

## **OIM 411: Supply Chain Analytics**

### **ShipEx Challenge**

#### **Last-Mile Delivery by Vehicle & Drone An Operational Study**

ShipEx is a last-mile parcel carrier operating in MA. It is exploring the potential deployment of a new technology -- delivery trucks that have the capability of carrying a portable drone. In so far, the company has competed in the sector of delivering parcels from the depot in North Pleasant St in Amherst by vehicle, as conventionally performed by such companies as FedEx, UPS, or USPS.

A task force has been formed, involving the operations manager, a senior logistician, a data analyst, and one of the truck drivers (and future drone operator) who work for the ShipEx. Your OIM team is hired to consult for ShipEx and analyze for a planning horizon of 5 days of data for customers living in select residential areas in Amherst. The data made available by the company is in a companion data file, which includes:

- Tab 1: Customers. A unique customer ID, their physical address, their map coordinates, the lot size associated with their address, the value of the land and building – along with a total appraisal value, and the type of residence (single home vs. condo)
- Tab 2: Demand. The demand over 5 days, with each order having the following attributes: The customer ID, the day for delivery, the service time (time to complete delivery on site) by either vehicle or drone, the monetary value of the order (\$), and the parcel volume.
- Tab 3: Vehicle inter-customer travels times in mins.
- Tab 4: Vehicle inter-customer distances in miles.
- Tab 5: Drone travel times in mins. You might note that the travels times, when negligible for nearby locations, are approximated by zero due to the speed at the drone flies.

A heated debate is taking place about the customers/orders who may be eligible for a drone delivery. The logistician is noting the order flagged as having a “Large” volume cannot be shipped by drone because of their weight-bulk characteristics. Only Small and Medium parcels might. The data analyst is also noting that the value of the orders varies substantially, and beyond parcel volume, it may be wise to consider a monetary threshold beyond which an order must be delivered in person, by a vehicle. The drone operator, on the other hand, has conducted field experiments and is doubtful whether a drone delivery is pertinent/safe in apartment complexes or condos, but is happy to do whatever management recommends. Finally, your team is wondering whether the data you are provided by the company is accurate and whether it would be necessary to verify the soundness of the travel times and distances.

It has been assumed that two vehicles, each with or portable drone, are available for this analysis. A vehicle departs from and returns to the depot, makes multiple stops, and at any stop has the possibility of launching the drone (one or multiple times) depending on how much time the operator is spending at a location or, more generally, in a neighborhood that involves a bigger cluster of customers.

Your consulting team has gleaned all the above information and has come up with these notes after brainstorming sessions:

- **Task 1:** It may be pertinent to display the customer locations on a map for each of the 5 days and see how scattered (or not) customers may be in this data set.
- **Task 2:** It could be useful to visualize demand data. Maybe this could further the discussion and help determine which customers may be eligible for drone delivery.
- **Task 3:** Determine a delivery policy that is suitable, under demand fluctuation across days:
  - Base benchmark: Drones are not used, all customers are served by vehicle (traditional method).
  - Clearly specify your policy with respect to which customers/orders are drone eligible.
  - Come up with a logic/rules-of-thumb for delivery: which customers to visit by vehicle, in which order, which customers to serve by drone when the vehicle makes a stop at another customer location, etc.
  - Determine metrics by which you will assess the potential benefits of deploying this new technology. You could use time savings, gas savings, environmental impact, etc.
- **Task 4:** Write your consulting report and submit it along with any support materials (excel or otherwise). Your report should be self-contained, well-structured, and pleasant to read. Elaborate on your findings, justify your recommendations, share insights, and highlight areas for future work/analysis (and potential consulting)
- **Task 5:** Give a presentation to ShipEx in which you will elaborate on your findings, justify your recommendations, share insights, and highlight areas for future work/analysis (and potential consulting).