

AMAZON.COM, INC – YARD MANAGEMENT

Fulfillment Center Truck Yard Capacity Forecasting

STUDENT TEAM:

Corinne Beemer – EGL (BSE & MSE Industrial and Operations Engineering)

Muhammad Umair – EGL (BSE & MSE Industrial and Operations Engineering)

PROJECT SPONSORS:

Sam Eldersveld – Director, Supply Chain Data Science, Transportation Execution

Navjot Singh – Sr. Manager, Technical Program Management, Transportation Execution

FACULTY ADVISORS:

David Kaufman – College of Engineering

Brain Talbot – Ross School of Business

Amazon, a world leader in retail, strives to be the Earth's most customer-centric company. To achieve this vision, Amazon focuses on continuously improving its vast network of operations to ensure top customer experience in a cost-effective manner. To drive operational excellence within their fulfillment network, Amazon's Fulfillment Execution Data Science (FEDS) team focuses on leveraging technology and operations to develop data-driven solutions for internal customers across the network. Specifically, the FEDS-Tauber team supported the Transportation Operations Management (TOM) team by developing solutions to manage truck yard capacity.

The TOM team manages day-to-day yard operations and seasonally procures additional yard capacity for Amazon's peak season. Due to current physical capacity constraints at Fulfillment Centers (FCs), off-site yards are sourced to manage excess trailer buffers and dwelling trailers and result in less efficient management of yard operations. During peak in 2017, tens of FCs exceeded their engineered yard capacity and would have entered a gridlock state if no off-site yards were present. Based on actual usage of the off-site yard, it was estimated that 25% of these FCs could forego an off-site yard with better proactive planning. TOM challenged the Tauber team to develop a robust tool to forecast yard utilization for the peak season and aid in efficiently managing yards to avoid unnecessary off-site yard spend.

The Tauber team initially focused on assessing the current state of the TOM team's yard capacity planning process to identify areas of opportunity. The team converged on two primary goals to manage yard capacity: the first was developing a long-term model that forecasts FC yard utilization over a 4- to 6-month horizon to make decisions on leasing off-site yards; the second was developing short-term visibility to proactively manage operational decisions. To achieve these goals, the team leveraged Amazon Web Services (AWS) and SQL to evaluate data sources and explored time-series forecasting techniques with RStudio. Using an iterative process with feedback from key stakeholders, the team developed forecasts for long-term yard utilization using historical data and FC volume predictions. Additionally, the team developed 1-, 2-, and 3-day forecasts of yard utilization and created metrics to monitor how long trailers dwell in the yard. This provided central visibility of yard performance and enabled managers to proactively address problems with dwelling trailers consuming yard capacity. The team also developed and launched an interactive dashboard to summarize and visualize forecasts and manage yard capacity and performance. This project generated savings in labor hours and yard spend, ultimately improving offsite yard planning and enabling more efficient truck yard management.