

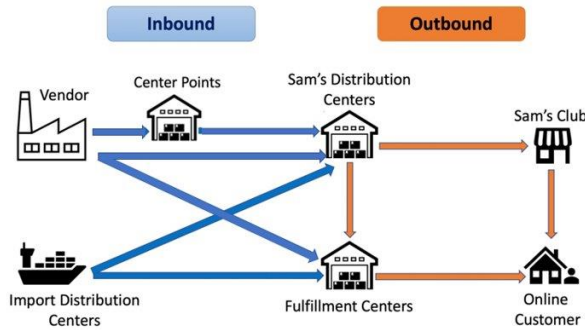
Emma Regier (Project Manager), Emily Eskens, Lucas Hicks, Jacob Reich, Austin Wood

Primary Contact: Ben Grunow - Sr. Manager Outbound Transportation

Secondary Contact: Abhishek Devadiga - Manager II, Supply Chain Management

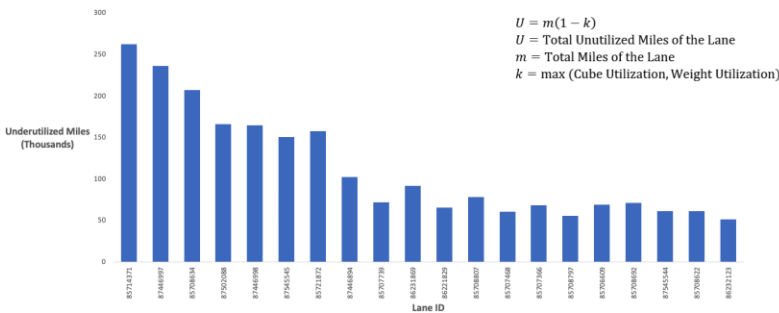
Sam's Club Inbound Transportation Network

Sam's Club, a subsidiary of Walmart, is a network of nearly 600 retail warehouse clubs across the US. Sam's Club members can buy items in bulk at reduced costs. Sam's Club merchants find and purchase large quantities of products from vendors. The Sam's Club transportation network is comprised of inbound and outbound lanes. We focused on the inbound transportation network, especially lanes going to distribution centers.



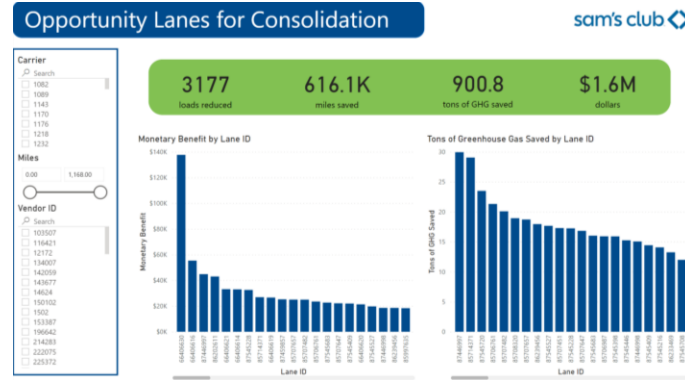
Opportunities for Load Consolidation

The inbound transportation network is extremely constrained due to truck and driver shortages. Sam's Club wanted us to find a way to increase the utilization of inbound loads. Initial investigation directed towards the use of heavy haul permits revealed permits are restricted to non-divisible loads. We then shifted our efforts to identifying opportunities where multiple loads on a lane could be consolidated. Our preliminary analysis of identifying underutilized miles showed multiple consolidation opportunities.



Consolidation in the Transportation Network

Our goal was to build a decision-support tool to identify currently underutilized lanes and provide potential savings and sustainability improvements to the user. Sam's Club provided our team with a dataset containing over 200,000 loads from July 2020 through September 2021. A database was created and used to identify lanes with low tonnage and cubage traveled at least once per week to help identify consolidation opportunities. The dataset was used to create a Power BI Dashboard to evaluate the cost savings and sustainability impacts associated with load consolidation.



Cost Benefit and Sustainability Impact

The cost benefit associated with consolidation efforts was computed using load details on a lane such as the current average utilization, average tonnage, and average mileage. Assuming every consolidated load could be filled to the maximum tonnage or maximum capacity, we calculated the monetary benefit based on the number of reduced loads that could be consolidated. To evaluate the sustainability impact, we first calculated the gallons of fuel saved based on the number of consolidated loads, their mileage, and the average mpg of fuel consumed for each lane. We then used an EPA converter to determine constant ratios that can be used to transfer gallons of gas saved into greenhouse gas emissions savings and other useful savings metrics.

$$\text{Number of Optimized Loads} = \frac{\sum t \cdot (1 - x)}{44500} + \frac{\sum v \cdot (x)}{3350}$$

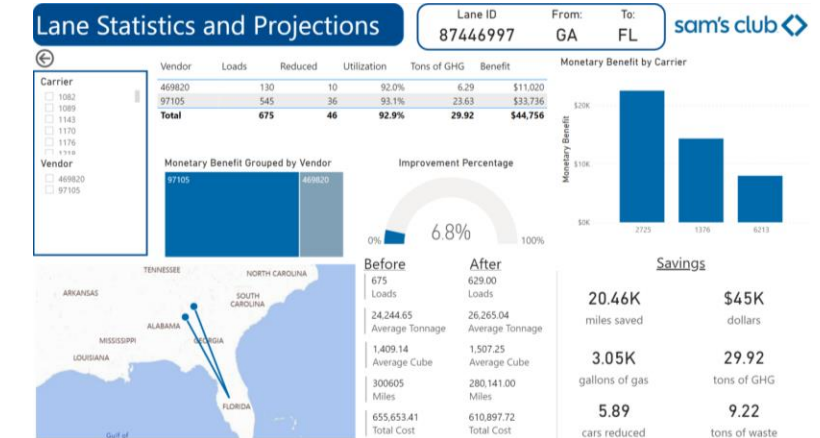
t = Tonnage
 v = Volume
 $x = \begin{cases} 1 & \text{If volume utilization is greater than weight utilization} \\ 0 & \text{Otherwise} \end{cases}$

Savings		
29.53K miles	4.41K gallons of gas	13.31 tons waste recycled
\$45K dollars	29.92 tons of GHG	8.51 cars reduced

Number of Loads Reduced = Current Number of Loads - Number of Optimized Loads

Lane-Specific Impact of Consolidation

We implemented a second-level view in our dashboard that allows a user to select a specific lane and drill through to a new page of the report to find more information regarding its consolidation opportunities. This allows a user to see the specific benefits that a particular lane would bring for consolidation while considering the individual vendors and carriers that are active in that lane. This will help Sam's Club make informed decisions on which vendors to contact for consolidation opportunities.



Network Consolidation Benefit

Our consolidation projections for Sam's Club's inbound transportation network has an upper bound of savings up to \$1.6 million. Our projections assume that each trailer can reach the maximum volume or weight. With this assumption, 3,177 loads can be saved with consolidation efforts. This relates to 616 thousand miles saved because of the reduced number of loads needed to transport Sam's Club products. The sustainability impact of consolidation is also large with 900 tons of greenhouse gas saved from emission reductions through load consolidation. Sam's Club can use our Power BI tool to identify underutilized lanes, and when they connect this dashboard to their live data source, they will be able track real-time opportunities for consolidation.

