

# ChemCo Distribution Case Study

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## ***Introduction***

ChemCo, a specialty chemical manufacturer, is considering how to best redesign its distribution network in Texas. This decision is especially relevant as the due date approaches for renewing their contracts with several of the 3PL warehouses they are currently using. David, the operations manager for the Texas region, has been actively leading the improvement of their Houston plant to remove bottlenecks in both production and distribution of the chemical products.

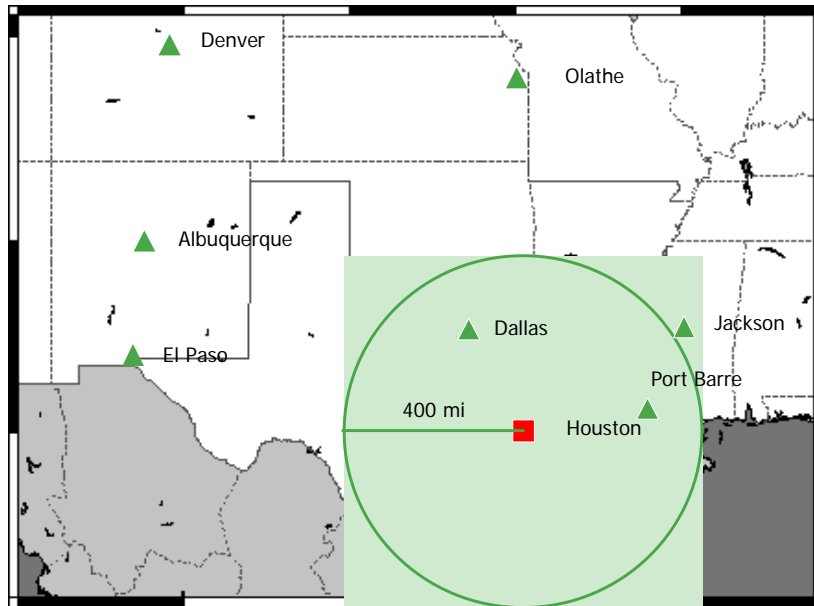
The Houston plant has always been a busy place and demand has had significant growth in the last 5 years. The Houston plant's ability to ship to customers was seriously constrained by congestion in its shipping and receiving area. Two years ago it was common to see a long line of trucks waiting to be loaded in the shipping area, and the associated cost of overtime.

But, by the end of 2004, David had "leaned-out" the plant operations to the point that the shipping area had 30% excess capacity. It was then when he started rethinking the current distribution network design. David wondered if it still made sense to have a separate distribution center in Dallas and, if not, how they would be able to serve those customers.

To help him make a sound decision, David has asked for some supply chain management help. Unfortunately, there is very limited time and data available for the analysis. Your team has been called into help in making a recommendation to David within the next few days.

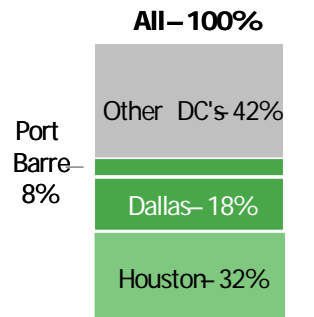
## Background

ChemCo manufactures bulk chemicals used in the construction industry. One plant (Houston) and seven warehouses (Dallas, Port Barre, Jackson, El Paso, Albuquerque, Denver, and Olathe) support company operations in the southwest region of the US, as shown in Exhibit 1. All products are delivered to customers either from one of the seven warehouses or direct from the Houston plant.



**Exhibit 1** Plant and warehouse locations in the southwest region.

Currently, the Houston plant handles the almost a third of all customer deliveries followed by the Dallas warehouse with 18% of all shipments as shown in Exhibit 2.



**Exhibit 2** Delivery contribution by location

All deliveries to customers are made using multi-compartmented bulk as shown in Exhibit 3. Using compartmented vehicles rather than single tank bulk trucks allows ChemCo to deliver several different chemicals to the same, or multiple, customers in the same trip. It is not uncommon for a truck to deliver to multiple customers in the same milk run.

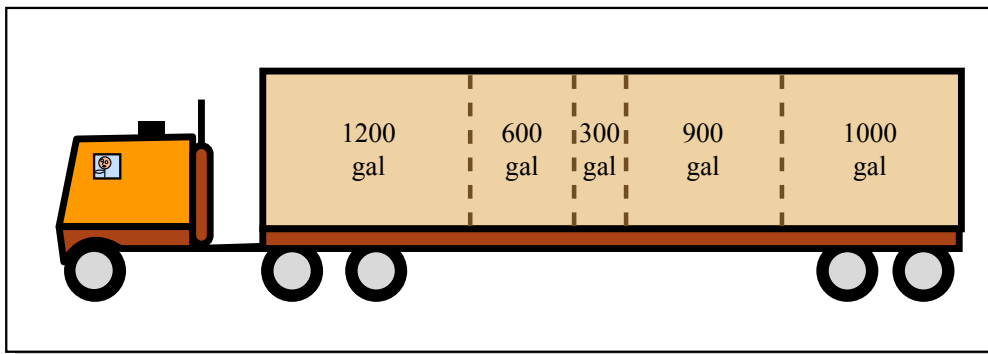


Figure by MIT OCW.

