

***The power of finding the best solution, on a large or small scale.***

2019 Young International Freight Forwarder of the Year Dissertation

## 1. Executive Summary

This paper will be looking at two very distinct shipments, both with their unique levels of complexity and risk. The first will be an import move and the second an export. The Manitoba Hydro Keeyask Generator is a large scale project, which started in 2014 and is expected to be completed in 2020 (Keeyask, 2018.). The purpose is to find the best way of transporting Full Containers (FCL) and Break Bulk pieces from suppliers in Europe (Germany, Belgium and the Netherlands) to the project site in Northern Manitoba, Canada. The move will be broken down into two parts.

- 1) Options for transporting the standard FCL liner shipping containers
  - a) Trans-load containers in Winnipeg truck to site
  - b) Direct truck containers to site from Winnipeg
- 2) Options for shipping the Break Bulk
  - a) Partial charter vessel into Thunder Bay
  - b) Break bulk liner into Hamilton

The export component of the project will be using air freight to transport laptops containing batteries, and replacement batteries. They will be shipped to a small city in Peru. Due to the nature of shipping Dangerous Goods (DG), this move will be broken down into two parts.

- 1) Passenger cargo shipping laptops containing batteries
- 2) Cargo plane shipping replacement batteries

For both moves, variables such as cost, transit time, risk and environmental impact will be compared. The conclusion will be based on the facts presented and information received.

*\* Disclaimer: All pricing contained within this paper is for illustrative purposes only, providing a realistic indication. The companies mentioned in this project are my choices as preferred carriers, based on their experience handling this type of cargo. These moves are just examples and not actual moves I have done or taken part in.*

Locations mentioned throughout the paper:

Antwerp, Belgium

Hamburg, Germany

Montreal, Quebec, Canada

Halifax, Nova Scotia, Canada

Hamilton, Ontario, Canada

Thunder Bay, Ontario, Canada

Winnipeg, Manitoba, Canada

Gillam, Manitoba, Canada

Cleveland, Ohio, United States

Mississauga, Ontario, Canada (YYZ)

Lima, Peru (LIM)

Panama City, Panama (PTY)

Hamilton, Ontario, Canada (YHM)

Miami, USA (MIA)

Ayacucho, Peru

Pisco, Peru

## **Acknowledgements**

*I'd like to give a special thanks to the following individuals below for their guidance and support. They are my primary sources of information.*

Peter Attardi- Business Support Representative Panalpina

Oswin Paes- Head of Energy & Project Solutions Panalpina

Cyril Rodrigues- Project Coordinator Panalpina

Scott Dawkins- Country Head of Customs Panalpina

Jan Van den Borne- Regional Trade Lane Manager Transatlantic Panalpina Germany

Marilyn Comrie- Country Insurance Manager Panalpina

Ban Wu- Regional QHSE Competence Centre Manager Panalpina

Pauline Lau- Air Export Agent, Country Air Freight Product Panalpina

Danny Li- Country Product Manager Air Freight Panalpina

Mark Kichiy- Customer Service Air Export, Air Export Panalpina

Mathew McGee- Air Export Agent, Air Export Panalpina

Alberto Uribe- Country Head of Perishable Panalpina Peru

Giuliana Martinez- Air Import Coordinator Peru

Martin Gonzalez- Country IV Manager Perishables Canada

Kelvin Castelino- VP of Sales at CNB Computers

Larry Palmer- DG Consultant at DGC Logistics

Fred Grootarz- Arco Navigation

*Secondary sources are listed in the References.*

## **Table of Contents**

### **Import shipment**

2. Overview of the project.....	8
3. Mode of transport for FCL component.....	8
3.1 Liner containers versus shippers .....	8
3.2 Sailing schedule.....	9
3.3 Inland transport.....	9
4. Mode of transport for break bulk .....	11
4.1 Partial charter.....	11
4.2 Break bulk liner.....	12
4.3 Inland transport.....	13
5. Import customs and documentation formalities.....	15
5.1 Duty- CETA.....	15
6. Insurance.....	16
6.1 Risk analysis.....	16
7. Final costing of the move .....	17
8. Recommendation for import move.....	18

### **Export shipment**

9. Overview of the move.....	19
10. Preparation of the cargo.....	20
10.1 Packaging and Labelling for Laptops (UN3481).....	20
10.2 Packaging and Labelling for Lithium Ion Batteries (UN3480).....	21
11. Canada export customs.....	22
12. Mode of transport for Laptops- Passenger cargo.....	22
13. Mode of transportation for Batteries- Cargo aircraft.....	24
14. Peru import customs and documentation.....	25
15. Final delivery.....	25
16. Risk analysis.....	26

16.1 Causes of Lithium-Ion battery explosions .....	26
16.2. Mitigation strategies .....	26
17. Final costing of the move.....	27
18. Recommendation for export move.....	28
19. Environmental impact evaluation.....	28
20. Final conclusion.....	29
Appendix.....	30
Reference List.....	37

## **Import Shipment**

### **2. Overview of the project**

Important items to take note of before any project are the terms of shipping. In this case it's Free On Board (FOB), so the port-door component of this move will be analyzed. We will however outline certain assumptions regarding the shippers' responsibility as needed. Shipping will be from port of Hamburg/Antwerp to the Keeyask site location, 725 km northeast of Winnipeg. The freight consists of FCL standard 5x20' and 10x40' containers as well as 37 break bulk pieces. For simplicity, the move will be looked at in two parts, which will be handled separately and quite differently. Regarding the timeline we will have cargo ready from April to June 2019. It's mentioned shippers will not have all cargo ready at exactly the same time, so needs to be staggered.

### **3. Mode of transport for FCL component**

The port of choice to ship from the Port of Hamburg. As the incoterm is FOB, the exact locations of the shippers hasn't been provided. There is no strategy for this choice but typically we try to book cargo to the closest port for the shipper. Port of Antwerp and Hamburg are similarly priced. OOCL will be used as the carrier of choice for this example. The routing will be for Hamburg to Winnipeg, via Montreal. The carrier places containers directly onto rail at the Montreal port.

#### *3.1 Liner containers versus shippers*

For this component of the project, it's important to first consider the pros and cons of using liner containers or shipper owned containers (SOCs). An article from *Container Services International* outlines risks of liner containers as destination

demurrage as well as origin detention. Questions that need to be asked are, how much time is needed for; loading, customs clearance, transit time to site and de-stuffing (Howard, n.d.).

Pros:

- Not having to pay any detention or demurrage
- Use the SOC's as storage on the project site until the pieces are used

Cons:

- In Hamburg, these 15 containers will cost EUR 20,625 (Van den Borne, personal communication, December 12, 2018)

### *3.2 Sailing schedule*

It's recommended to stagger the containers since the suppliers cannot load at the same time and likely the unloading at site will need to be limited as well. Based on the OOCL sailing schedule, there are 2 vessel departures from Hamburg per week with 14 and 17 day transit times. The 15 containers can be staggered over 2-4 sailings (see Figure 1). We can start shipping in April, as the break bulk will need to go at the end of June, which will be addressed further in section 4.

