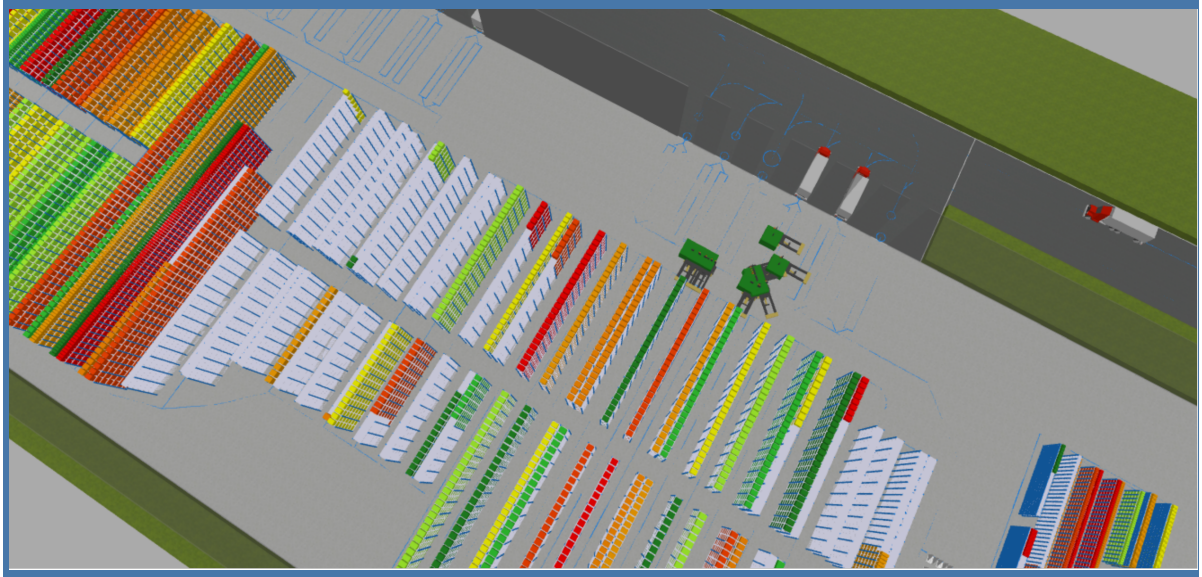
COMPARE WAREHOUSE ZONE PICKING VS LINEAR PICKING



Problem

Tennant Company, a big player in the cleaning appliances industry, manufactures floor cleaning equipment and operates a global warehouse that dispatches an average of 100 orders per day. Each order consists of a certain number of cases, items and pallets, requiring the picking of approximately 1500 products per day. The warehouse receives and unloads about 15 trucks daily and loads a similar number of trucks daily. Tennant Company is considering switching from linear picking to zone picking in order to improve their warehouse management efficiency.

The Hypothesis:

The zone picking method and the linear picking methods are expected to have different average picking time per order.

To validate and test this hypothesis, we have developed a simulation model, with a representation of the Warehouse. It represents a rack system with the following free capacities:

	Actual	Model	Initial Occupancy
Pallets Cells	6121	6494	Defined by user
Cases Cells	31570	17983	Defined by user
Items Cells	7406	15552	Defined by user

Rack system is divided in 3 big zones: pallets, cases and items.

Each Zone has different number of Lines (user defined named Types), showed with colors in the model.
All distances are in scale, and forklifts and foot pickers have real speeds. So, travel distance and speed are in scale according to reality.

Model Assumptions:

- A limited number of trucks unloading per day.
- Unlimited number of resources for downloading.
- Independent resources for loading and unloading.
- Limited resources by user of: Loading Forklifts, Loading Foot Pickers, Assemblers.
- Trucks unload pallets or cases or items, and only one type (color) per truck.

Adjustment between loading and unloading has been built giving more free space in levels (not adding travel distance) to have materials availability for order processing.

