TransPod in Alberta

Summary of study on the implementation of a *TransPod Line* from Calgary to Edmonton

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Contents

Note: this document is a summary version of the report submitted to Alberta Transportation on May 7th, 2021. The purpose of this report is to highlight the key results of the TransPod Alberta feasibility study in a way that is informative but more easily digestible than the full-length report.

1. Introduction

1.1. About Previous High-Speed Transportation Proposals in Alberta

There has long been an interest in constructing a high-speed transportation system in Alberta's main economic corridor, from Calgary to Edmonton. Several studies on the feasibility of high-speed rail in Alberta have been published since 1985, with mixed findings: some proposed that the system was feasible and would be profitable, while others proposed that the operating profits would not be able to compensate for the high up-front infrastructure costs.

This report builds upon the previous high-speed rail reports to propose a new, ultra-fast, sustainable, and financially viable method of transportation for the region: the *TransPod Line*.

1.2. About TransPod Inc.

TransPod Inc. is a Canadian company designing ultra-high-speed transportation systems. Through its technological advances and partnerships with global aerospace and engineering partners, this enables the global development of the TransPod ultra-high-speed line, and also contributes to an ecosystem of tube transportation and hyperloop in general.

1.3. The TransPod System

A *TransPod Line* is a new ultra-high-speed transportation system, designed to carry passengers between cities at over 1000 km/h. Powered by electric energy in a system that is unaffected by weather conditions, the tube transportation system enables passenger and cargo travel that is cleaner and faster than airline travel, creating an attractive choice for consumers, a high-potential investment opportunity for infrastructure investors, and a reliable mass transportation system that reduces congestion and emissions. A TransPod line is a new generation of hyperloop or tube transportation.

At TransPod stations, platforms will allow passengers to walk onboard the vehicles, each of which have rows of seats similar to a jet or train. With the passengers sitting comfortably, the vehicle accelerates, coasts, and slows down, arriving at the destination in a matter of minutes. Vehicles depart approximately every two minutes, allowing the customers to arrive and board the next pod whenever they want rather than needing to pre-book tickets and arrive in advance - similar to how a subway operates, but at a long-distance city-city scale.

1.4. About This Study

With support from Alberta Transportation, TransPod Inc. has undertaken a feasibility study on a potential passenger and cargo TransPod system spanning from Calgary to Red Deer to Edmonton. The objective of the analysis is to quantify the potential economic and socio-economic impacts, as well as the financial performance, of a TransPod line in Alberta.

2. Executive Summary

2.1. Context

Alberta has long been one of the economic leaders in Canada, home to over 4 million people and a GDP of over $307 billion per year. Its largest city is Calgary, in southern Alberta; its second largest city is Edmonton, almost exactly 300 kilometers due north of Calgary. Directly between the two is Red Deer, sitting 150 kilometers north of Calgary and 150 kilometers south of Edmonton. The route between these cities is relatively flat, uninterrupted Canadian plains. This report studies the feasibility of building a TransPod line for ultra-high-speed passenger and cargo transportation between Calgary and Edmonton, with a potential stop in Red Deer.

First, ridership estimates were conducted to understand the current traffic on each transportation mode between the cities. This analysis revealed that the vast majority of Albertans travel between the two cities by car, with air travel being the second most popular, and bus travel being quite minimal. A total of over 14 million passenger-trips are currently made each year between Calgary and Edmonton, in addition to 2.5 million between Calgary and Red Deer, 1.7 million between Red Deer and Edmonton, over 20 million from Calgary to the Calgary Airport, and over 10 million from Edmonton to the Edmonton Airport.

It is important to note that between Calgary and Edmonton, which is the main route under study, the fastest available travel option currently takes over three hours. Driving takes an estimated 3 hours 15 minutes; taking the bus is over 4 hours; and flying takes roughly 3 hours 30 minutes, when considering the time in the air, getting to and from each airport, and waiting in the airport before departure. In other words, this corridor is the perfect distance for a TransPod system, as it is in the “sweet spot” of distance where a TransPod system will drastically out-compete both driving and flying in terms of travel time. Moreover, the costs to travel for the current options are relatively expensive, largely driven by the fact that Canada’s airline industry is effectively a duopoly.

2.2. TransPod Summary

TransPod Inc. is a Canadian company designing ultra-high-speed transportation systems. Through its technological advances and partnerships with global aerospace and engineering partners, TransPod Inc. is globally developing the TransPod line system. This is a new type of tube-transportation (previous types have included vacuum trains, traditional hyperloop, hypertube, etc.) where vehicles travel in a low-pressure tube environment. The cutting-edge new TransPod system enables a significant reduction in capital investment, increases reliability, and improves operational performance, allowing a strong business case for this ultra-high-speed system. Powered by sustainable solar/electric energy in a system that is unaffected by weather conditions, the TransPod system enables passenger and cargo to travel faster than aircraft, creating an attractive choice for consumers and businesses, a high-potential investment opportunity for infrastructure investors, and a reliable mass transportation system. It is a revolutionary improvement over existing modes of transportation such as airplanes, cars, ships, and trains. It is immune to weather effects, sustainably powered by electric energy and at the same time safer, faster, more affordable, more convenient, and less disruptive to the environment than the existing options.

The TransPod service offerings in Alberta are proposed as follows, based on the current transportation offerings, data ridership and willingness to pay models:

- **Calgary to Edmonton:** A one-way trip between these cities will cost approximately $90 (CAD). The travel time of the 300km trip will be slightly above one hour (including access and egress time).

- **Calgary to Red Deer:** A one-way trip between these cities will cost approximately $50 (CAD). The travel time of the 147km trip will be slightly above 30 minutes (including access and egress time).
- **Edmonton to Red Deer:** A one-way trip between these cities will cost approximately $50 (CAD). The travel time of the 153km trip will be slightly above 30 minutes (including access and egress time).
- **Downtown Calgary to Calgary Airport:** A one-way trip along this route will cost approximately $12 (CAD). The travel time of the 16km trip will be slightly above 20 minutes (including access and egress time).
- **Downtown Edmonton to Edmonton Airport:** A one-way trip along this route will cost approximately $12 (CAD). The travel time of the 30km trip will be slightly above 20 minutes (including access and egress time).

Based upon the average income of Albertans and the current alternative transportation options, it is projected that these prices will be low enough to ensure the system is affordable to the masses, while still high enough to ensure that the system is not a loss-generator requiring taxpayer subsidies.

2.3. Financial Analysis

To better understand the financial attractiveness of building a TransPod line in Alberta, a full financial analysis was conducted. Our analysis showed that building a TransPod line between Calgary and Edmonton would cost an estimated $22.4 billion CAD, which translates into a cost of $45.1MM CAD per kilometer along roughly 350 kilometers of unique track, plus an additional cost of $6.7 billion for fixed infrastructure such as stations and other indirect costs.

For the full line, the financial model yielded a net present value of $145.60 billion and an internal rate of return equal to 9.51%. A sensitivity analysis demonstrated that only if multiple extreme worst-case scenarios occur simultaneously (e.g. revenue shortfall of 50%+, cost overruns of 50%+) would the TransPod line risk becoming NPV-negative. This strong financial performance is largely thanks to the TransPod system's ability to carry both passengers and freight rather than being restricted to only one of the two.

As a result of this analysis, it is not expected that public funding will be required. Rather, TransPod will secure the investment from private institutions, who are interested in the project due to the strong financial returns. This will ensure that the Alberta taxpayers are not financially responsible for the project.

2.4. Economic Analysis

In addition to a financial analysis, this study outlines the full economic analysis that was conducted, which identifies the quantifiable economic impacts that Alberta will experience as a result of the TransPod line. Specifically, the report quantifies the time savings, safety benefits, environmental impact, and economic benefits of the project.

- **Time Savings:** The TransPod line will save an average of 18 million travel hours per year, which contributes $1.9 billion per year to the Albertan economy. This figure grows consistently as ridership increases over the years. Between the first year of operations and 2060, that equates to a whopping $64.8 billion in economic benefits due to travel time savings.
- **Congestion:** It is estimated that the introduction of the TransPod line will remove roughly one-third of traffic between Calgary, Red Deer and Edmonton and roughly one-fifth of cars travelling between each city and its respective airport. That translates into reduced congestion and therefore significantly more consistent travel times for Albertans who choose to drive.