**Exhibit 3** Multi-compartmented bulk tanker truck

All of the warehouses, as well as the Houston plant, hold finished good inventory. These

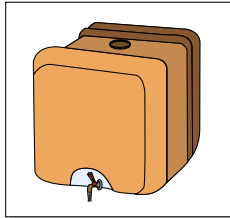
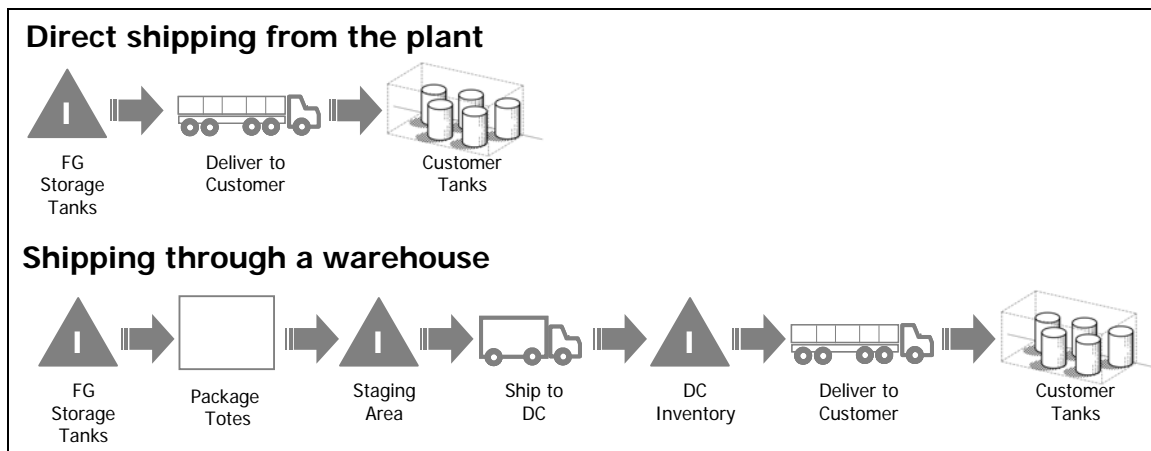


Figure by MIT OCW.

**Exhibit 4** 275 gallon chemical container tote.

warehouse inventories are replenished from the Houston plant using 275 gallon plastic totes, as shown in Exhibit 4. For a company that ships bulk chemicals, it might appear counter-intuitive that warehouse replenishment is made using plastic totes rather than larger single tank bulk trucks. A couple of years ago ChemCo decided to switch from replenishing their warehouses with bulk trucks to totes mainly due to the greater availability of both common dry van transportation and public storage. The public warehouses generally allow storage of chemicals in these totes while restricting (or charging much more for) large fixed tanks. Using totes instead of bulk tanks, however, does involve additional packaging and

handling steps, as illustrated in Exhibit 5.



**Exhibit 5** Operation steps involved in shipping direct from the plant vs. shipping from a warehouse

### **The Dallas Warehouse**

Monty, the logistics supervisor at the Dallas warehouse, explains the details of their operations. “We’ve had 3 drivers since we opened the warehouse in 2000. They work hard and last year alone we drove some 230 thousand miles. The Department of Transportation doesn’t allow more than 60 hours of work per week by driver, and our average is about 54 working hours”. He continued explaining the details, “Our drivers do it all. They load very early at the plant, drive, and unload the chemicals at our customer tanks”.

He also explained that they aggregate and route their shipments into three territories (Northwest, Northeast, and Central) surrounding the Dallas warehouse as shown in Exhibit 6. He commented that the deliveries outside this zone are exceptional and represent a small fraction of the total workload. Each zone is defined as a collection of 3 digit postal code regions as shown in the attached spreadsheet in the tab “routing territories.”

