Transport at Boîtes Accès Plus[1]

Julie Paquette, associate professor, HEC Montréal
Mouhamed El Fadel Ndoye, consultant, Groupe V2
Jonathan Grondin, director, Groupe V2

Annie Leclerc, a class-of-2000 HEC Montréal graduate, landed her first job in the logistics department at Rona. Having risen the corporate ladder within this large company, she recently moved to a new job at Boites Accès Plus, a medium-sized Quebec based company which has manufactured electrical access boxes for the last 30 years. After being at Boites Accès Plus for just a few weeks, Annie identified several challenges that her department must overcome in the following months. In particular, one of her first goals is to better understand the company's delivery expenses during the last few months, and to try to identify improvement opportunities. To help her with this task, she hired your consulting firm, which specializes in transport and logistics.

Boîtes Accès Plus

Boîtes Accès Plus manufacture a large variety of electrical access boxes. An access box is a small-size wall-mounted housing used to access, for example, the rear of a bulkhead or electric panel. Figure 1 displays a couple of the access boxes sold by Boites Accès Plus. These housings can be manufactured using different materials, such as metal or plastic. They can either have a locking mechanism or not, and can have different hinges. They can also be painted different colors. Finally, these products are available in multiple sizes. Thus, Boites Accès plus offer to its customers over 1800 different products.

Figure 1 : Example of access boxes sold by Boîtes Accès Plus

Boîtes Accès Plus has a manufacturing plant in Montreal (Quebec) and three distribution centers. The first is located next to the manufacturing plant (postal code H3S), and the other two are situated in Mississauga near Toronto, Ontario (postal code L5N) and in

[1] Translated to English by Carolyne Jodoin-Lapierre (carolyne.jodoin-lapierre@hec.ca) and Jorge E. Mendoza (jorge.mendoza@hec.ca).

Abbotsford near Vancouver, British-Colombia (postal code V2S). This distribution network can serve the entire Canadian market.

Boîtes Accès Plus' customers are mostly large retailers like Rona, but the company also caters to general entrepreneurs who build or renew houses. Orders usually include multiple lines (i.e., product references), each ordered, mostly, in large quantities. To ensure an exceptional service level and a short lead time between the moment an order is placed and the moment the product is received by the customer, Boîtes Accès Plus send the product from any warehouse having available stocks. In other words, if a customer orders, for instance, three different products and each product is only available at one of the warehouses, the customer may receive the order in three parts (each coming from a different warehouse). This strategy maximizes the service level but may result in additional costs. Therefore, the company's data base include both a customer purchase order number and an additional internal purchase order number, which is created to manage the products that are part of the same purchase order but are dispatched from different distribution centers.

Current Transport Partners

Boîtes Accès Plus currently use two alternatives (referred to as modes) to transport the products from its distribution centers to its customers: parcel or LTL ("less-than-truckload"). For every order, the decision to use either mode is taken by the transport department based on the total weight and volume of the order. As a matter of fact, to establish the costs of a delivery, the carriers always use the larger value between the actual weight of the shipment and the corresponding dimensional weight. The dimensional weight of a shipment is calculated as follows (all measurements in inches): (length x width x height) / 139. The shipment can be carried out by parcel if its maximum weight does not exceed 150 pounds.

Boîtes Accès Plus use two parcel carriers: Purolator and UPS. Purolator is a Canadian company serving all of Canada. On the other hand, although UPS serves the majority of Canada, it primarily focuses its operation on large urban and sub-urban areas.

For each parcel shipment, a transport analyst determines the least expensive carrier based on their corresponding pricing grids. To determine the cost for each shipment, the analyst must determine the total weight of the shipment and the pricing zone (which is based on the origin and destination). In addition, it is important to take into account the fuel surcharge that must be added to the shipping cost. This fuel surcharge is computed based on the average diesel price (by month for Purolator and by week for UPS, calculated two weeks before the shipping date) and a conversion table tailored to each carrier. All calculations are manually done by the transport analyst using Excel.

Over the years, in order to evaluate its carriers, Boîtes Accès Plus' transport department has monitored two performance indicators: the reliability and the product damage rate. Purolator is known for its reliability with a rate of 97%. The product damage rate is relatively low with only 0.5% of products being harmed during the transport. Historically, UPS has reported a reliability of 98% and a damage rate of 1%. Both companies offer shipment tracking via their websites.

