7.5 rpm / 60 cases per minute |
| Divert occupancy limit | 90% of Divert Length |
| Rejection Rate | 1 % |
| Palletization rate | 600 cases per hr , 6 seconds per case |

VARIABLE PARAMETERS

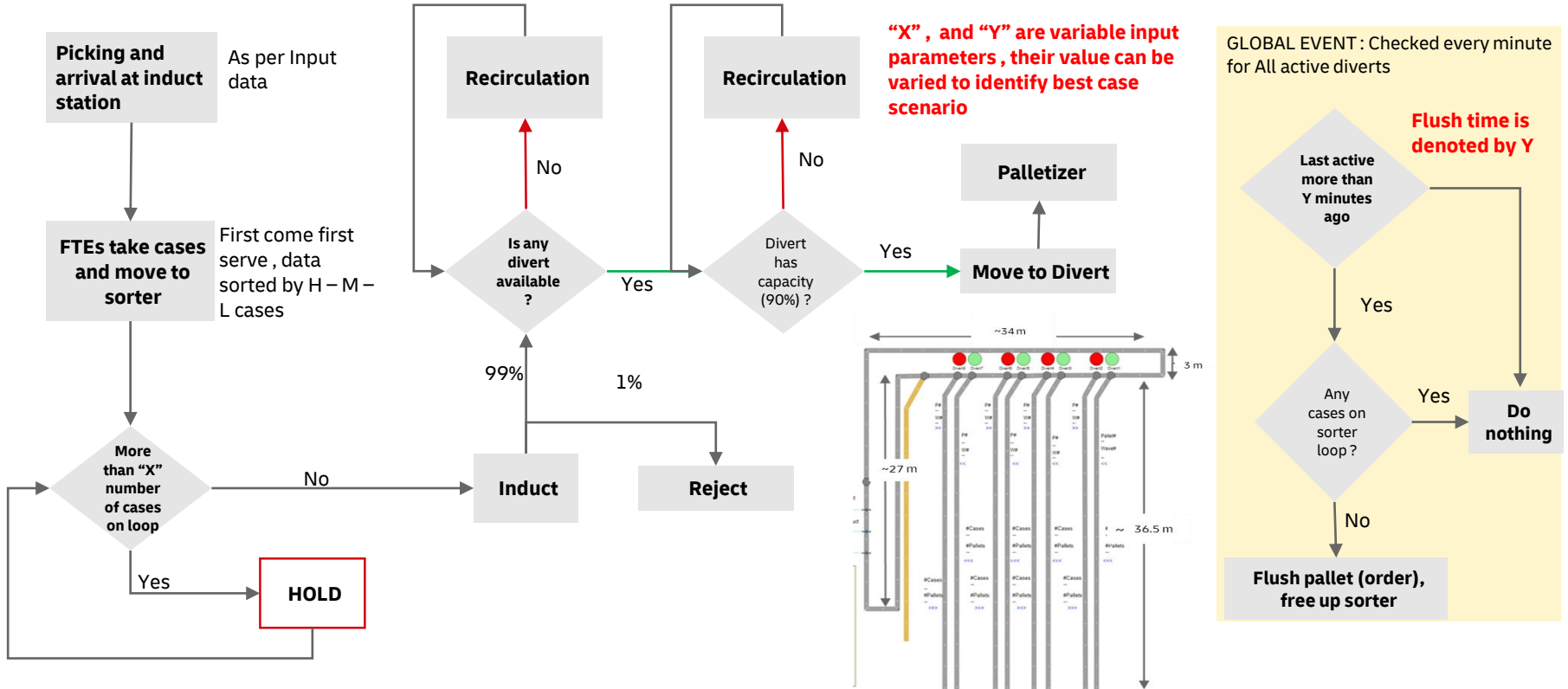
(X) Max cases on loop : Maximum number of cases on recirculation loop at a time

