Can Powerloop improve freight performance for shippers?

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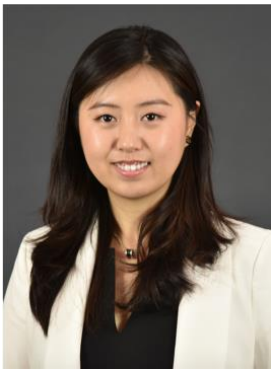
Topic Areas: Transportation

Summary: This research studied the impact of Powerloop, universal trailer pool program and affiliate of Uber Freight, on detention fees and on-time delivery performance. Unlike traditional live-load freight, Powerloop allows shippers to pre-load freight by using dropped trailers, improving carrier utilization and limiting detention time. For this study, data from both traditional live-load freight and Powerloop loads were used in a discrete-event simulation model. The results from the model indicate that Powerloop can save shippers up to $16 per load in detention fees and improve on-time delivery by 2% compared to traditional freight.

Prior to MIT, Elisa worked in last-mile logistics at Amazon for three years. Elisa holds a BS in finance and supply chain management from Arizona State University, and after MIT, will be joining The Gap in the Bay Area.



Prior to MIT, Ge worked in new product introduction sourcing at Cummins for three years. Ge holds a BA in Supply Chain Management from Michigan State University, and after MIT, will be joining Apple in the Bay Area.

KEY INSIGHTS

1. Shippers can potentially save up to $16 a load in detention fees by using Powerloop compared to traditional freight.

2. Powerloop can potentially improve on-time delivery rates by 2% compared to traditional freight

3. Powerloop can improve driver utilization, benefiting both carriers and shippers.

Introduction and context

Currently, there is an imbalance of supply and demand of freight in the U.S. The American Trucking Associations estimated that in 2017, there was a shortage of 50,000 drivers. This has created a need to improve driver utilization to improve freight matching speed and secure reliable freight transportation. The largest source of downtime for carriers is detention, or the time carriers spend at shipper facilities during the loading and unloading process. Carriers are not paid for this downtime, which typically averages two hours or more at each of the shipper and receiver facilities. After the two-hour mark, shippers are typically charged detention fees ranging from $25-90 an hour depending on the shipper-carrier agreement. The recent Electronic Logging Device (ELD) statute in December 2017 has added further pressure on the market, as drivers' hours are now electronically logged, ensuring better driver compliance with the hours of service limitations.

Traditional freight is both live-loaded and live-unloaded, creating a significant amount of downtime during which carriers are not being utilized for driving. In Powerloop loads, freight can be pre-loaded at the shipper facility by using dropped trailers for a quicker turnaround time at the facility. After the dropped freight is picked up from the shipper, the trailers are taken to the receiver facility and can either be live-unloaded (drop-live scenario) or dropped (drop-drop scenario). These two Powerloop scenarios of drop-live and drop-drop freight have the potential to improve on-time delivery performance and detention fees compared to the traditional live-live freight by minimizing the downtime carriers spend at facilities.

Methodology and Data

To quantify the expected on-time delivery (OTD) performance and detention fees for both traditional and Powerloop freight, we created a discrete-event simulation model based on the activities in the load delivery process. This type of simulation models the operations of a system in a series of discrete events. These events encompass all the various processes in the system, with no changes expected to occur between sequential steps.

To begin, we first conducted interviews with industry and operational experts at Uber Freight and Powerloop to gain an understanding of the unique challenges in the transportation industry and the key differences between traditional freight and Powerloop loads.

Next, Uber Freight and Powerloop provided six months of load data including timestamps for each activity, which was broken into discrete events for the model.