- **Safety Benefits:** By preventing car accidents along Alberta's roads, the TransPod system will help to avoid almost 300 traffic fatalities, over 15,000 traffic injuries, and over 112,000 property damage-causing accidents, over the course of the forecast period (between now and 2060). Based on the cost of these types of car accidents, that will contribute $3.5 billion to the Albertan economy, in addition to the more important fact that avoiding these car accidents will remove an emotional burden on Albertans.
- **Environmental Impact:** The analysis indicates that the operations of the TransPod line will help to remove an average of 636,000 tonnes of CO_2e emissions per year, by removing some cars and planes from circulation and by generating clean solar power along the length of the TransPod line. That is equivalent to the amount of CO_2 sequestered by a forest four times larger than Calgary, every single year. Based on Canada's cost of carbon, it translates into a value of over $6 billion.
- **Jobs:** In Alberta, this project is forecasted to drive a total economic output of over $39 billion, in addition to a GDP boost of almost $20 billion and over 140,000 full-time equivalent jobs created over the construction period. Moreover, the impact will not be limited to Alberta: additional indirect and induced growth will ripple across the entire Canadian economy due to the connected nature of Canada's supply chains and labour force.

2.5. Outlook

The analysis conducted in this report demonstrates one clear conclusion: implementing the TransPod project has the potential to positively transform Alberta.

The project will bring substantial time savings, environmental benefits, congestion reductions, safety improvements, and economic growth to the province of Alberta, and to Canada as a whole. Moreover, it will achieve all of this without requiring Alberta taxpayers funding; since the project is forecasted to have strong profitability, TransPod will be able to finance the project by raising private capital, and in the process injecting outside investment into the Albertan economy.

The TransPod project has the potential to forever improve the transportation landscape in Alberta. The time to act is now, to ensure a strong future for Alberta.


TRANSPOD

3. Technology

3.1. Overall Description

Ultra-high-speed tube transportation is designed to allow near-supersonic intercity transportation, connecting cities with a fixed guideway infrastructure. Tube transportation is similar to rail transportation but uses vehicles travelling inside a round linear guideway (tube) rather than traditional railroad cars travelling along a flat linear guideway (railroad tracks). The vehicles can reach near-supersonic speeds thanks to the benefit of reduced air pressure inside the tube, which reduces friction at high speed.

TransPod is a next generation of tube transportation. Compared to previous designs such as traditional hyperloop, TransPod's cutting-edge new technology enables a significant reduction in capital investment, increases reliability, and improves operational performance, which ultimately creates a stronger business case than traditional hyperloop systems.

The TransPod system includes infrastructure (the *TransPod line*) and vehicles (the *TransPod vehicle*).

The TransPod vehicle, sometimes called a "pod", is similar to an aircraft, minus the wings, and operates like a train. It has an aerodynamic fuselage and structure, to transport passengers or cargo between cities faster than a modern commercial aircraft. The system is designed to have several vehicles travelling in each direction simultaneously. Departures from stations can be scheduled every few minutes, making the system's operations similar to a subway, where travellers simply arrive at the platform, and wait for the next vehicle to depart. This departure system eliminates the hassle of airline ticket bookings, making travel extremely flexible and truly on demand.

The vehicles are computer-controlled and operated autonomously, enhancing passenger safety by eliminating human piloting errors. The system operates in a near-vacuum enclosed tube environment, making air resistance much lower than in the outside environment. In the case of any evacuation emergency, the tube can be returned to atmospheric pressure by systems which rapidly allow the ordinary air pressure back inside the tube. The tube is constructed out of steel or alternatively composite materials. It can be built below ground, at ground level, or above ground suspended by concrete pillars. To achieve maximum operating speeds, the tube transport line is designed to be as vertically and horizontally straight as possible, avoiding sharp curves which would result in strong and uncomfortable G-force sensations for passengers. The vehicles are propelled by linear induction engines, which are powered by fully electric energy. These powerful engines, with *fluxjet* technology, operating in a near-vacuum environment, enables passenger and cargo vehicles to travel at over 1000 km/h.

3.2. History of Tube Transportation

Tube transportation is under development by a number of transportation companies, combining the latest techniques from the aerospace and rail industry. The concept has been around for over two centuries.

3.3. TransPod Line: Technology Description

The basic concept of a *TransPod line* overcomes the following challenges in ground transportation:

- Friction resulting from rail-wheel contact: eliminated by levitation mechanisms (magnetic or air cushions);
- Aerodynamic friction between the air and the vehicle: lowered through reducing the ambient pressure in which the vehicles operate.

The combination of these factors allows electrically-powered vehicles to travel faster than aircraft, using relatively little energy, at ground level. This dramatically increases the typical speed limit of trains, above 1000 km/h, when cities are at least 500 km apart.

This system consists of transport infrastructure made of vacuum tubes, acting as guideways, or tracks, and vehicles that levitate and circulate inside the tubes.

3.3.1. Concept of Operations

Operations play a crucial role in this proposed transportation revolution. The vehicles are small in capacity and departure times are every two to three minutes. No need to book a ticket in advance - you just travel on the next departing pod which is heading to your destination. In this way, the TransPod system acts as a subway system on a provincial or national scale, offering speed, flexibility, and frequent departures, all while covering large distances.

TransPod stations will be multimodal, to allow for quick transfers from one mode of transport into another, and to allow passengers and cargo to quickly cover the last-mile distance when arriving in the destination city. The stations will also be installed as close as possible to city centers and airports, to ensure that the station is quickly accessible regardless of where in the city a passenger is coming from.

Several pods will travel at the same time in the TransPod network, in both directions (with each direction having its own dedicated tube). In current transportation modes, 80% of the transport accidents come from human errors. In contrast, the TransPod system is autonomous, and the traffic is controlled in real-time by a central computer which monitors and adjusts the speeds and locations of every pod, to ensure safety and smooth operations of the entire line.

TransPod lines can handle both passenger and cargo pods interchangeably, enabling the operator to optimize the utilization of the infrastructure. For example, during peak morning and afternoon commuting hours, the line can be filled mainly with passenger pods while during off-peak hours the capacity can be used to transport cargo.

3.3.2. Vehicles

Contrary to long and heavy trains, TransPod vehicles are small units: a vehicle is 25 meters long, capable of transporting up to 50 passengers, sitting in rows of seats separated by a central aisle. Cargo vehicles use the same structure as passenger vehicles, but the interior is designed to fit air cargo containers and/or pallets. One cargo vehicle can transport approximately 10 tonnes of goods.

The main subcomponents of a vehicle include:

Fuselage: The TransPod fuselage is made of composite materials similar to the construction of commercial aircraft today, therefore providing a very similar structural integrity.

Pressurisation: The cabin is pressurised for passenger comfort, similar to a jet aircraft. The vehicle systems are similar to existing commercial aircraft technology.

Liquid cooling system: Heat is transferred out of electronics, propulsion drives, motors, and the passenger air conditioning system. The cooling system is similar to engine cooling systems in the automotive and aviation industries.

Propulsion System: The vehicle is driven by electric power. Linear Induction Motors (LIM), a type of magnetic traction engine, use moving magnetic fields to generate force against the tube traction surface structure. These traction engines provide thrust to accelerate the vehicle, and braking to decelerate.

Levitation System: TransPod's patented JetGlide™ technology controls a magnetic levitation system, to keep the vehicle levitated off the bottom of the tube guideway, creating a smooth ride, and reducing energy consumption due to an absence of mechanical friction between the vehicle and the infrastructure.

Electrical Power Transmission: The electrical system (as patented in TransPod's Quantum Power™ technology), receives electrical energy onboard the vehicle from "3rd-rail" conductors inside the tube. In that way, external power from the grid connections is delivered into the tube, to the conductors mounted inside the tube, and in turn to the vehicle as it runs along these conductors inside the tube.

Interior: Air conditioning, filtering and circulation, comfortable suspension, and curved-wall LED video panels are all features to reproduce an outdoor environment, avoid claustrophobia, and provide a comfortable and welcoming environment in the vehicle.