### *3.3 Inland transport (in USD per container)*

Two options are available for the final leg delivery. We can trans-load the containers in Winnipeg, or directly truck them to site. Rail is not an option from Winnipeg. The cost is broken down as follows:

Service	Option 1: trans-load in WNP	Option 2: direct truck
20'/40' FOB HAM/ANR to WNP	\$2,970/\$4,045	\$2,970/\$4,045
Container delivery from WNP to Gillam	-	\$2,100
Pickup WNP rail to CFS WNP	\$250	-
Trans-load 20'/40'	\$500/\$650	-
Flat-bed truck with tarp	\$1,175	-
Total per container:	\$4,895/\$6,120	\$5,070/\$6,145
Total 15 containers:	\$85,675	\$86,800
Transit time	3-4days	2 days

Demurrage (while cargo is in container): 3 free working days from date of arrival to date of pickup. The cost for calendar day 4 to 8 is USD 140 per container. Detention (while container is empty): 4 free working days from pickup date to return empty. The cost for calendar day 5 to 8 is USD 140 per container. (Attardi, personal communication, December 11, 2018)

*Recommended Choice:*

Liner containers rather than SOCs and trans-load rather than direct truck options:

- Trans-load: we don't run the risk of incurring detention if unloading at the site and return of empty exceeds the 4 free working days. Given the transit time to get to the site is 2 days, we will likely be charged detention with the direct truck option.
- Liner containers because it's not confirmed that storage at the site is something needed. Also since we are trans-loading, detention is avoided.
- *Transit time and cost:* longer by 1-2 days, however we save \$1,125, and the risk of detention charges
- *Risk:* more handling involved with trans-load, so the cargo needs to be easy to load and unload

#### **4. Mode of transport for break bulk**

There are two options for transporting the break bulk components: A partial charter, and a break bulk liner. Geographically, the closest port to the project site is Port of Churchill. This would be the most ideal port to ship to, however it's only recently been back in operation after severe flooding. It's stated that freight and passenger services are expected to resume December 2018, and heavier loads beginning spring 2019 (Young, 2018). There is no certainty it will be fully operational and that it could handle this cargo. Given this information, two other viable options via Thunder Bay and Hamilton ports will be explored.

##### *4.1 Partial charter*

Spleithof will be the carrier of choice for this service. They have a service going from the port of Antwerp, Belgium to Cleveland twice a month. A request to charter the ship further to port of Thunder Bay is an option. We would need to use the "Long-Term T/C vessel" type. (see Figure 2) This vessel is Great Lakes fitted. This is critical as the Great Lakes are not like oceans, as they can freeze. The other important element is the deck cranes on board. There are 2 cranes capable of lifting 150 MT each (Spleithof, 2016). Having these cranes on the vessel itself eliminates the need to use the port cranes. This is necessary, as the Port of Thunder Bay does not have a crane that can lift over 104 MT (Port of Thunder Bay, 2018). It was confirmed directly with the port of Thunder Bay that this crane cannot handle a 105 MT transformer (Port of Thunder Bay, phone communication, January 3, 2019). Port of Thunder Bay is the closest port to the job site, which has major infrastructure in place to handle project cargo.

- Vessel Cost: USD \$800,000
- Transit time: Antwerp to Thunder Bay 19-22 days

#### *4.2 Break bulk liner*

The liner Fednav will be used as an example for this service. They have a regular twice monthly service from Port of Antwerp to Port of Hamilton (Fednav, 2018).

Hamilton, situated in SW Ontario, is closer to the final site, making it a convenient port of choice compared to other highly used ports such as Montreal and Halifax. It removes need for additional road permits/escorts trucking through the province of Quebec for example. Also more handling is required from Halifax specifically as this is a Ro-Ro port call. Also these are popular container ports with more congestion.

*Cranes:* Based on the liner Fednav, their vessels are equipped with cranes capable of handling 30-36MT based on the upcoming vessel schedule. This will not be suitable for loading the Shaft at 46MT and Transformers 105MT each. Port of Antwerp has an excellent infrastructure to handle break bulk cargo. They have an 800MT floating crane, twin lifts up to 224MT (Port of Antwerp, 2014). For offloading, the infrastructure at the Hamilton port is perfect for break bulk cargo. There is a 110 MT single shore crane lift, 200+ MT tandem shore crane lift, Forklift and reach stacker fleet: 5000-65,000lb capacity, and Ro-ro ramp and truck scale (Hamilton Port Authority, 2018.). Note however there would be an additional cost for port crane usage. Given the size of the loads, two 4 hour shifts would suffice. This cost would be \$6000 CAD for 8 hours.

- Vessel Cost: USD \$500,000
- Transit time: Antwerp to Hamilton 18-20 days

### *4.3 Inland transport*

The transformers are too heavy to be transported by road, so will need to be railed to the Limestone Generator Station or Gillam and then be transported back down to the Keeyask Site from there (see Figure 3). Both ports allow for direct discharge loading to rail, so we can load all 7 transformers. We will use the CN-HBRY (Canadian National Railway - Hudson Bay Railway) routing (see Figure 4). When unloading from the port, we will use cranes, jack & slide and hydraulic goldhofer (see Figure 5) to maneuver the cargo onto rail and trucks (Rodrigues, personal communication, December 21, 2018).

It's important to mention Manitoba's Spring Road Restrictions (SRR) Program during this time period. This is enforced every year to protect the surfaced pavements from damage, limiting the allowable axle weights during this time. Manitoba is divided into 3 zones. The project site is located in zone 3. If we truck from Winnipeg, they will cross all 3 zones (Figure 6). There are a network of roads running through all 3 zones that are normal loading (not restricted) and gravel road. Truckers will need to stay on these roads during March 1-June 10. (Figure 7). For the containerized cargo, this was not an issue as the loads are not heavy compared to these break bulk pieces. We need to ensure they are shipped later in June so that they arrive in July, which is past the SRR season.

Pricing for is as follows:

## Road

Break Bulk Pieces	Equipment	Port of Thunder Bay (CAD)	Port of Hamilton (CAD)
7 Transformers Trucking portion	12 Line Multi Axle (7 loads)	\$102,500 each (\$717,500)	\$102,500 each (\$717,500)
1 Generator Shaft	4 Axle Step Deck	\$8,525	\$12,500
4 Stator Frames	Step Deck (4 loads)	\$7,975 each (\$31,900)	\$11,500 each (\$46,000)
4 Rotor Hub Stations	4 Axle Step Deck (4 loads)	\$24,062 each (\$96,248)	\$24,700 each (\$98,800)
12 Guide Sections	4 Axle Step Deck (6 loads)	\$18,425 per 2 (\$110,550)	\$22,110 per 2 (\$132,660)
1 Shaft	6 Axle Step Deck	\$21,725	\$28,500
4 Stator Rings	4 Axle Step Deck (4 loads)	\$16,225 each (\$64,900)	\$17,700 each (\$70,800)
4 Head Sections	6 Axle Step Deck (4 loads)	\$18,800 each (\$75,200)	\$20,075 each (\$80,300)
<b>Total</b>	-	<b>\$1,126,548/ USD \$844,911</b>	<b>\$1,187,060/ USD \$890,295</b>
<b>Transit Time</b>	-	<b>3 days</b>	<b>5 days</b>

\*Permits/escort cost included

## Rail

Break Bulk Pieces	Equipment	Port of Thunder Bay (CAD)	Port of Hamilton (CAD)
7 Transformers Railing potion	Heavy Duty 8 Axle Railcars (7 loads)	\$195,000 each (\$1,365,000/ USD \$1,023,750)	\$215,000 each (\$1,505,000/ USD \$1,128,750)
<b>Transit Time</b>	-	<b>7-14 days</b>	<b>14-21 days</b>

*Recommended Choice: Partial Charter*

- Thunder Bay is physically closer to the site, lowering the distance for final leg
- It's preferred to use vessels with their on board equipment. The risk of a port crane not being usable due to a breakdown for example would cost in delays from the carriers (truckers and vessels) could be astronomical.
- *Transit time:* Thunder Bay 29-39 days and Hamilton 37-46 days

- Cost: Thunder Bay USD \$2,668,661 and Hamilton USD \$2,523,545.