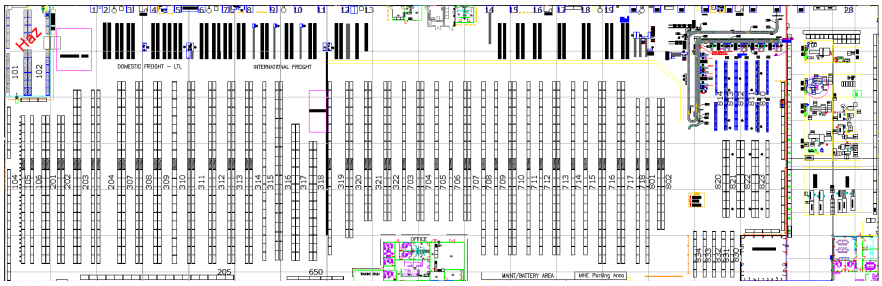
- Orders:
  - Arrive to be processed according to different rates, related to their type: LTL, INTL, CP & SP.
  - Orders that do not find desired materials are kept in standby and next order is processed immediately.
  - Order generation vary along the day, according to rates (respond to a Poisson probability), according to frequencies.

- Three Transport Methods
  - Reach Truck (designated “Pallets”)
  - Order Picker (Designated “Cases”)
  - Foot Pick (Designated “Items”)

- Three Areas
  - Pallets (aisle 310 & North)
  - Cases (between pallets and items)
  - Items (800’s excluding 801 & 802)

- Four Departments
  - Canadian Pool
  - Small Parcel
  - LTL / Domestic Freight
  - International

Warehouse Layout:



Model Warehouse Layout:

Model Scenarios:

- The model allows to run different scenarios according to initial inputs:
  - Change % initial storage for Pallets / Cases / Items.
  - Change the number of lines per zone.
  - Change the number of forklifts.
  - Change the number of foot pickers.
  - Define Assembling time: average and St Dev.
  - Choose Picking type.

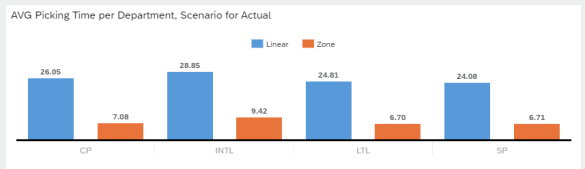
SOLUTION

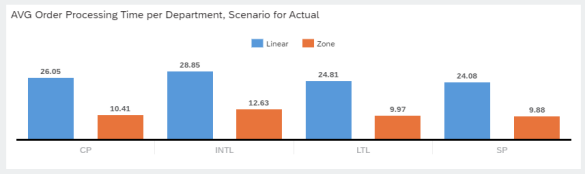
This model has been designed with **AnyLogic** using both discrete events and agent-based methodologies. Using a Material Handling java library.

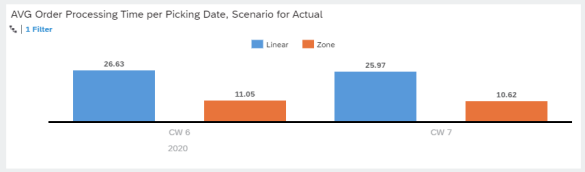
- The model loads the following data
  - Transport Method Speed forTruck / Forklift / Picker.
  - Order Profile by four custom probability distributions (Lines Per Order by Area) based on Department.
  - INTL – LTL – SP – CP (profiles generated by historical data analysis)
  - Order Arrival by four Department Schedules (historical data)

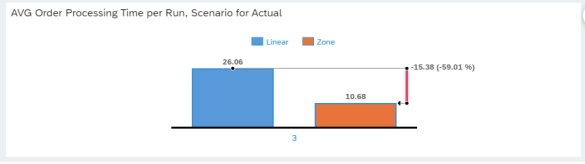
Model Output:

1. Two comparative output versions:
   - Linear picking
   - Zone picking + Assembling Time
2. AVG Picking Time per Department
3. AVG Order Processing Time per Department
4. Average Pick Time per order:
   - Linear = 26.06 Min
   - Zone = 10.68 Min
5. Assembly time.