3.3.3. Infrastructure

The infrastructure consists of a dual tube system resting on concrete pylons, the height of which depends on the configuration of the line and the surrounding terrain. The guideway infrastructure related to the TransPod line considers three types of engineered structures:

1. Elevated guideway
2. Ground-level guideway
3. Underground guideway

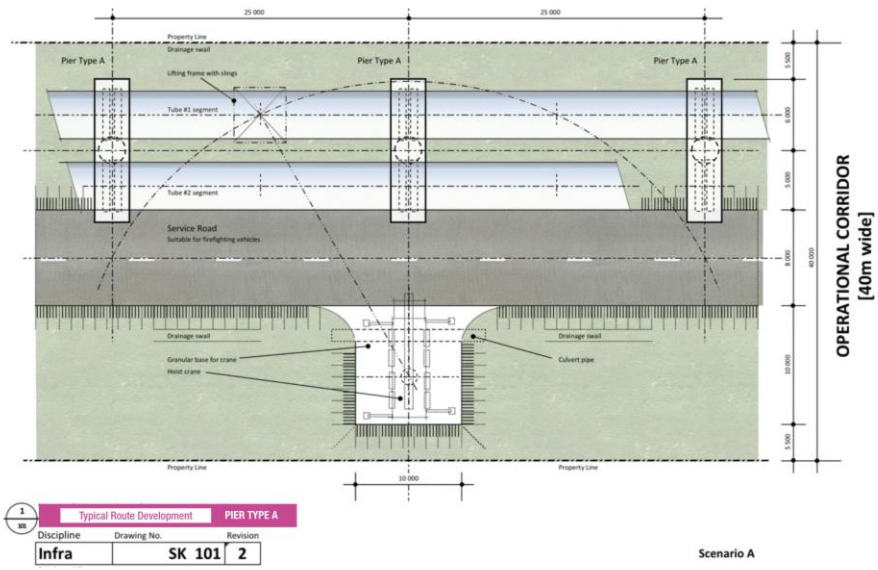
Regarding this study, we focus on an elevated guideway structure as this configuration will be the most prevalent in Alberta. It also has significant advantages compared to a conventional high-speed rail (HSR) system both in terms of safety and cost. Being elevated is safer as there is no need to implement a crossing control system at roadway intersections to mitigate the risk of collisions involving people and/or vehicles. It is cheaper as the land footprint is smaller for a pylon compared to a railway track. It also allows vehicles and agricultural machines to cross underneath the line, rather than dissecting properties as required by a train system. Underground grade separations are considered to provide even better safety features, but these come at a drastically higher cost.

Figure 1: Basic illustration of the TransPod system

General arrangement

TransPod's typical guideway corridor is 40 meters wide, including a service road for maintenance, emergency services, and construction purposes. The service road can be decommissioned after the construction period to avoid land acquisition, and the land can be returned for local use (agriculture or other).

Figure 2: Aerial drawing of a portion of the TransPod line



Side Elevation

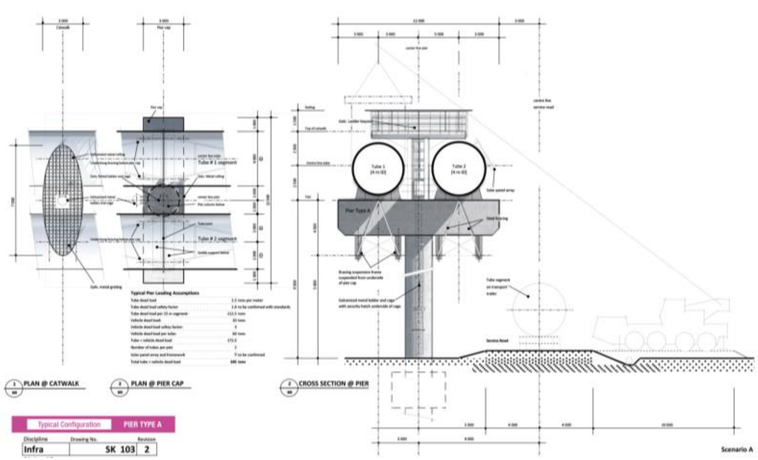
The TransPod vehicle's typical span is designed to rely on standard construction techniques. The following elements are included in the infrastructure:

- Steel bracings are provided to reinforce the tube integrity as vehicles travel inside the tube, and to maintain the shape of the tube over time.
- Standard galvanized framing is used to install optional solar panels on the tube so that the system generates energy. Solar panels will be positioned according to either the optimum angle towards the sun, or a rotating structure, depending on which is deemed most appropriate in each location.

Cross Section

The following figure represents a cross-section of the elevated structure and illustrates a potential construction scenario to install tube segments over each pier.

Figure 3: Cross-section drawing of the infrastructure



Emergency Exits

As per applicable regulations currently being drafted in Canada, the TransPod system will require emergency exits evenly spaced throughout the line, allowing for passengers to exit the tube without having to walk long distances. Those emergency exits will be protected from weather elements at any given time to allow a safe evacuation regardless of external conditions.

Figure 4: 3D visualization of the infrastructure

Energy Requirements and Solar Panels

The TransPod system is fully electric and uses power delivered from the grid. As long as the source of energy is clean and renewable, the TransPod system is a clean means of transportation. Moreover, the TransPod design allows for the installation of solar panels on top of the tubes, in order to leverage the surface created by the infrastructure. The energy generated by the solar panels will add to the capacity of Alberta's electrical grid and will thereby help shift some of Alberta's energy mix towards a renewable source.

Alternatively, the energy generated by the TransPod system can be distributed locally in various "microgrids", helping to bring electricity into remote areas without having to build expensive power lines.

3.3.4. The TransPod Advantage

The main challenge faced by previous vacuum tube transportation systems (such as previous hyperloop designs) remains how to reduce the infrastructure costs to make the system economically viable. To achieve this, TransPod offers a unique levitation and thrust system specifically for the vehicle, which means that costly electromagnets do not need to be installed along hundreds of kilometers of track. This reduces the infrastructure costs drastically.

To date, the most popular option for developing tube transportation technology has been to use magnetic levitation, or "MAGLEV." This technology was developed in the 1970s and has been successfully tested on several high-speed train projects such as the German Transrapid and the Japanese Shinkansen, which can reach speeds up to 600 km/h, higher than conventional wheel-based high-speed trains. Despite this achievement, MAGLEV technology has only been used for a few small transportation projects around the world due to major cost shortcomings.

The inventors of TransPod decided to move away from using superconducting magnets or "MAGLEV" technology for two reasons. First, using superconducting magnets in a vacuum has several technological limitations such as producing corona that accelerates the degradation of materials. Second, the extraordinary cost to lay down superconducting magnets over many kilometres of track makes MAGLEV systems economically non-viable.

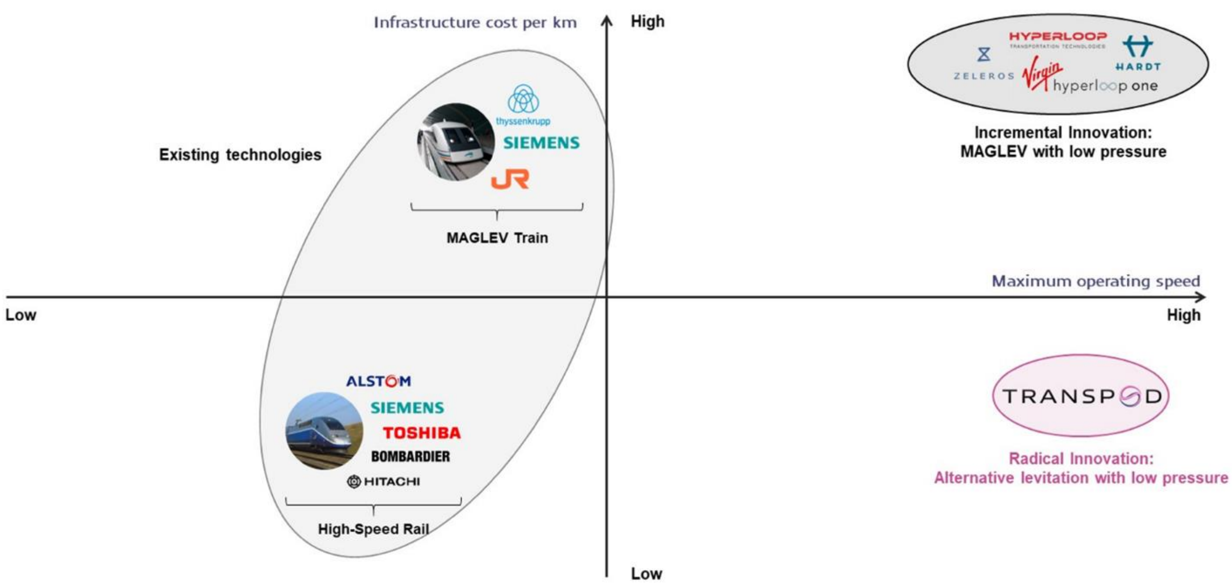
Instead, TransPod has developed key innovations which concentrate the technology on the vehicle to drastically reduce infrastructure costs. This technology allows levitation, propulsion, and high-speed power transfer without expensive MAGLEV systems or batteries.

Propulsion system: TransPod uses active levitation achieved through magnetic engines located on the vehicle. Similar to linear induction motors on some trains, these generate thrust and braking, and maintain the vehicle position along the guideway. TransPod is equipped with a self-canting mechanism which allows it to easily navigate in curves along the guideway, allowing for a smooth ride similar to high-speed rail systems. This system is patented internationally.

Power transmission: Endeavoring to be the world's fastest power transmission system, beating the capability of high-speed trains, this TransPod technology is a new innovation. This power transmission overcomes the limitations of traditional train pantographs, MAGLEV, and 3rd rail shoe systems, and is possible due to the low pressure inside the tube. This system is patented internationally.

The following figure provides an overview of TransPod's competitive positioning. To date, most competitors are focusing on the more-expensive MAGLEV technology.