Although the liner option to Thunder Bay is more expensive, it's preferred because of the points listed above regarding transit time, proximity to site and equipment.

## **5. Import customs and documentation formalities**

The customs broker (in-house or external) is responsible for submitting the customs entry to the CBSA (Canada Border Services Agency) for customs release of the goods and final accounting. The information reported to CBSA is extracted from the commercial invoice, house bill, packing list and any relevant documentation, i.e. CETA (Canada-European Union (EU) Comprehensive Economic and Trade Agreement) origin declaration (if applicable). Regarding the ACI reporting, freight forwarders must electronically transmit advance house bill data on consolidated freight to the CBSA. The CBSA must receive and validate data within the time frames specified. In this case, for marine it's 24 hours in advance sailing (CBSA, 2018). In order to mitigate issues with the CBSA, it's also important to identify who the Importer of Record (IOR) is, ensuring they are registered and have a B/N (business number). First time importers run a higher risk of being targeted for a customs exam. It's important to file the customs entry (for release of goods) with the CBSA once the manifest is received from the carrier (Dawkins, personal communication, December 24, 2018).

### *5.1 Duty- CETA*

CETA is a trade agreement between Canada and the EU, which came into force on September 21, 2017. Looking at examples of HS codes, *Heading 8504. Electrical transformers, static converters (for example, rectifiers) and inductors*, are duty free

under the MFN (Most Favored Nation) tariff treatment. If any of the items being imported are not duty free under MFN tariff treatment, the CETA tariff treatment should be applied, providing the CETA origin declaration is included (see Figure 8) (Government of Canada, 2017).

## **6. Insurance**

It has been confirmed that the value of cargo is USD 7.5 million for the break bulk pieces and USD 200,000 for the containerized cargo. Every effort must be made to mitigate risk of damage. There is a minimum carrier liability, however given the high value of this cargo, it's advisable to purchase third party insurance. Also according to an insurance provider, it's a requirement for a project of this value, to have a qualified surveyor at every loading and unloading of the break bulk goods (Comrie, personal communication December 20, 2018). The insurance premium and surveyor fee will be included in the final job costing in section 7.

### *6.1 Risk analysis*

Much of our risk analysis and mitigation strategy lies at the point of origin with the suppliers. While the shipping terms are FOB, and the responsibility lies with the shippers for proper packaging, it's important to point out these responsibilities as it would mitigate potential damage on route.

- Cargo must be secure to withstand the most severe conditions which it would be exposed to during the journey. Incidents in transport are attributed to poor practices in the packing of cargo transport units, including inadequate securing of

the cargo within the cargo transport units, overloading and incorrect declaration of contents (International Maritime Organization, 2018).

- For containerized cargo, proper block and bracing with treated lumber is essential (see Figure 9). Also proper crating and skids are needed for safe loading and unloading.
- Transformers: Although outside of the scope of this project, the design of the transformers is an important part of the risk analysis. The placement of lift and lashing points should be 2 per side which equate at least 50% of the weight of the transformer (Allianz Global Corporate & Specialty SE, 2017, pg.4). The voyage will be using multiple modes of transport, so the transformers need to be built to accept different levels of ‘g’ forces for road, rail, barge, etc. (Allianz Global Corporate & Specialty SE, 2017, pg.7).

## 7. Final costing of the entire move

<b>FCL trans-load from Winnipeg</b>	<b>Cost (USD)</b>
20’/40’ FOB HAM/ANR to WNP	\$2,970/\$4,045 per
Delivery from WNP to site	\$4,895/\$6,120 per
Total 15 containers	<u>\$85,675</u>
<b>Break Bulk</b>	
FOB Partial Charter to Thunder Bay	\$800,000
Trucking to site	\$844,911
Rail of transformers to Limestone Generator Station	\$1,023,750
Total 37 pieces	<u>\$2,668,661</u>
Insurance premium \$0.25/\$100: CIF value + 10%	\$28,821
Surveyors (7 total days: 2 loading Antwerp, 2 loading Thunder Bay, 2 loading at site, ½ day preplanning, ½ day report write up)	\$7,000
Customs Entry \$55/bl	\$110
<b>Grand total</b>	<b>\$2,790,267</b>

## **8. Recommendation for import move**

This paper presented options and recommendations for the FCL and Break Bulk components of this move. For the containers, it's recommended to move them from port of Hamburg using liner containers to Winnipeg. From there we will trans-load cargo from the containers onto flat beds with tarps to the job site. For the break bulk, it's recommended to move them from Antwerp on a partial charter vessel to Thunder Bay. From there we will truck them to the site. The 7 transformers are too heavy and need to be railed to a closer location such as Gillam or the Limestone Generator station. From there they can be trucked. Typically more communication with the customer and their requirements (deadlines, time for offloading, need for storage at the site) is needed to provide a custom solution, however assumptions have been made.

## Export Shipment

### 9. Overview of the move

A customer of CNB Computers, in Mississauga, Canada would like to purchase refurbished laptops and replacement batteries to send to Peru. There is a university in a small city called Ayacucho located about 570km from Lima (Figure 15). This is a relatively new university that opened in 2010. The laptops are being sent to the engineering department, to provide students with more up to date equipment that will be able to run advanced and newer software programs. This location presents challenges with logistics and security. The terms will be Delivered Duty Paid (DDP). CNB commonly exports refurbished laptops from Canada to many regions in the world, for use in education, government, not-for-profit, etc. The main region for exporting is the Middle-East, which is a hub to Africa. The second largest is Europe, for example the UK and the third region is Latin America. (Castelino, personal communication, March 27, 2019). There will be 10 laptops, with their batteries, and 5 replacement batteries. Due to regulations of shipping lithium ion batteries, we will need to dissect this move into two parts. One with the laptops and one with the batteries.

Before we delve into the logistics, some important facts about lithium batteries will be outlined. These are classified as Class 9, Miscellaneous Dangerous Goods. There are two types of batteries, Lithium Ion which is a rechargeable type of battery and Lithium Metal which is not. The IATA (International Air Transport Association) association, classifies batteries, so they are universally recognized. Lithium ion batteries “contained in equipment” are UN3481 and lithium ion batteries only are UN3480 (IATA, 2018, p.4).

## **10. Preparation of the cargo**

CNB computers, is the shipper and will arrange delivery of the 10 laptops and 5 replacement batteries to a third party company called DGC Logistics. They specialize in preparation of DG to ship via air, ocean and road freight, ensuring it's compliant with current IATA, IMDG and TDG regulations. They complete the Dangerous Goods Declarations, regulatory compliant packaging, on-site inspections and labelling (Palmer, personal communication, March 13, 2019). Due to the complexity of shipping DG, many shippers rely on these third party companies for their expertise.

