Distribution Network Optimization to Reduce Process Variability for an Online Retailer

Amazon

BUSINESS PROBLEM

Amazon employs a unique process to ship goods between cross-dock facilities and its fulfillment centers, using "hybrid" trailers consisting of assortments of corrugate cases and standardized plastic totes. Often, these containers are "floor loaded" rather than palletized, as the tighter packing into shipping trailers results in higher density and lower per-item transportation costs. However, this method does have some costs, including increased labor for trailer loading and unloading, as well as uneven and unpredictable container flow into fulfillment centers upon unloading, which at times results in insufficient work and line outages.

APPROACH

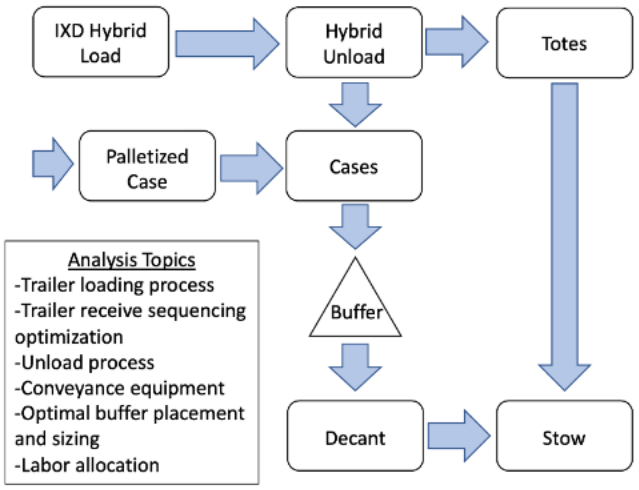
The project used the following methods to accomplish its goals: Observe current state processes, and map out trailer loading and unloading processes in addition to the decant process Define a new metric to capture the frequency and duration of decant out-of-work events, and make this data available to stakeholder teams within operations and engineering organizations Using Amazon's extensive set

DATA SOURCES

Amazon maintains a tremendous amount of data on all aspects of its processes. Information on trailer manifests, container scans, line worker station logs, costs, labor history, SKU dimensions and weight, and automated conveyance scanner logs were all used to develop the models used here. Data was extracted via source SQL/Redshift servers and in some cases scraped from internal web pages.

Data Types and Format

Time series, normalized tables.



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IMPACT

Immediate changes to the physical inbound dock processes which where partially piloted during the project are estimated to result in a significant reduction in lost labor hours, totaling more than $20MM for decant labor alone. As Amazon continues to grow, these cost savings will increase as well. Work on optimal trailer scheduling has not been tested yet, but backtesting against historical shipment data indicates a potential 73% reduction in variability of case flow throughout a shift. The effects of this variability reduction cannot be adequately quantified without onsite testing, but will entail significant benefits to Amazon's ability to conduct accurate labor allocation, maintain continuous flow, reduce out-of-work events, and eliminate long-standing unprocessed inventory.

DRIVERS

Amazon's relentless need to reduce costs and improve processing time in order to provide faster delivery and a better experience for its customers was the overarching driver for this, and most of Amazon's process improvements. On a more local level, shipping represents a large portion of fulfillment costs, and this project addressed secondary impacts resulting from a change designed to decrease shipping expenses.

BARRIERS

Amazon's scale means that there are numerous teams and stakeholders, each with partial ownership of data and processes involved. There were several teams working on related and overlapping initiatives, and it took time to understand this landscape initially and coordinate among all parties involved.

ENABLERS

In general, Amazon prizes excellent communication and fosters a willingness to cooperate toward achieving common high-level goals. This cultural aspect was certainly felt, and it made it easy to ask for input or help, and to gain traction needed to experiment and test new ideas.

ACTIONS

We began multiple pilot trials of specific process changes on the inbound dock and decant line at one fulfillment center. Each pilot revealed new strengths and weaknesses in the proposed solutions, allowing them to evolve. Additionally, coordinating closely with the fulfillment software team allowed the work on trailer scheduling to be integrated with a larger software tool currently in production.

INNOVATION

Amazon did not previously have a means to quantify decant out-of-work time, so this project provided a tool to drive informed decision-making. As a result, we were able to evolve the decant and dock processes to better manage buffer sizing and placement and modulate work flow. This project also provided the first mathematical program for trailer scheduling, which will be released in 2021 as part of a larger planning software initiative.

IMPROVEMENT

The primary measured improvement here are the process changes to inbound processes and workflows which will reduce decant out-of-work time by a number of hours equivalent to an annual labor savings of $20MM when process changes are scaled across the North American fulfillment network.

BEST PRACTICES

Taking time to understand the system, processes, and stakeholders, and asking a lot of questions up front. This enabled building a clear picture of the relevant processes, and conversations to explain the current state often naturally yielded to discussions of possible improvements, and this is how multiple successful partnerships were formed.

OTHER APPLICATIONS

General purpose warehousing, e-commerce fulfillment, cross-dock operations, and supply chain applications involving assembly line and transportation.