Figure 5: Competitive landscape in high-speed transportation



3.4. Comparison with Other Modes of Transport: Calgary to Edmonton

To better understand the nature of the TransPod system, we will compare the practical applications of each passenger transportation option for one of the origin-destination pairs in the proposed corridor, Calgary to Edmonton.

	Passenger Flights	Car	Bus	TransPod
Length of Trip (door-to-door)	Estimated travel time: 3hr 28min	Estimated travel time: 3hr 15min	Estimated travel time: 4hr 2min	Estimated travel time: 1hr 2min
Cost of Trip	High $162	Low $37	Medium $61	Medium $90
Frequency of Departures	Medium Hourly	High On demand	Low ~6 per day	High Every 2 min
Capacity of Vehicle	High 50-215 passengers	Low 4-8 passengers	Medium 50 passengers	Medium 50 passengers

Likelihood of Trip Cancellation	Moderate (Due to weather, particularly in the winter)	Medium (Due to weather, particularly in the winter)	Medium (Due to weather, particularly in the winter)	Low Protected tube environment
Safety	High Accidents are very rare	Medium Winter conditions can be challenging	Medium Winter conditions can be challenging	High Protected tube environment

Length of trip (door-to-door)

When considering the door-to-door travel time, i.e. from the moment a passenger leaves their home to the moment they arrive at their final destination, the TransPod system drastically improves upon the current options in Alberta, saving passengers roughly 2-3 hours of travel time.

Cost of Trip

The overall cost of the trip will vary with the type of ticket purchased (economy vs business class flights, driving a budget vs a luxury vehicle, etc.) However, for the typical traveller, flights are the most expensive option, with an average one-way economy ticket price of $162. The TransPod system cuts this price almost in half, with economy tickets proposed to cost $90. Bus fares are approximately $60 on average, and costs incurred by car drivers work out to approximately $37 per one-way trip (considering the cost of ownership, fuel, parking, etc.)

Frequency of Departures

Airlines offer flights in each direction between Calgary and Edmonton approximately once per hour, from 6am to midnight. Cars are available on demand (as long as one owns a car). Buses are less popular in Alberta and therefore tend to only offer a few trips per day. Finally, the TransPod system will be able to send a new vehicle along the line every 2-3 minutes.

Capacity of Vehicle

Air Canada and WestJet both tend to use small-to-medium sized planes between Calgary and Edmonton (the De Havilland Bombardier Dash-8 and the Boeing 737), with capacities of 50-215 passengers depending on the model. Buses and the TransPod system both offer medium-capacity vehicles, each capable of carrying approximately 50 passengers. Cars offer the lowest capacity, as they are generally designed to carry between 4-8 passengers.

Likelihood of Trip Cancellation

Planes, buses, and cars are all susceptible to weather conditions. In the summer, this is usually a non-issue in Alberta; however, winter storms can bring decreased visibility, iced-up airplanes and roads, and significant snow. As a result, trips in these three modes of transport are vulnerable to inclement weather during the winter months. In contrast, the TransPod system operates in an enclosed tube environment which is designed to maintain its functionality at temperatures well beyond the range of highs and lows experienced in Alberta. Therefore, the TransPod system is much less vulnerable to weather conditions and thus less likely to be cancelled.

Safety

Cars and buses are generally safe in good conditions, but winter conditions can cause drivers to lose control more frequently. For this reason, January is identified as the time of year with the most injury-causing car crashes in Alberta, and the province experiences over 140,000 crashes per year[1]. Thus, cars and buses provide only moderate safety. In contrast, planes are one of the safest travel options, as plane crashes are

[1] *https://open.alberta.ca/publications/0844-7985*

very rare. Likewise, the TransPod system will offer a safe mode of transportation. The system will not be vulnerable to weather conditions, and numerous redundancies and failsafes - both mechanical and electronic - are designed to ensure the system remains safe for passengers.

4. Current Context of the Calgary - Red Deer - Edmonton Corridor

4.1. Economic and Transportation Landscape in Alberta

Alberta has been leading Canada's economy for decades. Between 2004 and 2014, the province contributed disproportionately to economic growth in Canada, growing at 3.4% – which is more than twice the rate of growth in the rest of the country (at 1.6%). In that time, the province created more jobs than anywhere else in the country. As an economic powerhouse, Alberta's contribution to the rest of the country has been truly staggering.

Today, Alberta continues to build on its economic strengths. Alberta's economy emerged from its 2015/2016 recession, and was a leader across the nation in economic growth until the Covid-19 pandemic ravaged the global economy in 2020. Now, Alberta is again in the process of emerging from an economic downturn.

As part of previous recoveries, Alberta has taken advantage of opportunities to ensure that Albertans have access to high-skilled jobs in growing sectors and has supported Albertan companies in their quest to become globally competitive and fully capable of reaching new markets. To that end, Alberta's economy is positioned for continued success. However, the province is vulnerable to shocks in the oil market, as evidenced by the economic performance in 2020. Beyond the lockdowns enforced around the world, a major driver of economic hardship in 2020 was the plummeting prices of oil, falling from $63 per barrel in December 2019 to below $20 per barrel in April 2020[2]. Despite the fact that the whole world was affected, Alberta was hit harder than many regions due to its continued reliance on the oil economy: Alberta's economy contracted an estimated 7.8%[3] in the year, whereas the rest of Canada contracted an estimated 5.4%[4].

It is essential that Alberta diversifies its economy and invests in new infrastructures to continue to be a leader in the future. There is a need to invest in new sources of competitive advantages and to foster new industries. The Alberta government, through Alberta Innovates, is moving in the right direction: it has committed to working with industry to support new technology development, increase commercialization and develop new markets and opportunities.

Concurrently, the Government of Alberta has exhibited a commitment to providing Albertans with a safe and sustainable transportation system. This is why key strategies identified by the Ministry of Transportation include the following: (i) maintaining Alberta's existing transportation assets and investing in new strategic infrastructure, (ii) adapting Alberta's transportation system to new innovations and technologies. The City of Calgary has been leading the way for the Embracing Innovation strategy by approving in 2017 a motion to "support the development of a research centre and test track as the first steps in determining the viability of [hyperloop vacuum-train] technology".

The project presented by TransPod Inc. directly aligns with the objectives of Transport Canada and Alberta's Ministry of Transportation by offering a framework to bring sustainable transport solutions that could profoundly impact Alberta's economic landscape.

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[2] *https://www.macrotrends.net/1369/crude-oil-price-history-chart*

[3] *https://www.alberta.ca/economic-outlook.aspx*

[4] *https://www150.statcan.gc.ca/n1/daily-quotidien/210302/dq210302a-eng.htm*

4.2. Findings of the Previous Feasibility Studies

For half a century, feasibility studies have been conducted on the potential of a high-speed transportation solution between Calgary and Edmonton. First in 1985, the Alberta Department of Economic Development published “High-Speed Rail Prospects in the Calgary-Edmonton Corridor”, which concluded that a high-speed rail system would be technically feasible, financially viable, attractive to passengers, and an important source of jobs to contribute to Alberta’s economy. Then in 2004, the Van Horne Institute published “Calgary-Edmonton High Speed Rail: An Integrated Economic Region” which reached similar conclusions: a high-speed rail system could be financially viable and would provide Albertans with travel time savings, thousands of jobs, and environmental benefits. The main barrier would be infrastructure costs. In 2008, TEMS Inc. and Oliver Wyman jointly published “Economic Benefits for Development of High-Speed Rail Service in the Calgary-Edmonton Corridor” on behalf of Alberta Infrastructure and Transportation. The report again showed significant economic and community benefits that would be produced thanks to the new high-speed transportation system; however, again the infrastructure cost was deemed to be the main barrier.

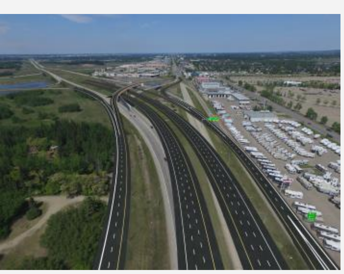
In all studies, there is a consensus that the corridor has a need for a high-speed transportation system. Alternatives in the province are not currently sufficient: roads can make driving treacherous during the winter months; flights are expensive and do not save the traveller much time compared to driving given the moderate distance of the trip; and bus service has been minimal ever since Greyhound exited the region in 2018. As such, a new transportation solution which is affordable, fast, and safe would provide significant benefits to the province.

4.3. Current Transportation Solutions in the Corridor

Alberta is separated into several distinct economic zones. The distance between the main metropolitan centres, Calgary and Edmonton, is roughly 300 kilometers. Directly in between them is Red Deer, almost exactly 150 kilometers away from both Calgary and Edmonton. The northern region of the province serves as the primary Canadian home for the oil and gas industry, with notable cities such as Fort McMurray acting as the launching point for several oil ventures.