### *10.1 Packaging and Labelling for Laptops (UN3481)*

DGC will package the 10 laptops, which are all the same model and packaged into an overpack. This means all units are enclosed in one handling unit. They need to be properly packed, marked and labelled, and must not contain packages enclosing different substances which might react dangerously with other packages. An overpack should be marked with the word "overpack" in lettering 12mm high. In addition, a label required is the Lithium Battery Mark (Figure 11). (International Air Transport Association, 2018, p.627). The removable batteries will be weighed separately, as there is a weight limitation per piece of 5kg per battery. A Shipper's Declaration for Dangerous Goods is not required. The air waybill must indicate "Lithium ion batteries in compliance with Section II of PI 267" (International Air Transport Association, 2018, p.626).

## *10.2 Packaging and Labelling for Lithium Ion Batteries (UN 3480)*

DGC will package the 5 replacement batteries into a box. They need to be separated with blister pack, cushioning and cardboard dividers to prevent short circuits and damage to terminals. They must also be packed in a rigid outer packaging (Figure 13). It's critical to ensure that the state of charge (SoC) of the batteries does not exceed 30% of their rated capacity (International Air Transport Association, 2018, p.619). This would either be confirmed by the shipper on the Shippers Declaration which would include the certification statement or can be verified by DGC if there is an indicator on the battery (Palmer, personal communication, March 13, 2019). The weight limitation per package is 35kg, which this shipment is well under (International Air Transport Association, 2018, p.619). Labels required are the Class 9 hazard label (note there is a new label, effective January 1, 2019 that needs to be used, see Figure 10) and the Cargo Aircraft Only label (Figure 12) (IATA, 2018, p.8).

Once DGC has completed everything, delivery from their location will be arranged by truck to our warehouse, where we screen and process all airfreight before delivering to the Toronto Pearson Airport (YYZ). We will verify weight, dimensions, labels, packaging, screen, and DG declaration ensuring what the shipper declares corresponds. Once we as the freight forwarder have done our due diligence, we arrange delivery to the airport. When transporting by truck, no DG placard needs to be located on the truck as the shipment is below 500 kg (Kichiy, personal communication, April 2, 2019).

## **11. Canada export customs**

In regards to export formalities in Canada, we complete a B13 or file electronically on CAED (Canadian Automated Export Declaration) on behalf of the shipper. Sometimes, the shippers complete this themselves. This export declaration needs to be submitted a minimum of 2 hours before goods are loaded for Air moves. When following export procedures we must ensure the goods are not restricted, controlled or prohibited. If they are restricted or controlled, an export permit would be required. Additionally, it must be verified that there is not any US origin goods or technology. If there is, then the US Export Administration Regulations (EAR) needs to be adhered to as well; plus general export permit #12 must be quoted on the export declaration and paperwork. The items being exported, and the recipient country for this exercise, are not restricted or controlled and therefore do not require a permit according to Global Affairs Canada. Additionally, there is not any US content of technology in the laptops or batteries (Dawkins, personal communication, April 10, 2019).

## **12. Mode of transport for Laptops- Passenger cargo**

There are a few options of passenger planes that travel to Lima, which will take laptops as cargo. Before looking for carrier options, the IATA DG regulations guide outlines a number of carriers who have variations to be aware of, that may not accept such cargo. When considering carriers which are able to take this cargo, we will look at the best price and the best transit time. One option is using Copa Airlines, which departs from YHM to LIM via PTY. The price for this option is the most attractive as per chart below. The second option is Air Canada, which departs YYZ to LIM direct. The price is not as attractive as the Copa Airlines option, however the transit time is better.

While sourcing this information unfortunately, news broke on March 13 that all Boeing 737 Max planes have been grounded due to the crash of one of the same model jets, which crashed in Ethiopia, killing all passengers and crew on board (Mutzabaugh, 2019, March 13). The first choice was Copa Airlines, since the cargo is not critical and the extra transit time is acceptable by the customer. Unfortunately they were using the Boeing 737 Max for this routing. It's recommend we use the Air Canada option given the unforeseen situation that arose. As a forwarder, it's critical we have other options available, so this will not impact the movement shipment. In general, uncontrollable factors such as extreme weather, and political unrest as well can directly impact the way freight forwarders move cargo so it's always important to be up to date on current affairs.

<b>10 Laptops (UN3481)</b>	<b>Copa Airlines CM (CAD)</b>	<b>Air Canada AC (CAD)</b>
Origin charges -Outbound Handling \$57.50 -Screening \$20 -B13 \$25 -Air waybill \$30 -OTC \$15 -Pickup \$40 -Lithium battery ELI \$30	\$217.50	\$217.50
Air freight (min. 100kg)	\$212	\$274
Destination charges -Arrival airline \$227.57 -Inbound handling \$200.8 -E-data \$13.39 -DTC \$401.60 -Import customs \$455.14	\$1,298.50	\$1,298.50
<b>Grand total</b>	<b>\$1,861.87</b>	<b>\$1,923.87</b>
<b>Transit time door to airport</b>	2-3 days connection in PTY	1-2 days direct

### 13. Mode of transport for Batteries- Cargo aircraft

Similarly to the laptops, there are two options for the batteries using cargo freighters. The number of freighters coming out to YYZ is not many. The first option is Cargo Jet, which is a weekly service out of YYZ to LIM via MIA. Miami is the world's largest gateway to Latin America & the Caribbean, controlling the north & south cargo flows in the Western Hemisphere. They handle 84% of all air imports and 81% of all exports from the Latin American and Caribbean region (Miami International Airport, n.d.). This option is the most favourable in terms of price and transit time. A second option that was explored was trucking to the Miami gateway, where there are multiple options of cargo freighters going to Lima. This is a more expensive option mainly due to the trucking cost from Toronto to Miami, for such a small shipment.

<b>5 Batteries (UN3480)</b>	<b>Cargo Jet (CAD)</b>	<b>Miami Gateway (CAD)</b>
Origin charges -Outbound Handling \$57.50 -Screening \$20 -B13 \$25 -Air waybill \$30 -OTC \$15 -Pickup \$80 -DG Charge-\$65	\$292.50	\$301.62
Trucking to MIA	-	\$370
Air freight (min. 100kg)	\$225	\$147.15
Destination charges -Arrival airline \$227.57 -Inbound handling \$200.8 -E-data \$13.39 -DTC \$401.60 -Import customs \$455.14	\$1,298.50	\$1,298.57
<b>Grand total</b>	<b>\$1,949.87</b>	<b>\$2,251.14</b>
<b>Transit time door to airport</b>	2-3 days connection MIA	5 days (truck to MIA+air)

#### **14. Peru import customs and documentation**

In order to customs clear the goods in Peru, our Peru office has set up an account for the consignee. For imports, Customs (SUNAT) requires a Customs Merchandise Declaration (DAM – in Spanish), a commercial invoice, an airway bill, a packing list, and an insurance letter (Export.gov, 2018, June 11). In regards to duty, as per the HS codes, they are classified as duty-free. They are however subject to an 18% IGV (tax). The HS code for the laptops requires us to obtain authorization to import by the MTC (Ministry of Transportation and Communication) in Peru (Martinez, personal communication, April 21, 2019).