Other Uses of the Simulation Model:

- Simulate Picking Waves
- Simulate Order picking with different Zone Definitions (current and best practices)
- Understand forklift idle movement and positioning
- Analyze forklift utilization based on product allocation along the warehouse
- Simulate Average Time to pick and order, optimizing FTE & Order Fulfillment window
- Simulate/Optimize Order Fulfillment window overall
- Simulate/Optimize Picking labor reduction overall
- Simulate the Impact of future Order Increase

Additional Model Outputs:

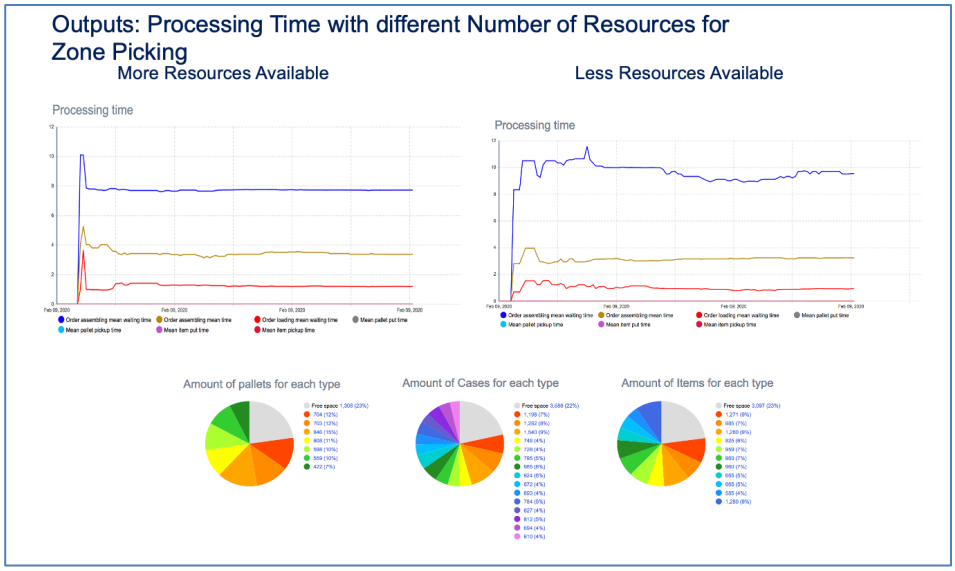


Figure 1

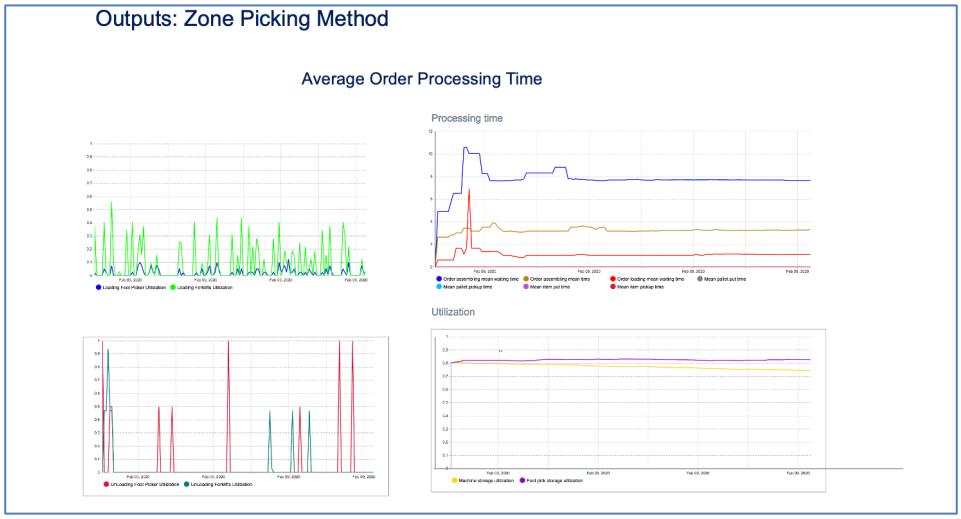


Figure 2