The main types of transportation within the Calgary-Edmonton corridor include road and air, with rail serving predominantly as a means for transporting natural resources.

Air Transportation
Air travel is controlled in the region by two major players, Air Canada and WestJet, in addition to several smaller airlines which offer less frequent flights. The flow of movement in the region is such that both companies offer frequent passenger flights (approximately hourly) between Calgary and Edmonton, but no flights to Red Deer. At the same time, cargo planes are frequently arriving in both Calgary International Airport and Edmonton International Airport.



Road Transportation
Road transportation in the region occurs almost entirely on Highway 2, a provincial highway which runs directly north-south between Calgary and Edmonton (and beyond, both north and south). Additional roadways run in approximately the right direction to connect Calgary and Edmonton, such as provincial highways 21 or 22, but neither provides direct travel like Highway 2. Roads are mostly filled with passenger vehicles or trucks carrying freight; however, there is also a (limited) bus service in the region.

Rail Transportation
Passenger rail is currently not offered between Calgary and Edmonton. Instead, the rail tracks in the region are reserved for freight, and are predominantly used by Canadian National and Canadian Pacific to transport heavy goods such as natural resources or raw materials which would be inefficient to transport by truck or plane. Looking elsewhere in the province, there is a feasibility study underway regarding a passenger rail service from Calgary to Banff.

4.4. Summary of the Current Transportation Context in the Corridor

Overall, the Calgary-Red Deer-Edmonton corridor is one that is dominated by car travel. The region has a high propensity for car ownership - in 2016, Alberta had 3.6 million car registrations[5] and a population of only 4.1 million, meaning that there are almost as many cars as there are people in the region. Additionally, the distance between the cities is short enough that in the time one could drive to an airport, check in, wait to board their flight, and finally fly to their destination, they could have just as easily driven the full distance and saved some money in the process. As a result, plane travel is less common in this region than in many others around the world. Finally, bus services are lacking, with very infrequent departures.

All of this points to the fact that there is currently no "stand-out" travel option in the region. Planes and buses are not well suited to the needs of the province, and as a result, Albertans have to date been forced to continue to rely on driving, even when the conditions pose risks.

[5] *https://open.alberta.ca/*

5. Stations & Route Options

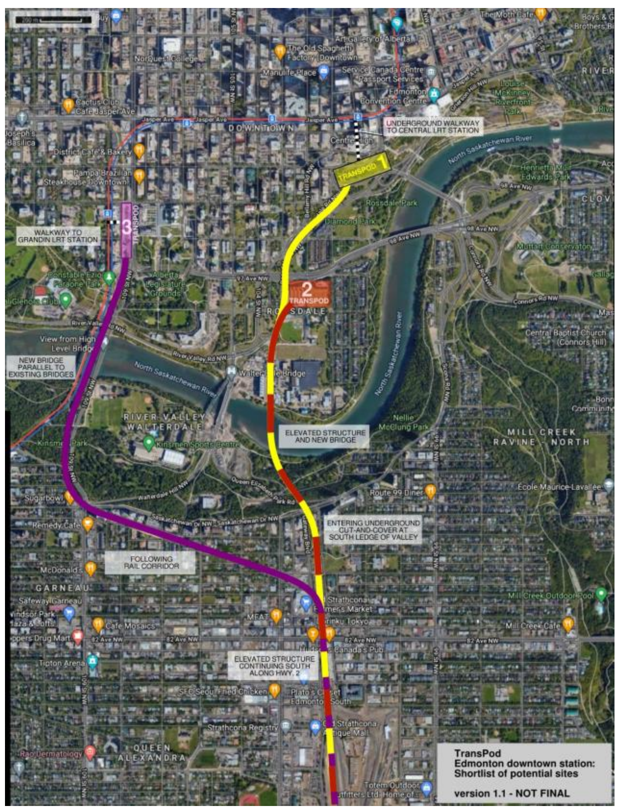
5.1. Context

Several station locations and high-speed route options have been identified in Alberta through detailed analysis of the region. This chapter summarizes the results of TransPod's analysis. The full analysis is available in the full report to the Alberta government.

It is essential to note that a TransPod line has specific features that are different from a train, and different from previous hyperloop designs, leading to the benefits for Alberta in terms of cost and performance from this Canadian system. This leads to a specific optimized route for a TransPod line in Alberta. Following the customization process below unlocks the benefits of a TransPod line for application in the region.

5.2. Edmonton Downtown Station

In Edmonton, three potential sites were shortlisted, as shown in the following map:

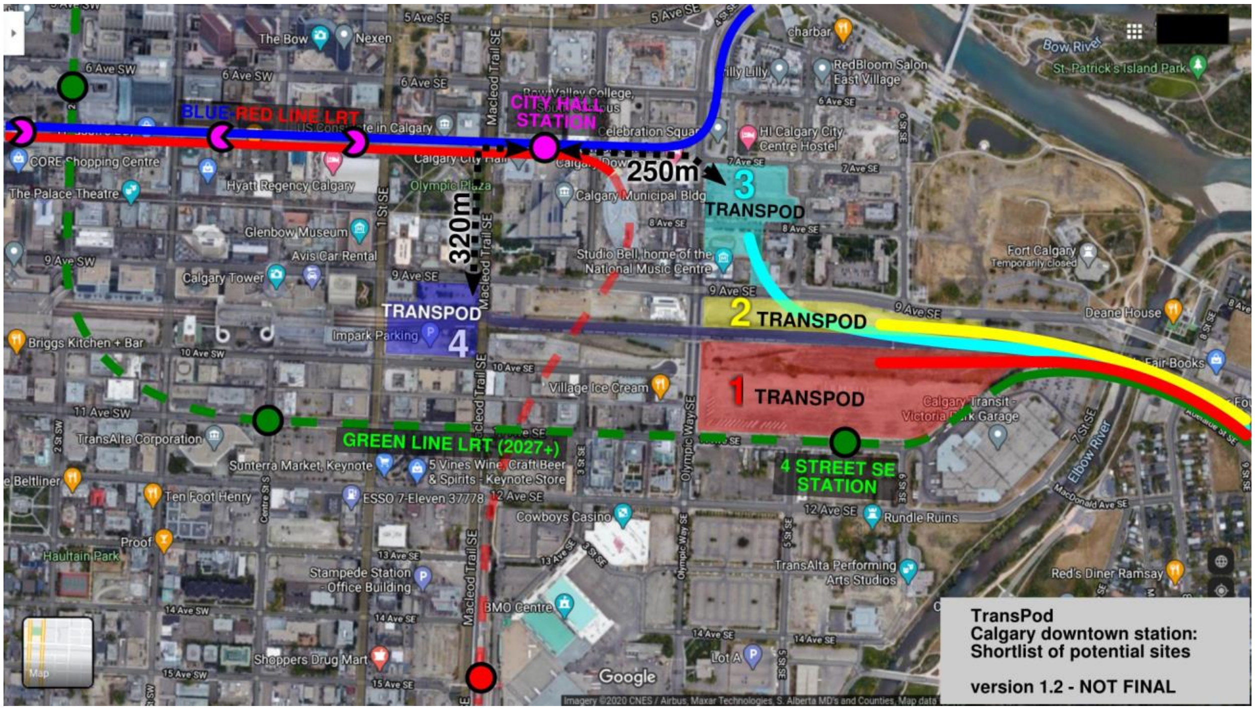


Following the analysis of each selection criteria *(see full report)*, Site 1 has been recommended for the Edmonton Downtown TransPod Station.

Further analysis showed that, in addition to using Site 1, by also adding a portion of Site 2 (to be used to augment Site 1 for vehicle processing and turnaround), the combined configuration could better facilitate constructability and cost at Site 1 for the station itself.

5.3. Calgary Downtown Station

In Calgary, four potential sites were shortlisted, as shown in the following map:



Following the analysis of each selection criteria *(see full report)*, Site 1 has been recommended for the Calgary Downtown TransPod Station.

In this location, the site provides excellent space for a full-featured station, including an architecturally grand passenger station, parking facilities, and TransPod facilities including guideway curves, and vehicle processing facilities. The full-featured station would also allow bus terminal operations, and a direct connection to the future Green Line LRT station onsite. It can also allow cargo shipping/receiving.