#### **15. Final delivery**

For the final leg delivery in Peru, it's typical to arrange for additional security for cargo as thefts are common in this region. The additional service of an armed person on the truck will be added in the final costing. The price is not very high in relation to the value of this cargo, so the customer actually requested this. As a freight forwarder we look at multiple modes for the final delivery to door. In this case, rail is not an option from Lima, as the infrastructure is not set up for commercial shipping, so direct truck or local air transport are the only options. Since the lithium batteries are “cargo freight only”, the only option can be to truck them. The best route is Panamerica highway south from Lima to Pisco. From there the drive east is on an incline into the mountainous region. Ayacucho is about 2,761 meters above sea level (Figure 15) (Martinez, personal communication, April 21, 2019).

	Option 1: truck	Option 2: Air + truck
Truck Laptops + Batteries	\$2,970	-
Air Laptops	-	\$776.25
Truck Batteries	-	\$2,970
Total	\$2,970	\$3,746.25
Transit time	11 hours	2 hours air/ 11 hours truck

\* Cost in CAD

The trucking cost is for a dedicated truck given the location, there is to LTL, so it's quite expensive to truck the batteries separately. Since the freight is not urgent, a direct truck is the best option.

**16. Risk Analysis**

As of September 15, 2016, 129 air and airport incidents involving lithium batteries carried as cargo or baggage that have been recorded since March 20, 1991 (FAA Office of Security and Hazardous Materials Safety, 2016). That being said, the FAA is seeing an increasing trend of incidents involving Lithium-Ion battery fires, which are now averaging every 10 days in the US alone. Any passenger flight might contain hundreds of batteries in phones, laptops and now wireless headphones and e-cigarettes, which weren't on the market until a few years ago (St. John, 2017, June 7).

*16.1 Causes of Lithium-Ion battery explosions*

Protections are built into lithium-ion batteries to help maintain their safety. It's when abnormalities occur, such as manufacturing defects, excessive temperature elevation, and penetration by outside materials that these batteries can become hazardous. If enough microscopic metal particles converge within the cell, an electrical short can develop, resulting in the elevation of the battery's temperature to dangerous

levels. This can lead to thermal runaway, and cause the battery to ignite or explode. See figure 14 (Langnau, 2013).

*16.2 Mitigation strategies*

This presents the importance of a risk mitigation strategy and procedure. The first step is awareness through engagement with all parties involved, including the freight forwarders who can guide the process. Loading on the aircraft should be in “class c” cargo compartment, which includes a smoke detector, which warns the crew of smoke, and a built in fire extinguisher. The incidents that have occurred have been caused by non-compliance, such as being undeclared. Consequently, carriers should accept lithium batteries from approved shippers and freight forwarders. (International Air Transport Association, 2014). Also the use of third party specialists for correct packaging and labelling such as DGC should be used if a shipper is unsure of the proper policies.

**17. Final costing of the move**

	<b>Cost (CAD)</b>
<b>10 Laptops</b>	\$1,923.87
<b>5 Batteries</b>	\$1,949.87
Final delivery by truck	\$2,970
Armed guard	\$200
Insurance premium \$0.35/\$100: CIF value + 10%*	\$73.31
<b>Grand total</b>	<b>\$7,117.05</b>

\*Regarding insurance, we need to provide an insurance letter in order to import goods into Peru. The calculation above is based on the value of this cargo as CAD \$11,998 for the laptops and batteries.

## **18. Recommendation for export move**

The second shipment, presented options to move laptops and batteries on two separate flights due to regulations with shipping Lithium-Ion Batteries. Due to an unforeseen event in the airline industry, the choice for laptops ended up being a more expensive, but faster transit time with Air Canada. Regarding the batteries, the choice is Cargo Jet, which was faster and less expensive. For the final leg delivery options were limited, and a direct truck is the best option. Insurance and an armed guard were added as extra precautions given the risk of shipping to Ayacucho.

## **19. Environmental impact evaluation**

With all industries globally, we must give consideration of our impact on the environment within our analysis. The effects are now being seen and information is more readily available. A focus on mitigating our impacts through sustainability programs, as well as complete prevention of a further impact has taken on a deeper role in the modern world. For shipping specifically, we look at sound pollution, oil spillage, sewage, loss of marine life, and emission of greenhouse gases (Barasa, 2018).

There are important factors to consider when doing an environmental impact study. We need to take note of the age of the equipment, for example the vessels for ocean freight, and also truckers for the final leg delivery. The newer models are better for the environment in terms of fuel efficiency. Also the modes of transport play a factor for example rail is a better choice compared to trucking. Another consideration is to choose a transit time that is quicker. If a route has stops, increasing transit time, this

would increase the impact per container or shipment (Wu, personal communication, December 24, 2018).

Given this information, for the import move, the solutions I have recommended align. Carriers chosen have environmental policies, boasting efficient routings, young fleets, regular engine cleaning, etc. Also by choosing the routing to Thunder Bay significantly reduces the distance we need to truck to final destination, which is better for the environment.

For the export move, typically it's preferred to ship lithium batteries via ocean, which has less of an environmental impact given how much cargo can move on one ship. However, given the size of the shipments in this example, it's much more efficient to airfreight them. The recommendation of a direct flight for the laptops, and not using the MIA hub option for the batteries are the more efficient routes in terms of the environment.

## **20. Final conclusion**

As a freight forwarder, I have been able to explore two very unique moves, both requiring some creative thinking. First, the import move was challenging with the sheer size of the cargo and also with the final site location. As I've demonstrated, every detail needs to be looked at when moving such large pieces. The second move, was much smaller in size, but just as challenging. DG cargo is very tightly regulated, and so we always need to ensure we are up to date with the correct processes. I've learned so much throughout this process and am truly grateful to have participated.

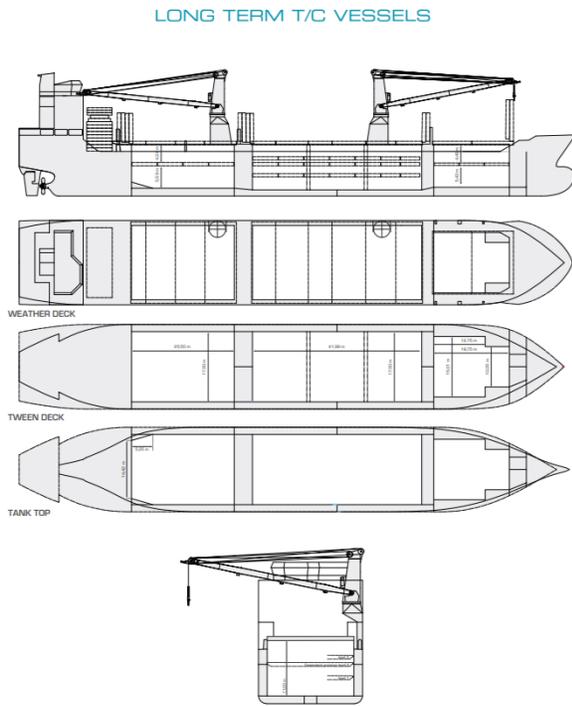
# Appendix

## Figure 1

Origin	Transshipment Port	Destination	Est. Transit Time	CY Cutoff	Cargo Nature	Service	Vessel Voyage	Origin Pickup	Destination Delivery
Hamburg 03 May (Fri) 13:00	→	Winnipeg 21 May (Tue) 11:00	17 day(s)	03 May (Fri) 13:00	Dry/Reefer	GEX1	MSC ELENI 766W18	Door	CY/Door
Schedule Details ▾									
Hamburg 03 May (Fri) 14:00	→	Winnipeg 18 May (Sat) 16:00	14 day(s)	03 May (Fri) 14:00	Dry/Reefer	GEX2	MONTREAL EXPRESS 05W18	CY/Door	CY/Door
Schedule Details ▾									
Hamburg 10 May (Fri) 13:00	→	Winnipeg 28 May (Tue) 11:00	17 day(s)	10 May (Fri) 13:00	Dry/Reefer	GEX1	OTTAWA EXPRESS 97W19	Door	CY/Door
Schedule Details ▾									
Hamburg 10 May (Fri) 14:00	→	Winnipeg 25 May (Sat) 16:00	14 day(s)	10 May (Fri) 14:00	Dry/Reefer	GEX2	QUEBEC EXPRESS 44W19	CY/Door	CY/Door
Schedule Details ▾									