Furthermore, Boîtes Accès Plus use three carriers for LTL shipments: Stewart Logistics, West Transport, and Canada C.L Transport. The transport analyst determines which carrier to use for each shipment by comparing their costs and some qualitative criteria. The freight costs are determined by using the weight of the shipment, and its origin and destination. A fuel surcharge is also added. The latter is based on either the carrier's specific grid or the grid proposed by the Freight Carriers Association of Canada (FCA).

Stewart Logistics is a family owned company established in 1960 in Ontario. The company has a Canadian network made up of 15 terminals, seven of which are situated in Ontario, four in Quebec, and four in Vancouver. Historically, the late delivery rate is only 2% and the product damage rate is under 1%. The company offers shipment tracking across its entire network thanks to its advanced technology.

West Transport is a Canadian company with headquartered in Calgary. The company has a Canadian network of 8 terminals, three of which are situated in British-Columbia, two in Alberta, one in Saskatchewan, one in Manitoba, and one in Ontario (which serves eastern Canada). This company has rapidly grown over the last few years. Three years ago, the late delivery rate was only 3% but it is currently 5%. The product damage rate, on the other hand, has remained stable at 1.5%. This company uses the grid proposed by the FCA to compute its fuel surcharge.

Canada C.J Transport is a Canadian company with an extensive network in Canada and the United States of America. With over forty terminals located in Canada's largest metropolitan areas, they provide an ocean to ocean coverage. Historically, this carrier has a reliability rate of 93% and a product damage rate between 2 and 2.5%. Canada C.J Transport offers limited shipment tracking across its network. This company also applies a fuel surcharge but it is calculated using its own grid (which can be found on their website).

Collected Data

This morning, during your first meeting with miss Leclerc, she provided you with a variety of data, including historical sales for the last six months (December 2017 to May 2018) and the pricing grids of each carrier. The data collected is explained in greater detail in Appendix 1. Information on the formulas and more advanced functions used are also explained in Appendix 2.

Mandate

First, miss Leclerc would like you to analyze the data in order to draw a better picture of the current situation. For example, she would like to be able to answer the following questions:

- What is the sales volume? Is there any demand seasonality?
- What is the importance of each region in terms of sales or number of orders? Are some customers more important than others?
- How many orders was the company able to service and how many orders were shipped from each distribution center?

- What is the average weight, volume, and number of units per order?
- What is the size of the budget associated to the outbound transport costs (for parcel and LTL transport)?

Second, miss Leclerc would like to know if she should give select a PanCanadian carrier or rather select a carrier per region (for each type of shipment — parcel or LTL). Explain in detail your recommendation.

Third, she would like to better assess the tradeoff between the transportation costs and the service level that is currently being given to the customers. In particular, she would like to determine what would happen if the orders where always dispatched from the distribution center that is closest to the customer, independently of stock availability. This could potentially lead to longer lead times, but would most probably reduce the costs. She would like to know:

- What are the potential savings?
- What are the impacts on each of the distribution centers?
- What would be the impacts on the other logistics departments?

Lastly, she would also like you to suggest leads to simplify the decision-making process concerning all the transport activities at Boîtes Accès Plus. For each improvement lead, she would like to receive an estimated budget and implementation timeline.

Appendix 1: Description of the Excel File provided by miss Leclerc

The file « **Data_Boites_Acces_Plus.xlsx** » contains 13 tabs.

The first tab « **Sales** » holds information about the company's sales. It contains 10065 lines, each corresponding to one customer order. The description of the data reported in column follows:

- Column A- Customer order number: purchase order number of the order
- Column B- Internal order number: internal purchase order number created to handle the dispatching of multiple lines from different warehouses.
- Column C – Customer Number: ID of the customer placing the order
- Column D – Product Code: ID of the product
- Column E – Product family: ID of the product family
- Column F – Length (in): length of the package
- Column G – Width (in): width of the package
- Column H – Height (in): height of the package
- Column I – Weight (lbs.): unit weight of product in pounds
- Column J – Billed quantity: product quantity delivered to the customer
- Column K – Market value: value of the shipping
- Column L – Date: shipping date
- Column M – Origin: first three characters of the postal code of the distribution center from which the order was dispatched
- Column N – Destination: first letter of the postal code where the order will be delivered to the customer*

* The first letter of the Canadian postal code refers to a large area within a province or to a whole province as shown in Figure 2.