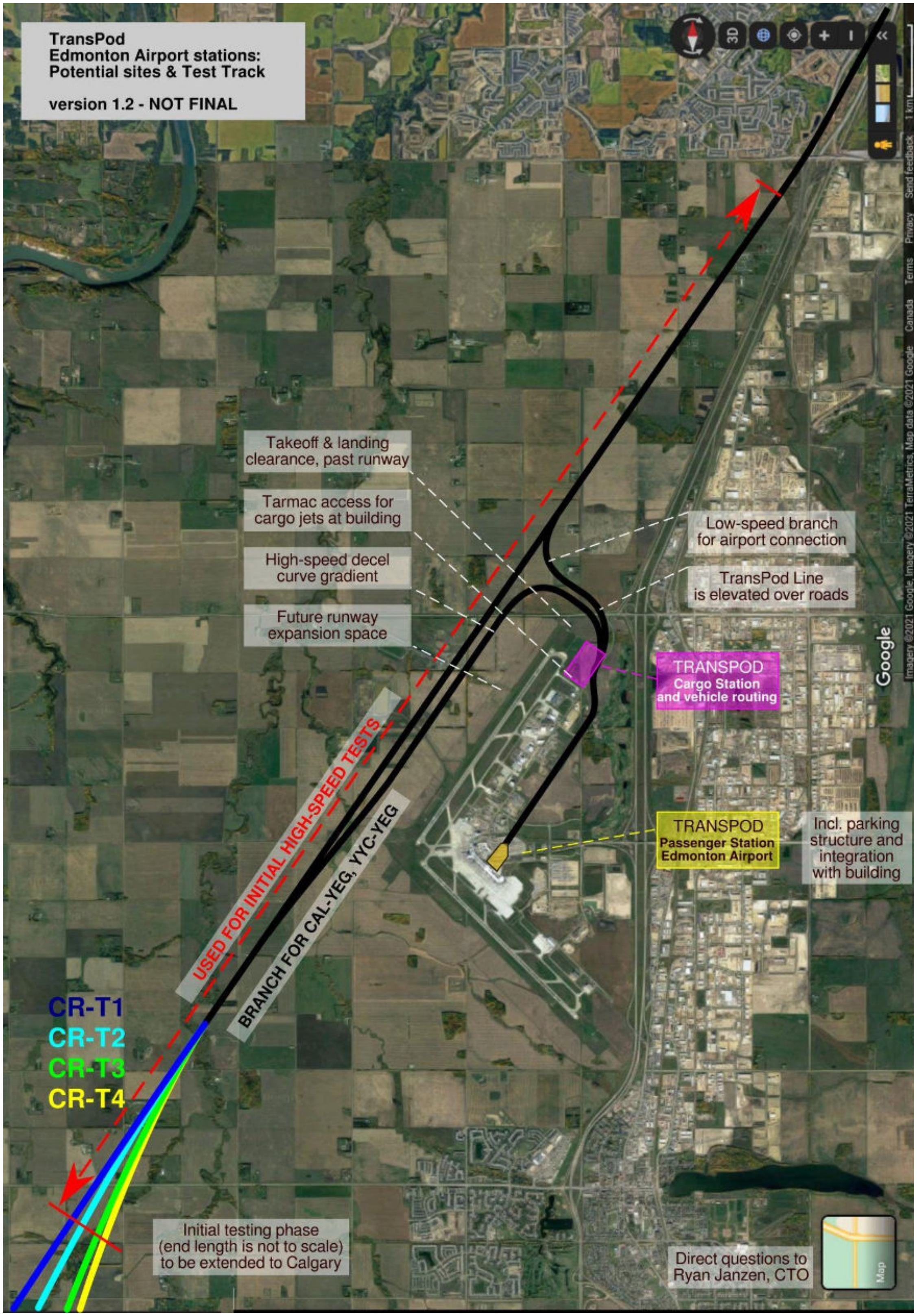
5.4. Edmonton Airport Station, and Test Track

The proposed Edmonton International Airport station is the next site to consider. Both passenger and cargo travel were identified as a target market. Therefore, passenger and cargo facilities are planned. These are initially proposed at separate locations, to be located as close as possible to passenger terminal areas and the cargo processing areas and jet apron access.

TransPod Inc. will work with the respective airport authorities to identify further available land on the airport property that will allow for a smooth passenger and cargo transition between the airport facilities and the TransPod system.

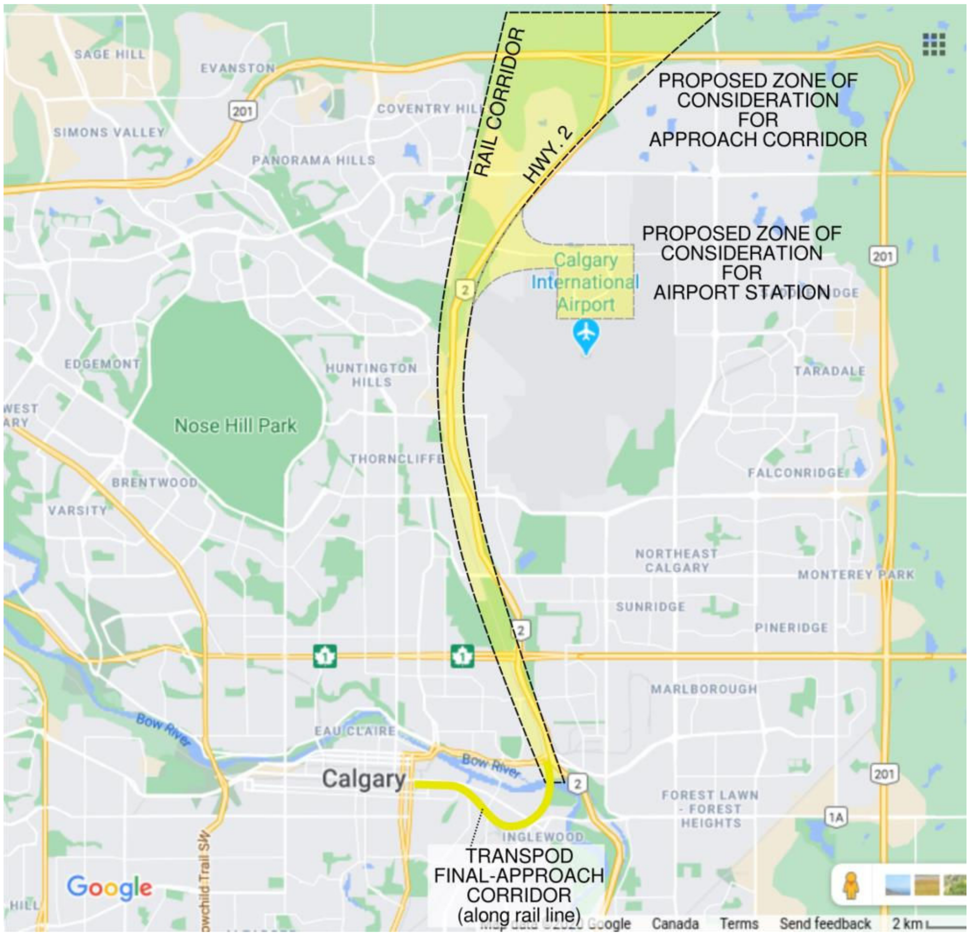
Additionally, a test track is proposed near the Edmonton Airport site, as part of a first phase of construction to enable certification of the overall system with high-speed tests. This will be described in further detail in the "Implementation Plan" section of this report.

The proposed integrated test track route and Edmonton Airport Stations are shown on the following map. For more details on the corridor options, see the following sections, as well as the full report.