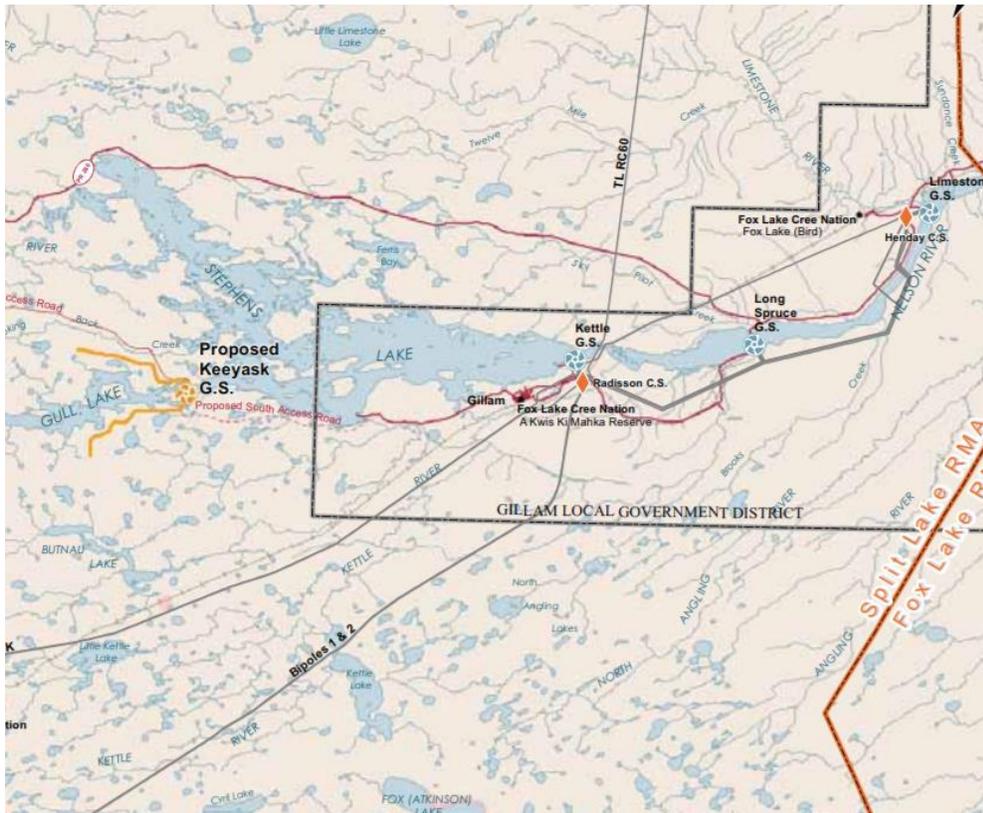
Source: (OOCL, 2018)

## Figure 2



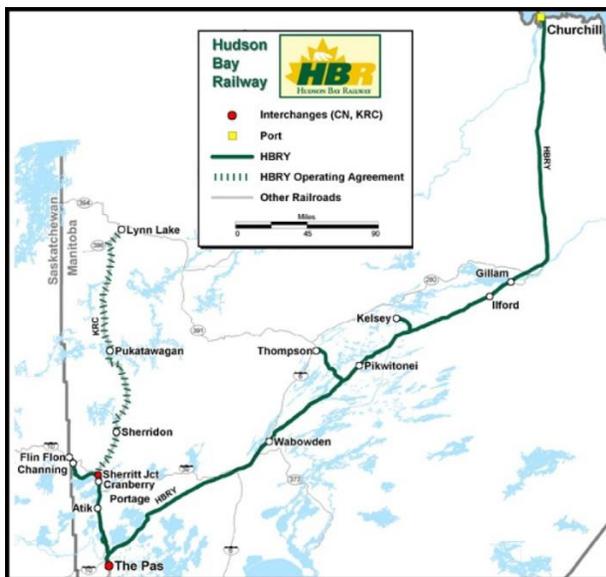
Source: (Spliethoff, 2016).

Figure 3



Source: (Keyask Hydropower Partnership Limited, 2018).

Figure 4



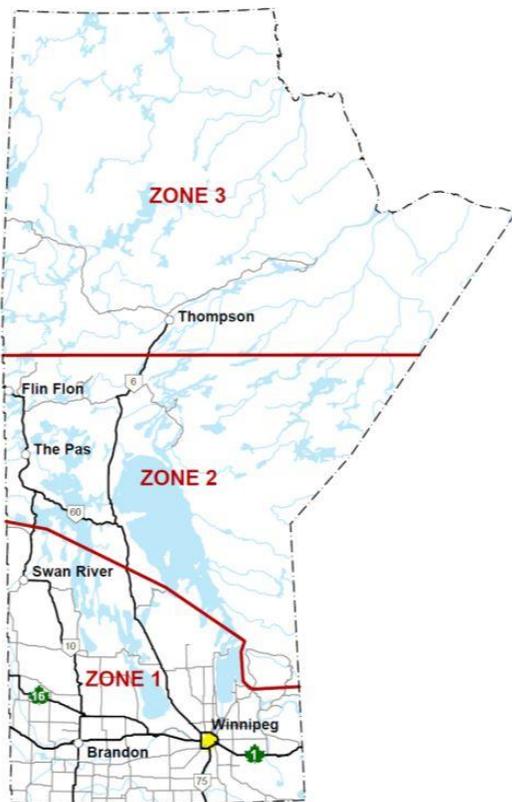
Source: (AECOM Canada Ltd., 2017.).

**Figure 5**



Source: (Equipment Express, 2018.).

**Figure 6**



Source: (Government of Manitoba, 2018b)

# Figure 7

## Implementation dates

The earliest start dates of Spring Road Restrictions are March 1 for Zone 1, March 6 for Zone 2 and March 12 for Zone 3. The start date in a climate zone may be delayed in years of late thaw. This is determined based on the trend of thawing index in each zone. The latest end dates of Spring Road Restrictions are May 31 for Zones 1 and 2, and June 10 for Zone 3. SRR may be ended earlier in a climate zone depending upon weather conditions (trend of the thawing index) in that climate zone.

SRR Levels	Earliest Start Date	Latest End Date
<b>Zone 1</b>		
Levels 1 & 2	March 1	May 31
<b>Zone 2</b>		
Levels 1 & 2	March 6	May 31
<b>Zone 3</b>		
Levels 1 & 2	March 12	June 10

Source: (Government of Manitoba, 2018a)

# Figure 8

## Annex 2 – Text of the origin Declaration

The origin declaration, the text of which is given below, must be completed in accordance with the footnotes. However, the footnotes do not have to be reproduced.