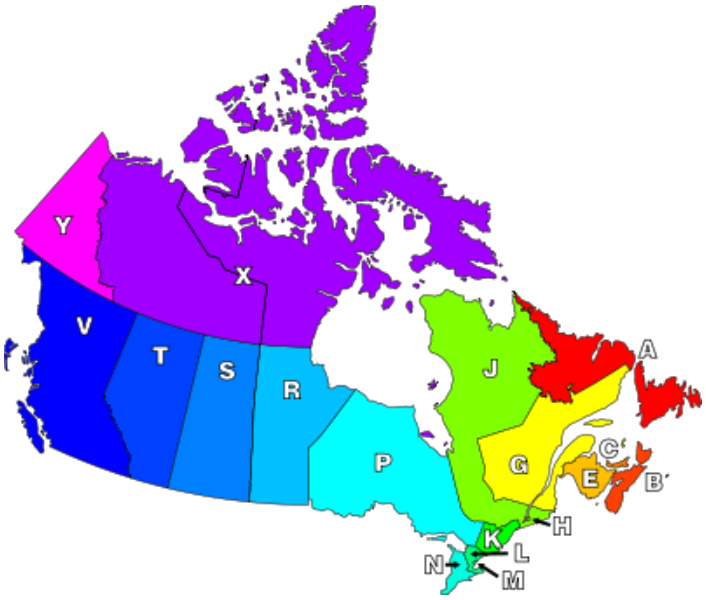

Figure 2: Map of Canada identifying the first letter of the postal code for each area (Reference: Wikipedia)

The « **Diesel_price** » tab contains information about the average weekly and monthly diesel price in Canada. This information is useful for computing the fuel surcharge for parcel deliveries.

The « **Purolator_Zone** » tab contains information about Purolator's zone guide.

To identify the zone to be used to read the pricing grid, we must first identify the first letter of the postal code of the shipment's origin and that of its destination. We can then find the corresponding zone (Ranging from D01 to D16)

For example, the zone corresponding to a shipment from the Montreal distribution center (H) and to a customer situated in area A is D12.

The « **Purolator_Tariffs** » tab contains information on the rates currently offered by Purolator for parcel type deliveries.

The transport cost for a delivery is based on the weight of the delivery and the zone.

For example, the cost for a two-pound delivery in zone D01 is $16.25.

The « **Purolator_Surcharge** » tab contains information on Purolator's fuel surcharge.

The fuel surcharge is added to the transport rate.

Purolator's fuel surcharge is calculated based on the average monthly diesel price in Canada.

For example, for a shipment sent on January 1st, 2018, the corresponding fuel surcharge is 13.5%, because the average diesel price for that month was $1.26. Thus, for a $16.25 shipment, the total final cost is $18.44.

The « **UPS_Zone** » tab contains information about UPS' zone guide.

To identify the zone to be used to read the pricing grid, we must first identify the first letter of the postal code of the shipment's origin and that of its destination. We can then find the corresponding zone (ranging from 200 to 212).

For example, the zone for shipment from the Montreal distribution center (H) to a customer situated in area A, is 211.

The « **UPS_ Tariffs** » tab contains information on the rates currently offered by UPS for parcel type deliveries.

The transport cost for a delivery is based on the weight of the delivery and the zone.

For example, the cost for a two-pound delivery in zone 200 is $16.85.

The « **UPS_Surcharge** » tab contains information on UPS's fuel surcharge.

The fuel surcharge is added to the transport rate.

UPS calculates the fuel surcharge based on the average weekly diesel price in Canada two weeks prior to the shipping date.

For example, for a shipment sent on January 1st, 2018, the fuel surcharge is 14.5%, because the average diesel price for the week of December 18th, 2017 was $ 1.22. Thus, for $16.25 shipment the total final transport cost is $18.61.

The « **Stewart_Logistics_Tariffs** » tab contains information on the current LTL rates proposed by Stewart Logistics.

The transport cost, for every hundred pounds of a shipment, is based on its origin, destination, and weight.

When the transportation cost, computed based on the shipment's weight, is less than the minimum fare, the minimum fare is applied.

For example:

If we want to ship 200 pounds from the Montreal distribution center to a customer located in zone A, then, we have to pay 2 x $48.81 = $97.62

If we want to ship 175 pounds from the Montreal distribution center to a customer located in zone B, then, we have to pay $55.18 because 1.75 x $20.34 = $35.60 is less than the minimum fare ($55.18).