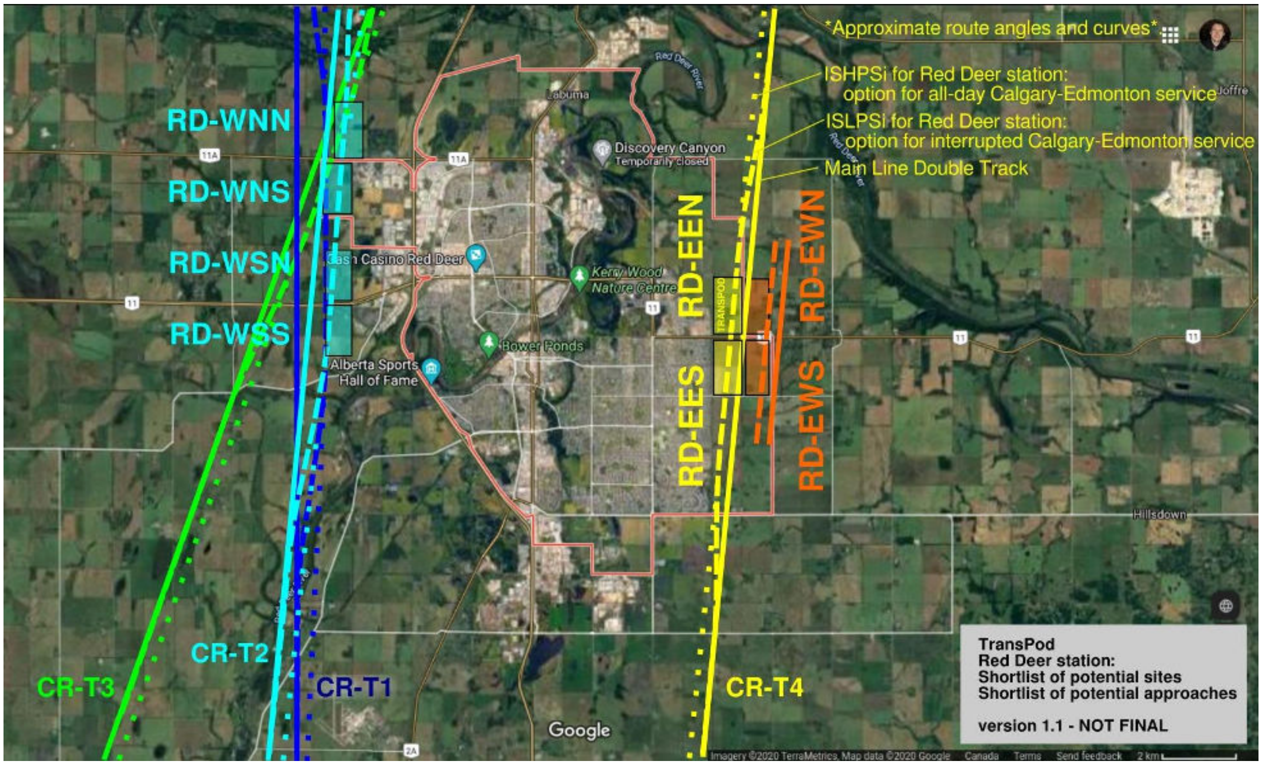
5.5. Calgary Airport Station

In Calgary, a test track will not be necessary if the test track is constructed near Edmonton. Therefore, only the city approach and airport stations must be evaluated. To connect Calgary Downtown, Calgary International Airport, and the high-speed portion of the route, an initial proposal for the approach corridor is illustrated as follows.



5.6. Red Deer Station

Pending further cost-benefit analysis, a fifth station is under consideration for Red Deer. This decision will be made in consultation with the Alberta Government and all relevant stakeholders. In the event that a Red Deer station is built, eight potential sites were shortlisted, as shown in the following map:

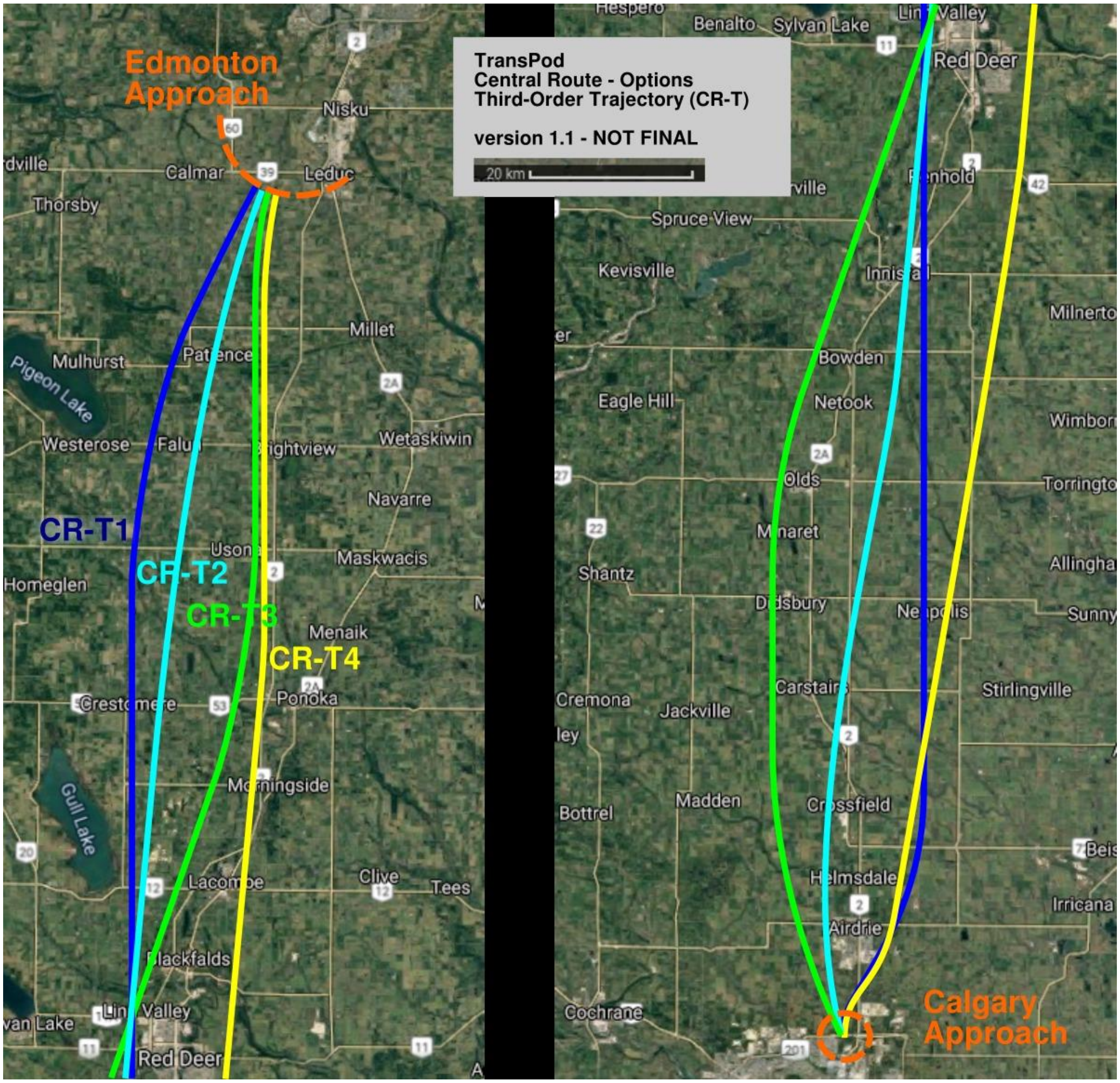


The Red Deer map also shows a series of route trajectory options, which are detailed in a next section. They are shown here for reference, to show the ability to connect to the potential station locations above.

All eight of these sites have direct highway access, and can offer space for bus transit stations to easily get from the TransPod station to downtown Red Deer. These site options for Red Deer are reserved for the decision of high-speed route topology, in the next section.

5.7. Central Route: Corridor Options

Based on the unique requirements of the TransPod system and the local considerations in Alberta, four broad categories of central route order-2 trajectory (CR-T) have been proposed as options to consider, outlined in the map below:



CR-T1 is the maximum-rectilinearity route. It reduces as much as possible the number of individual property-owners which need to be negotiated with. Therefore, the project risk is reduced. This route straddles between Penhold and Innisfail to cross Highway 2. Similarly, CR-T3 has the second-highest rectilinearity. It achieves this with two separate north-south sections, and otherwise crosses Red Deer at a greater angle. The main disadvantage of CR-T1 and CR-T3 is that these routes are longer overall lengths, which increases certain parts of the infrastructure cost such as those cost factors which involve physical construction and materials.

In contrast, CR-T2 is the maximum broad curvature route. This route achieves the shortest distance between Calgary and Edmonton, but comes at the sacrifice of a higher number of property crossings and higher property risk.

CR-T4 is a compromise between the above principles. CR-T4 also is the only route topology that entirely crosses the east side of Red Deer.

Please see the full report for the full analysis. Based on the analysis in the full report, CR-T1 or CR-T4 are recommended; however, both CR-T2 and CR-T3 are also constructable. Further consultation with the Government of Alberta, and other stakeholders, will be used to select the route trajectory. Based on the preliminary analysis, all four of the selected routes are feasible, with a recommendation for options CR-T1 and CR-T4.

Following further stakeholder consultation, future steps will be the 4th-order detailed engineering of the route trajectory, to consider vehicle dynamics in higher-order mathematical formulations.

6. Passenger Demand in the Base Year

6.1. Methodology

There are three potential sources of passenger demand for the TransPod system:

1. Diverted demand: people who would otherwise take another transport mode, such as a car. Diverted TransPod demand was calculated using a logit model, in line with previous high-speed rail studies in Alberta.
2. Induced demand: people who would otherwise not travel, but are compelled to do so by the better offer of the TransPod system. Induced demand was calculated using price and time elasticity of demand and comparing the TransPod system to the current travel options in Alberta.
3. Flight reorganization demand: several countries, such as France and Germany, have been moving towards banning short-haul flights and instead prioritizing high-speed rail for these trips. This helps airlines reduce unprofitable short-haul routes, while likewise helping countries pursue their environmental targets. The TransPod system could enable Alberta to do the same. Potential flight reorganizations were determined based on an analysis of historical flight schedules in Alberta; note that this demand source only affects travel between Calgary and Edmonton, not trips to Red Deer.