Using the data provided, we performed statistical analysis on the distribution of detention time. Since detention time is the key factor that determines detention fees and check-out times, which in turn impacts on-time delivery at the receiver, it is critical to apply the correct distribution of possible detention times to the model. The distribution of detention is unique, however, in that it is always positive, has long right tails, and has peaks that occur around 30- and 60-minute intervals. We first tested triangle and normal distributions against the data, as they are commonly used in business applications. We next tested 80 different common distribution types using a Python fitter package, including lognormal, chi-squared, and log-laplace. Given the unique distribution of detention, all the tested distributions failed chi-squared tests to determine if it fit the data in a statistically significant manner. Finally, we used a probability density function (PDF) to create a distribution that simulated the actual data. A PDF provides the probability a random variable will fall between a specific range of values. To generate the PDF, we binned the detention data into 15-minute intervals and calculated the probability of detention falling into each bin. We then used the PDF to generate 10,000 random detention variables for the simulation, and simulated 10,000 loads for each scenario of traditional live-live freight and Powerloop's drop-live and drop-drop loads.

Results

The results of the discrete-event simulation demonstrated that Powerloop loads have a higher on-time delivery performance and lower average detention fees per load compared to traditional freight.

Demonstrated in Figure 1, drop-drop scenarios have the lowest estimated average detention fees, followed by drop-live, then live-live. Compared to traditional freight, shippers can save approximately $11 by using drop-live freight, and $16 with drop-drop freight.

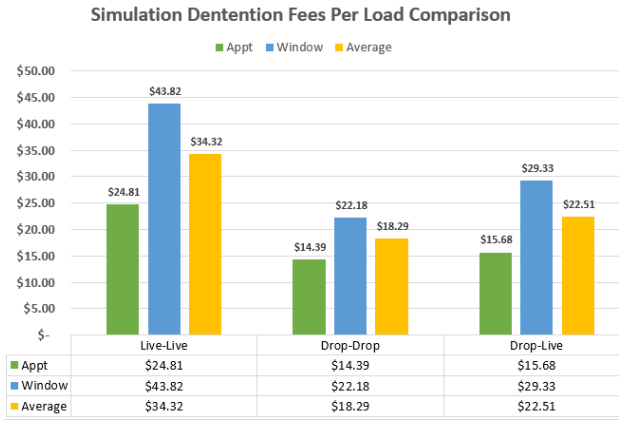


Figure 2 Simulation detention fees per load comparison between traditional and Powerloop loads

For a shipper who executes 100 loads per day, the savings of utilizing the drop-drop freight would translate into $1,600 per day, or approximately $400K per year assuming 260 work days per year (Figure 2).

The model also indicated that schedule types have an impact on the performance of the freight. For both pickup at the shipper facility and drop-off at the receiver facility, the predetermined arrival schedule type can be either an appointment time or a window.