(Period: from \_\_\_\_\_ to \_\_\_\_\_(1))

The exporter of the products covered by this document (customs authorisation No ...(2)) declares that, except where otherwise clearly indicated, these products are of ...(3) preferential origin.

.....(4)  
(Place and date)

.....(5)  
(Signature and printed name of the exporter)

(1) When the origin declaration is completed for multiple shipments of identical originating products within the meaning of Article 19.5, indicate the period of time for which the origin declaration will apply. The period of time must not exceed 12 months. All importations of the product must occur within the period indicated. Where a period of time is not applicable, the field can be left blank.  
 (2) For EU exporters: When the origin declaration is completed by an approved or registered exporter the exporter's customs authorisation or registration number must be included. A customs authorisation number is required only if the exporter is an approved exporter. When the origin declaration is not completed by an approved or registered exporter, the words in brackets must be omitted or the space left blank.  
 For Canadian exporters: The exporter's Business Number assigned by the Government of Canada must be included. Where the exporter has not been assigned a business number, the field may be left blank.  
 (3) "Canada/EU" means products qualifying as originating under the rules of origin of the Canada-European Union Comprehensive Economic and Trade Agreement. When the origin declaration relates, in whole or in part, to products originating in Ceuta and Melilla, the exporter must clearly indicate the symbol "CM".  
 (4) These indications may be omitted if the information is contained on the document itself.  
 (5) Article 19.3 provides an exception to the requirement of the exporter's signature. Where the exporter is not required to sign, the exemption of signature also implies the exemption of the name of the signatory.

Source: (Government of Canada, 2017).

**Figure 9**



Source: (Hapag-Lloyd, n.d.)

**Figure 10**



Source: (IATA, 2018).

**Figure 11**



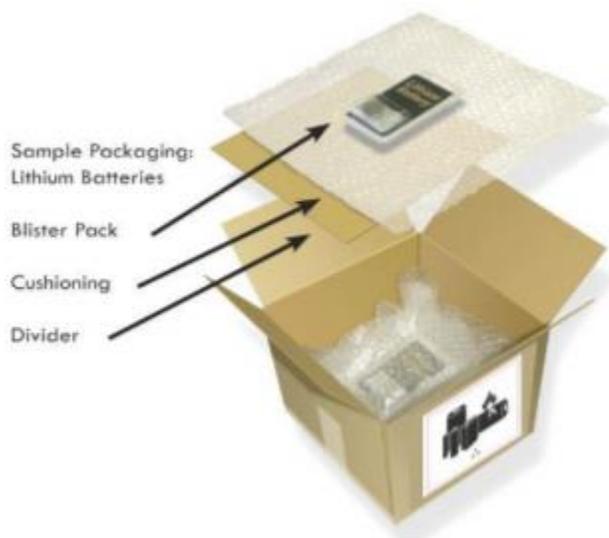
Source: (IATA, 2018).

**Figure 12**



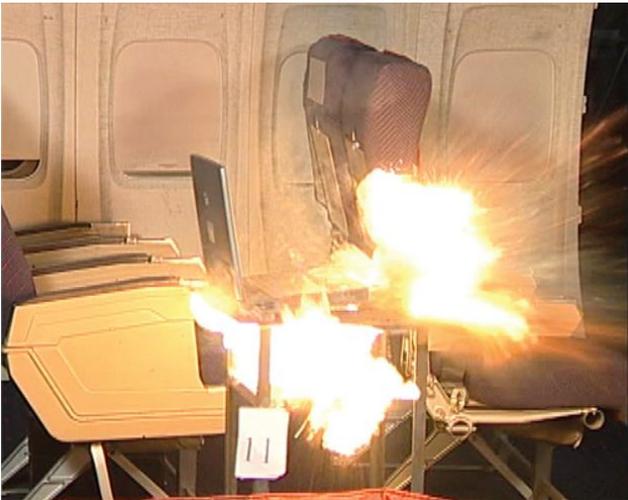
Source: (IATA, 2018).

**Figure 13**



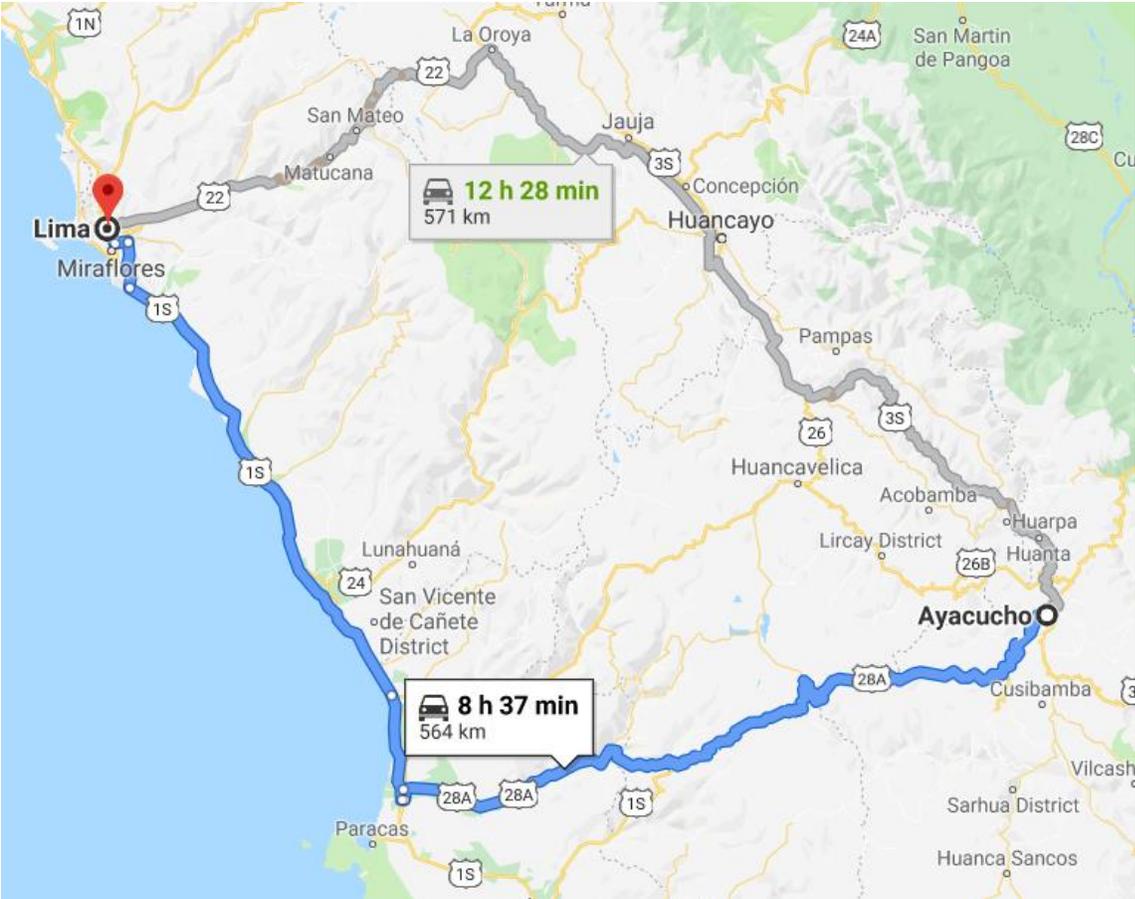
Source: (IATA, 2018, p.11)