(Y) Flush Time : Time after which orders are flushed from sorter

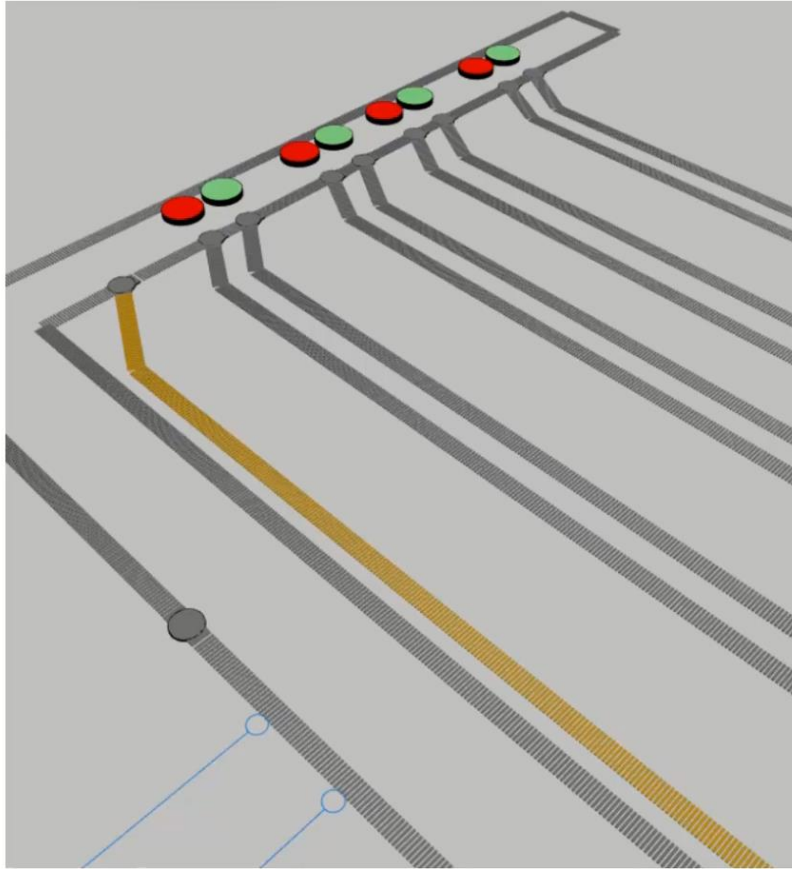


Simulation Logic

Input data: Historical data used as input. This data provides arrival sequence of cases, their order numbers , and dimensions.

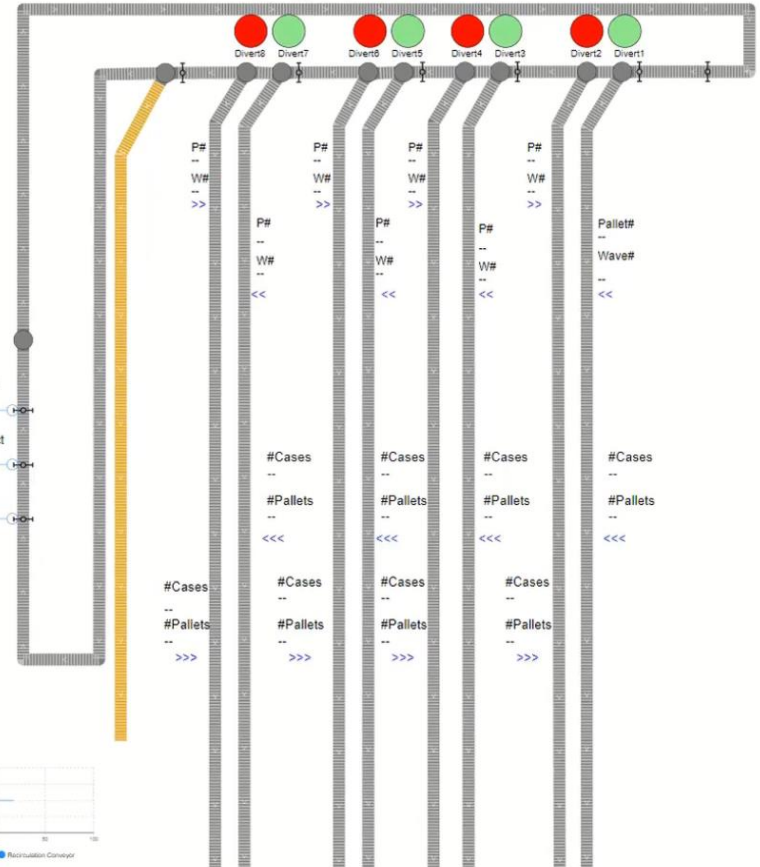
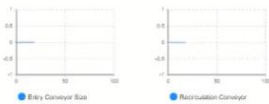
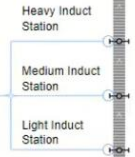


Simulation Model













KEY Inputs

| | |
|---|-------|
| Cases on Loop | 140 |
| Flush Time | 20 |
| Divert Capacity Limit in Inches | 1,300 |
| Divert Rate (Cases per minute) | 60 |
| KEY KPIs | |
| Present Wave | ## |
| #Cases Inducted | 0 |
| #Cases Sorted | 0 |
| #Pallets Built (Incl. Active, excl. Flushed) | 0 |
| #Pallets Flushed | 0 |
| #Jackpot Cases | 0 |



Interpretation of Parameters : Flush time and Max cases on Loop

| | Congestion | Sortation Rate | Additional Pallets |
|---|--|--|--|
| Cases On Loop – High <i>More cases are allowed to be inducted on loop</i> |  High |  Low |  High |
| Flush time – Low <i>System waits lesser before flushing idle diverts</i> |  Low |  High | |
| Cases On Loop – Low <i>Lesser cases are allowed to be inducted on loop</i> |  Low |  High |  Low |
| Flush Time – High <i>System waits longer before flushing idle diverts</i> |  High |  Low | |

Analysis Outputs

Sensitivity analysis was done while varying input parameters for various scenarios :

| Parameter: | <i>Min value</i> | <i>Max value</i> | <i>Step Size</i> |
|-------------------|------------------|------------------|------------------|
| 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 |



Thank you.