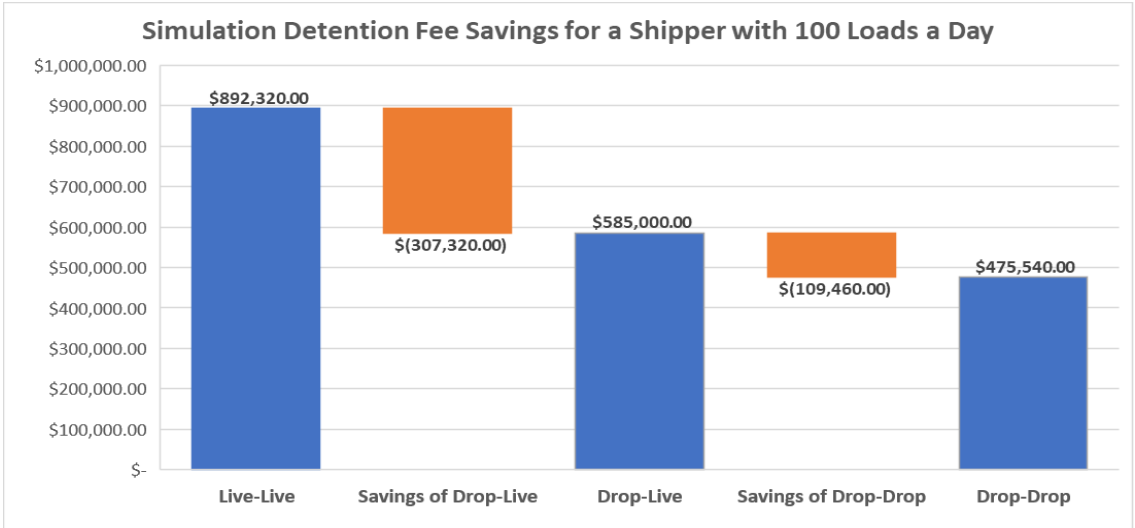


Figure 1 Simulation savings from using drop-live and drop-drop for a shipper who takes 100 loads a day

For appointments, a specific time is set for the carrier to arrive. After a 30-minute grace period, the carrier is considered late. Window schedule types provide a wider time frame, some as much as 24 hours, during which the carrier can arrive at any point in the window and be considered on time.

Loads with window schedule types have higher expected detention fees than appointment schedule types. This is related to on-time delivery performance, as detention fees are only incurred if the carrier arrives on time. If the carrier is late, no charges are incurred. Since windows provide a longer range of time during which the carrier can arrive and be considered on-time, they have higher on-time performance and therefore a higher probability of being eligible for detention fees. Shipper behavior could also play a role, as it is easier for a shipper to anticipate when resources are needed to load or unload freight when there is an appointment compared to a longer window.

The simulation results also indicate that Powerloop loads outperform traditional freight in terms of on-time delivery by 2% (Figure 3).

In the future, we expect the on-time delivery performance to increase as Powerloop continues to move along the learning curve and gains greater operational density. The reduced detention time at the initial shipper facility allows carriers to have a higher likelihood of getting to the receiver on time. Loads that have window schedule types have higher on-time delivery compared to appointments, as carriers have a greater range of time to arrive, making it easier for carriers to achieve higher OTD performance.

Conclusion

By switching to Powerloop, shippers can potentially save up to $16 per load in detention fees and increase their on-time delivery rate by 2% compared to traditional freight. Given the current imbalance of supply and demand of truck drivers, it is crucial to improve driver utilization to ensure a reliable source of freight and improve freight matching speed. Powerloop provides a potential solution to this challenge, and can improve freight performance for shippers.

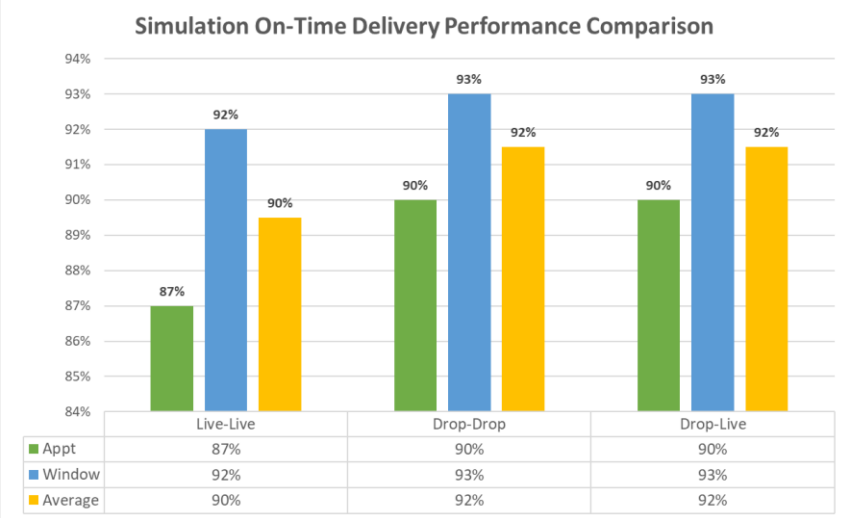


Figure 3 Simulation on-time delivery performance comparison between traditional and Powerloop loads