# Is There Ever an "Average" Day?

## Incorporating variability into transportation modeling



Most large shippers spend a great amount of time and expense collecting, analyzing and maintaining the data used to drive daily transportation planning and execution. This data, when codified and integrated into the shipper's transportation system, is the organization's transportation policy. The policy is comprised of lanes, modal options, rates, service levels, carrier and fleet capacity, as well as a multitude of other decision variables and rules that must work in concert to drive daily decision-making.

As the transportation policy defines the framework upon which all transportation decisions will be made, it is imperative that it is constructed in a manner that is not overly constricting. It needs to be flexible enough to provide the advanced optimization capabilities of the transportation management system and the latitude to find savings. It also needs to be built in a manner that takes into account the typical variability found within virtually every supply chain. This is where there are often opportunities for improvement over existing processes.

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### Deterministic versus Stochastic Strategic Planning

When developing the data that make up the transportation policy, most analysts still rely heavily on statistical averages. This approach completely ignores the inherent variability that underlies nearly every aspect of transportation. From order sizes and lane volumes to travel times and fuel prices, using a single, discrete value to represent each of these variables during strategic planning will lead to a poorly designed transportation policy that will ultimately be reflected as inefficiencies in daily planning.

So why do most organizations develop their policy in this manner? The simple answer is that averaging is easy to comprehend and calculate. Additionally, averages provide a discrete, numeric value than can be used by deterministic optimization tools, which are sometimes employed in transportation modeling. Unfortunately, averages rarely reflect reality. For example, if half the time a supplier ships 5,000 pounds and the other half they ship 40,000 pounds, then the average is 22,500 pounds. But in reality, the supplier never ships 22,500-pound orders. In this case, a fundamental input used as the basis for a transportation policy is completely wrong.

*Through stochastic optimization and simulation, the variability of data can be modeled in a manner that provides the analyst a greater degree of confidence that the "best" decision—as defined not by a snapshot of data, but over time—will be made.*

To be clear, when doing daily planning, using a deterministic planning tool is usually the most logical method since order quantities, rates, capacity and other values are known. However, strategic planning should utilize a "stochastic" approach that is based on calculated probabilities, not the oxymoronic concept of forecasted certainties that is implied in the deterministic approach. Applying stochastic principles is not new to supply chain planning. The concept of safety stock exists due to the realization that we cannot predict, with complete certainty, customer demand, lead times or order fill rates. The latest transportation modeling technology allows for combined stochastic optimization and simulation, which enables analysts to incorporate known variability into the process of developing the transportation policy.

**How does this work in the real world?**

Let's take the example of prepaid-to-collect conversion. Which should be prepaid and which should be collect?

First, this decision is driven by the difference between the freight allowance provided by the supplier and the transport cost to be incurred by the customer. Although there are many constants in this example that might lead to a deterministic solution, prepaid to collect is a long-term, strategic decision that is subject to significant levels of variability that must be considered.



Key elements that need to be modeled for variability include:

- Order quantities
- Order quantities of neighboring suppliers, i.e., can LTL shipments be converted into multi-stop TL movements? This is important, because looking at each supplier independently will not identify the benefits associated with inbound multi-stop TL consolidation.
- Freight rates
- Fuel prices, i.e., if no fuel surcharge is charged back to the supplier, the customer is taking all the risk around fuel price volatility.
- Order frequency
- Transport lead times, i.e., does the customer have time to perform consolidations or are the ordering patterns such that they have to regularly use direct and/or expedited freight?

A deterministic approach involves taking an average ship quantity for each of the suppliers and optimizing it through a deterministic solver. However, this assumes the customer understands the rate and fuel surcharge that would be used throughout the year and the order quantity would vary little. Through stochastic optimization and simulation, the variability of these data can be modeled in a manner that provides the analyst a greater degree of confidence that the "best" decision—as defined not by a snapshot of data, but over time—will be made.

*Only by taking variability into account will analysts be able to create an operationally-resilient and efficient transportation policy that reflects the reality of an ever-changing world.*

In summary, most organizations today take a deterministic approach when developing their transportation policy simply because it's easy to do and it's the way it has always been done. However, long-term strategic planning must take into account known variability. Only by taking variability into account will analysts be able to create an operationally-resilient and efficient transportation policy that reflects the reality of an ever-changing world.

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## About the Author:

**Michael Mulqueen, Sr. Director of Product Management**

Mike Mulqueen joined Manhattan Associates in December 2010 as Sr. Director of Product Management with responsibility for the company's Transportation product line. He comes to Manhattan with over 20 years experience designing and implementing logistics-focused supply chain solutions. Most recently, Mike was with Accenture, where he served as the firm's Logistics Business Area Lead for the US Postal Service. Prior to Accenture, Mike held transportation systems leadership positions with JDA/Manugistics, UPS Logistics Technologies and C&S Wholesale Grocers.

Mike holds a BS degree from the University of Maryland, College Park, and a Master of Engineering degree in Supply Chain Management from the Massachusetts Institute of Technology.

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North & South America + 1 877.596.9208 • Global + 44 (0)1344 318000 • www.manh.com

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