If we want to ship 4800 pounds from the Montreal distribution center to a customer located in zone A, we theoretically have to pay 48 x $46.69 = $2,241.12. However, the carrier would allow us to pay $2,201 by granting us access to the next price interval, i.e. 50 x $44.02 = $2,201.

The « **West_Transport_Tariffs**» tab contains information on the current imposed rates for LTL type deliveries conducted by West Transport.

The transport cost, for every hundred pounds of a shipment, is based on its origin, destination, and weight.

When the transportation cost, computed based on the shipment's weight, is less than the minimum fare, the minimum fare is applied.

For example:

If we want to ship 1000 pounds from the Montreal distribution center to a customer located in Zone A, then, we would have to pay 10 x $51.0 = $510.50.

If we want to ship 200 pounds from the Montreal distribution center to a customer located in Zone B, then, we will have to pay $66.34, because 2 x $20.91 = $41.82 is less than the minimum fare ($66.34).

If we want to ship 9600 pounds from the Montreal distribution center to a customer located in Zone A, we theoretically have to pay 96 x $46.68 = $4,481.28. However, the carrier would allow us to pay $4,472 by granting us access to the next price interval, i.e. 100 x $44.72 = $4,472.

The « **Canada_CJ_Tariffs**» tab contains information on the current LTL rates proposed by Canada C.J. Transport.

The transport cost, for every hundred pounds of a shipment, is based on its origin, destination, and weight.

When the transportation cost, computed based on the shipment's weight, is less than the minimum fare, the minimum fare is applied.

For example:

If we want to ship 5500 pounds from the Montreal distribution center to a customer located in Zone A, then, we have to pay 55 x $19.79 = $1,033.45.

If we want to ship 200 pounds from the Montreal distribution center to a customer located in Zone B, then, we have to pay $88.40 because, 2 x $26.66 = $ 53.31 is less than the minimum fare ($88.40).

If we want to ship 19200 pounds from the Montreal distribution center to a customer located in Zone A, theoretically we would have to pay 192 x $17.25 = $3350.40. However, the carrier would allow us to pay $3,334 by granting us access to the next price interval, i.e. 192 x $44.72 = $3,334.

The « **FCA_Surcharge** » tab contains information on the fuel surcharge suggested by the Freight Carriers Association Canada (FCA).

This information is useful for computing the fuel surcharge for the LTL shipments performed by Stewart Logistics and West Transport.

The « **Canada_CJ_ Surcharge** » tab contains information on the fuel surcharge used by Canada C.J. Logistics.

This information is useful for computing the fuel surcharge for the LTL shipments performed by this carrier.

Appendix 2: Useful excel functions

roundup(COLUMN;1): rounds up the number in the column to the next integer.

concatenate(COLUMN_1; COLUMN_2): appends the string COLUMN_2 to COLUMN_2. For instance, if you call the function =concatenate("Hello"," ","world"), the results is a single string with value "Hello world".

right(COLUMN;NUMBER): extracts the rightmost NUMBER characters from the string or number in COLUMN. For instance, right("hello",2) returns characters "lo".

left(COLUMN;NUMBER): extracts the leftmost NUMBER characters from the expression or number in COLUMN. For instance, left("hello",2) returns characters "he".

vlookup(LOOKUP_VALUE; TABLE_ARRAY; COL_INDEX_NUMBER; RANGE_LOOKUP)

where:

LOOKUP_VALUE: the value that we are looking in the first column of a table.

TABLE_ARRAY: the table in which we are looking for the value (the values in the first column must be sorted from A to Z.

COL_INDEX_NUMBER: corresponds to the column of the array for which the value is returned

RANGE_LOOKUP: Leave blank

Example:

LINE	COLUMN A	COLUMN B	COLUMN C
1	Shipment Weight (pounds)	D01	D02
2	1	$ 16.15	$ 20.65
3	2	$ 16.25	$ 21.25
4	3	$ 16.35	$ 21.55
5	4	$ 16.50	$ 21.90
6	5	$ 16.60	$ 22.40

LINE	COLUMN E	COLUMN F	COLUMN G
1	Weight to use	Zone	Cost
2	3	D01	=vlookup(…)
3	2	D02	=vlookup(…)
4	5	D01	=vlookup(…)

= vlookup(E2;A2:A6;if(F2="D01";2;3);)

Here, we want to send the value from Column B if the Zone is D01 and the value from Column C if the zone if D02.