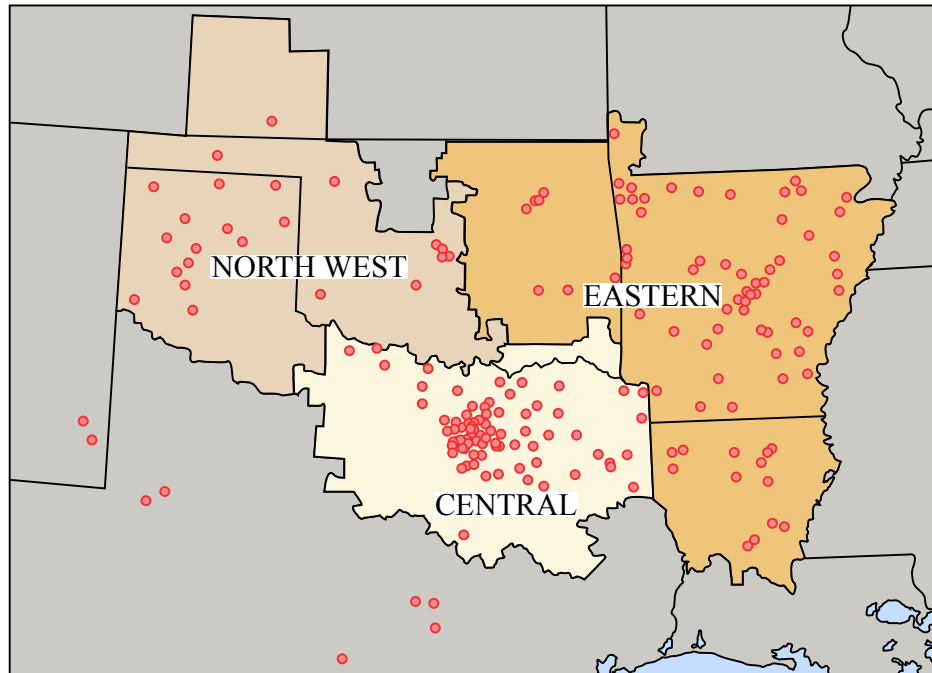


Figure by MIT OCW.

**Exhibit 6** Zones for shipping to customers from the Dallas warehouse.

The attached spreadsheet contains data available for your analysis. There are three tabs.

- Deliveries – This lists the deliveries made to all relevant customers in 2004. The customer ID number, product ID number, delivery date, and quantity are provided for each delivery.
- Customer\_info – This tab contains all of the relevant customers. The customer ID and location is provided. The location is described both as city, state, postal code and latitude/longitude. The latitude/longitude was collected using the website [www.batchgeocode.com](http://www.batchgeocode.com). This data should be checked for any anomalies.
- Routing\_territories – This tab shows the territories that are currently used out of the Dallas warehouse. Also, the 3 digit postal codes that correspond to each of the territories are listed as well.

Neither Monty nor David can provide any more detailed information in time for your analysis. Monty did note that deliveries to customers are made on a weekly planning basis. He estimated that it takes about 45 minutes per stop at each the customer site and an hour and a half to load a 4000-gallon trailer. He also commented that in 2004, for the average trip the trailers were only filled to 80% of their capacity.

For the purpose of this analysis, Dave is willing to make the following additional assumptions. Each driver's salary and benefits are 80 K USD/year. For each driver, a truck and a trailer are dedicated. Currently they have a mixed fleet of trailers with 3, 4 and 5 compartments all with a total tank capacity of 4000 gallons. Trucks are leased at 70K USD/yr and the trailers, which are owned and maintained by the company, have an annual depreciation and maintenance cost of about 80K USD/year.

David explains the replenishment costs associated to supply the Dallas warehouse from the Houston plant. They usually ship dry van trucks with sixteen 275-gallon totes. Each shipment is a round trip where an equal number of empty totes from the warehouse are returned back to the plant. He has a contracted rate of 700 USD per round trip between Dallas and Houston. Totes need to be replaced every 7 turns and each tote costs about 100 USD to replace. The Dallas warehouse lease costs 220 USD/year and is expected to increase 5% next year. Currently, Dallas holds about 80K USD in finished goods inventories on average.

### ***The Challenge***

David is excited by the new opportunities that the 'new found' capacity at his Houston plant has offered. He is optimistic about shipping direct from the Houston plant to the customers currently served from their largest warehouse in Dallas, TX, since both their interplant transportation and warehouse rent have been rising over the last year. However, whether his idea will yield any benefits depend on numerous factors, to include the number of drivers he will need to add in Houston, since transportation is a significant part of the total landed cost.

David has asked your team to draft a short memo (with supporting figures and exhibits if needed) that answers the following questions.

1. What is the current cost of the as-is network? You need to model the current solution. Be sure to provide details as to the cost of transportation, inventory, etc.
2. Should David shut down the Dallas warehouse? Justify your decision with specific estimates of costs, service factor impact, and any other issues that should be considered. Clearly state and justify any assumptions that you are making.
3. Assume that the Dallas Warehouse is shut down.
  - a. How many additional drivers would you recommend David to have in place at the Houston plant to deliver to the customers previously served by the Dallas Warehouse?
  - b. Should the territories be changed? If so, how? Justify your answer.
4. What other considerations should David take into account before making this decision?
5. What additional data and analysis would you like to have in order to make a more detailed recommendation? Be very specific.

### ***References***

Daganzo, Carlos. Logistics Systems Analysis. Third Edition. 1999. Springer-Verlag  
Daganzo, C.F. and Newell, G.F. (1985) "Physical distribution from a warehouse: vehicle coverage and inventory levels", Trans. Res. B 19B(5), 397-408.