**Figure 14**



Source: (Langnau, 2013)

**Figure 15**



Source: Google Maps

## Reference List

- AECOM Canada Ltd. (2017, August 18.). HBR Herchmer Subdivision Flood 2017. Retrieved on December 2, 2018 from [https://media.winnipegfreepress.com/documents/HBR-Herchmer-Subdivision-Flood-2017\\_Final-Report.pdf](https://media.winnipegfreepress.com/documents/HBR-Herchmer-Subdivision-Flood-2017_Final-Report.pdf)
- Allianz Global Corporate & Specialty SE. (2017, April.). Safe Transport of Transformers. Retrieved on December 15, 2018 from [https://www.agcs.allianz.com/assets/PDFs/ARC/Risk%20Bulletins/MarineReport\\_SafeTransportOfTransformers.pdf](https://www.agcs.allianz.com/assets/PDFs/ARC/Risk%20Bulletins/MarineReport_SafeTransportOfTransformers.pdf)
- Barasa, F. (2018, May 30.). What Is The Environmental Impact Of Shipping?. *Worldatlas*. Retrieved on November 24, 2018 from <https://www.worldatlas.com/articles/what-is-the-environmental-impact-of-shipping.html>
- Canada Border Security Agency- CBSA. (2018, September 12). Commercial reporting requirements. Requirements by client type. Retrieved on December 5, 2018 from <https://www.cbsa-asfc.gc.ca/prog/aci-manif-ipecc/req-exig-eng.html#tab2>
- Equipment Express. (2018). Equipment Express Website. Retrieved on December 21, 2018 from <http://equipmentexpress.com/>
- Export.gov. (2018, June, 11). Peru-Import Requirements and Documentation. Retrieved on April 4, 2019 from <https://www.export.gov/article?id=Peru-Import-Requirements-and-Documentation>
- FAA Office of Security and Hazardous Materials Safety. (2016, September 15). LITHIUM BATTERIES & LITHIUM BATTERY-POWERED DEVICES. Retrieved on February 12, 2019 from [https://lessonslearned.faa.gov/UPS6/battery\\_incident\\_chart.pdf](https://lessonslearned.faa.gov/UPS6/battery_incident_chart.pdf)

- Fednav. (2018). Liner Shipping-Falline. Retrieved on December 21, 2018 from <http://www.fednav.com/en/services/liner-shipping-falline>
- Government of Canada. (2017, October 3). Text of the Comprehensive Economic and Trade Agreement – Protocol on rules of origin and origin procedures. Retrieved on December 5, 2018 from <https://www.gov.mb.ca/mit/srr/index.html>
- Government of Manitoba. (2018a). 2019 Manitoba Spring Road Restrictions (SRR) Program. Retrieved on December 1, 2018 from <https://www.gov.mb.ca/mit/srr/index.html>
- Government of Manitoba. (2018b). SRR Climate Zones. Retrieved on December 1, 2018 from <https://www.gov.mb.ca/mit/srr/zones.html>
- Hamilton Port Authority. (2018). Breakbulk & Project Cargo. Retrieved on December 21, 2018 from <https://www.hamiltonport.ca/move-cargo/projects/>
- Hapag-Lloyd. (n.d.). General Blocking/Bracing Requirements. Retrieved on November 20, 2018 from [https://www.hapag-lloyd.com/content/dam/website/downloads/pdf/HLAG\\_metal\\_products\\_requirements\\_for\\_CS.pdf](https://www.hapag-lloyd.com/content/dam/website/downloads/pdf/HLAG_metal_products_requirements_for_CS.pdf)
- Howard, S. (n.d.). Shipper Owned Containers (SOCs) – Overview. *CSI Container Services International*. Retrieved on November 20, 2018 from <https://www.csiu.co/soc-shipper-owned-containers-for-forwarders-and-nvoc>
- IATA. (2018, December 12.). IATA Lithium Battery Guidance Document – 2019 Rev 1. Retrieved on March 12, 2019 from <https://www.iata.org/whatwedo/cargo/dgr/Documents/lithium-battery-shipping-guidelines.pdf>

International Air Transport Association. (2014). Lithium Batteries Risk Mitigation Guidance for Operators. Retrieved on April 21, 2019 from <https://www.rechargebatteries.org/wp-content/uploads/2015/01/lithium-battery-risk-mitigation-guidance-for-operators-1st-ed.pdf>

International Air Transport Association. (2018). *Dangerous Good Regulations, 60<sup>th</sup> Edition*. Montreal; Geneva. (Original work published 1956)

International Maritime Organization. (2018). Cargo Securing and Packing. Retrieved on November 20, 2018 from <http://www.imo.org/en/OurWork/Safety/Cargoes/CargoSecuring/Pages/default.aspx>

Keeyask Hydropower Limited Partnership. (2018.). Project Description. Retrieved December 2, 2018 from <https://keeyask.com/the-project/project-description/>

Langnau, L. (2013, June 5). *Innovative Design Improves the Safety of Lithium-ion Batteries*. Retrieved April 15, 2019 from <https://www.designworldonline.com/innovative-design-improves-the-safety-of-lithium-ion-batteries/>

Miami International Airport. (n.d.) Miami International Airport Cargo Hub 2015-2016. Retrieved April 12, 2019 from [http://www.miami-airport.com/library/pdfdoc/MIA\\_Cargo\\_Brochure.pdf](http://www.miami-airport.com/library/pdfdoc/MIA_Cargo_Brochure.pdf)

Mutzabaugh, B. (2019, March 13). Which airlines are still flying the Boeing 737 Max 8? None, as of Wednesday. Retrieved March 15, 2019 from <https://www.usatoday.com/story/travel/flights/todayinthesky/2019/03/13/boeing-737-max-8-southwest-american-airlines-flying-jet/3150296002/>

Port of Antwerp. (2014, January.). Antwerp, your project cargo in safe hands. Retrieved on November December 15, 2018 from

<https://www.portofantwerp.com/en/publications/brochures-cards/antwerp-your-project-cargo-safe-hands>

Port of Thunder Bay. (2018). Thunder Bay Port Authority's Mobile Harbour Crane. Retrieved on December 21, 2018 from

<http://www.portofthunderbay.com/article/thunder-bay-port-authoritys-mobile-harbour-crane-288.asp>

Spliethoff. (2016.). Long Term T/C Vessels. Retrieved on November December 15, 2018 from [https://www.spliethoff.com/media/2016/spliethoff\\_long-term-tc-vessels-2.pdf](https://www.spliethoff.com/media/2016/spliethoff_long-term-tc-vessels-2.pdf)

St. John, A. (2017, June 7). What's Behind the Increase in Lithium-Ion Battery Fires on Planes? Retrieved on February 12, 2019 from

<https://www.consumerreports.org/product-safety/whats-behind-the-increase-in-lithium-ion-battery-fires-on-planes/>

Young, R. (2018, December 1.). Rail Line to Port of Churchill Running Again After 2017 Flooding. *Harvard Broadcasting*. Retrieved on December 24, 2018 from

<https://www.harvardbroadcasting.com/syn/350/62672/rail-line-to-port-of-churchill-running-again-after-2017-flooding/>