6.2. Demand Projections for Each Origin-Destination Pair

Based on the three demand sources described above, demand for the TransPod system has been projected from the first year of operations until 2060. *These calculations are described in detail in the full report submitted to Alberta Transportation.*

Calgary - Edmonton

Between Calgary and Edmonton, if no flight reorganization occurs, it is projected that the TransPod system will achieve a share of approximately 39% of the total passenger trips between Calgary and Edmonton, equal to roughly 6.07 million passengers per year based on current travel patterns. If flight reorganization does occur, TransPod could see up to 9.15 million passengers in the best case scenario. Cars remain the most popular transportation option, with roughly a 61% market share.

For the sake of the financial analysis, a base case assumption of limited flight reorganization was used, resulting in 6.7 million passengers per year in the baseline year.

Calgary - Red Deer

Between Calgary and Red Deer, TransPod is projected to achieve a market share of approximately 36%, equal to 0.91 million passengers per year in the baseline year. Cars remain the most popular with roughly 63% of ridership, and bus grasps a market share of less than 1%.

Edmonton - Red Deer

Between Edmonton and Red Deer, TransPod is projected to achieve a market share of approximately 37%, equal to 0.65 million passengers per year. The car remains the most popular with roughly 62%, and the bus grasps a market share of less than 1%.

Downtown Calgary - Calgary International Airport

Between Calgary and YYC, the TransPod system is projected to grasp approximately 23% of passenger travel, or 5.02 million passengers in the baseline year. Cars and taxi/Uber services remain the most popular with roughly 77%; and bus services have less than 1% market share.

Downtown Edmonton - Edmonton International Airport

Between Edmonton and YEG, the TransPod system is projected to grasp approximately 22% of passenger travel, or roughly 2.59 million passengers in the baseline year. Cars and taxi/Uber services remain the most popular with a market share of 78%; and the bus grasps less than 1% of the market.

It is worth noting that there are other potential sources of passenger demand which have been intentionally omitted from this analysis. For example, some Albertans may choose to move to a new city within the corridor once the TransPod system is built, and commute to work daily using the TransPod system, since TransPod will enable them to complete their multi-city commute in under an hour. This could be a potentially significant source of passenger demand; however, an adequately comparable project has not been completed in the past, so it is difficult to make reliable projections of the number of Albertans that will pursue this option. As a result, it has been omitted from our analysis, resulting in more conservative but also more defensible passenger projections.

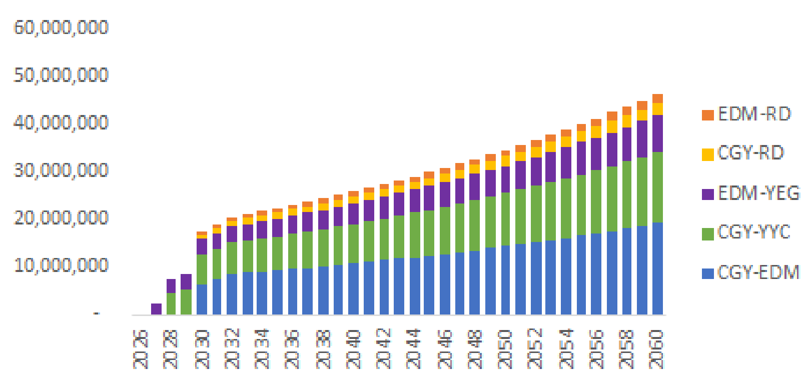
6.3. Corridor-Wide Demand

Following the introduction of new transport infrastructure and services, there is typically a delay in achieving the forecast demand levels, as travellers adapt to the availability of a new transport facility. This is referred to as the ramp-up period. Ramp-ups are widely used in high-speed rail studies and provide a more conservative view on the demand for new modes of transport. The following figure provides an overview of the ramp-up used in this analysis:

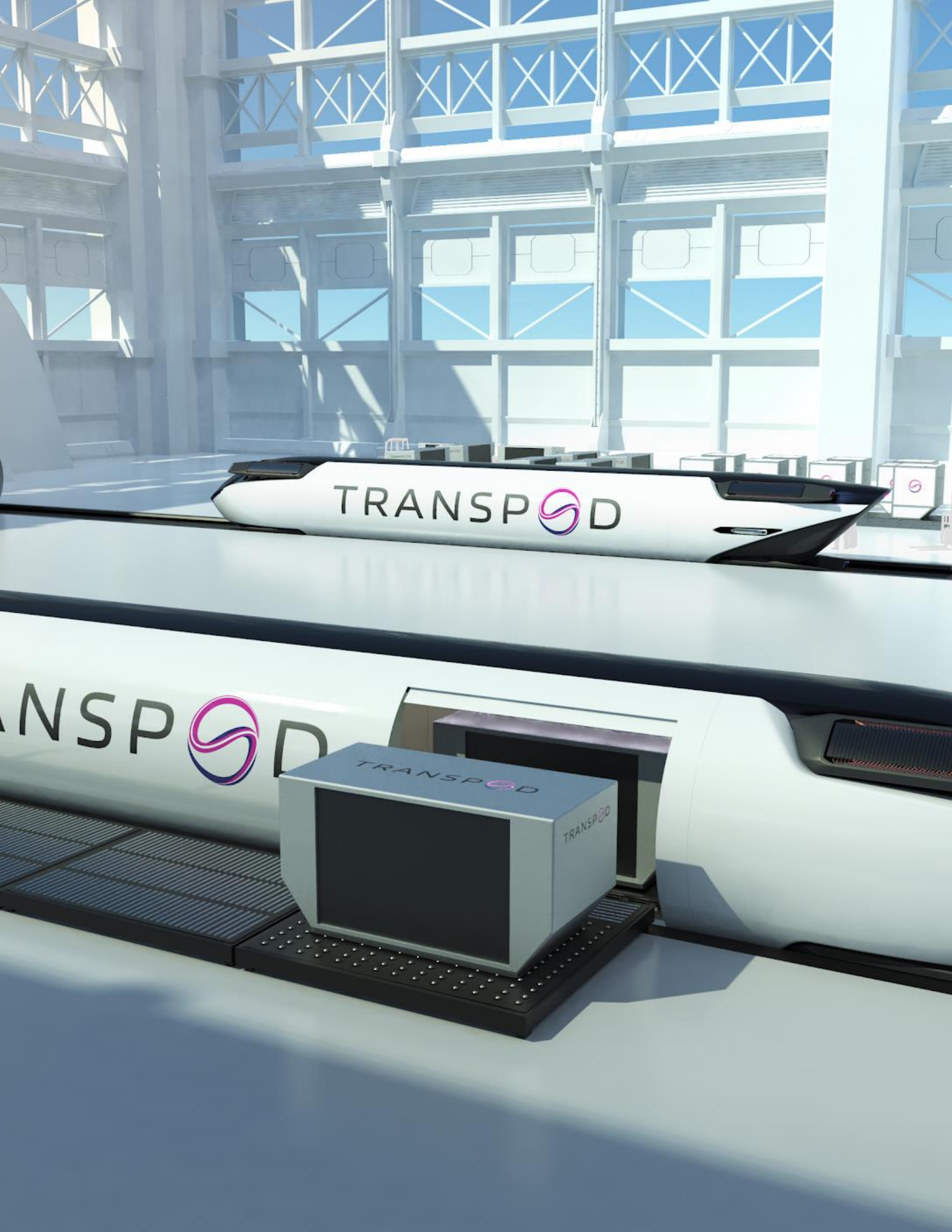
	2027	2028	2029	2030	2031	2032
Segment 1 / 2	80%	90%	100%			
Full Line				80%	90%	100%

Using this ramp-up rate, the following figure presents an overview of the total passenger demand projected for the TransPod system from 2027 to 2060, including all origin-destination pairs.

Figure 6: Total Ridership within the Alberta corridor, 2027-2060



The forecast begins in 2027 when the segment connecting Edmonton with Edmonton International Airport will be available to begin operations, and then jumps sharply in 2030 when the full Calgary-Edmonton construction will be completed. Thereafter, demand grows steadily, in line with population growth.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7. Cargo Demand

In addition to passenger transportation, the TransPod system has been designed to carry freight. Cargo pods will be able to function interchangeably within the tube alongside passenger pods, and will appear from the outside to be the same. However, the interior of the cargo pods is custom designed to be compatible with the most common types of freight containers and pallets, making the TransPod cargo system easily interoperable with current truck and air cargo systems.

7.1. Methodology

To determine the demand for freight transportation on a TransPod line, TransPod analyzed the total volume of freight currently transported in the region; the characteristics of that freight such as weight and time-sensitivity; and the characteristics of each competitive option including air freight, rail, and trucking.

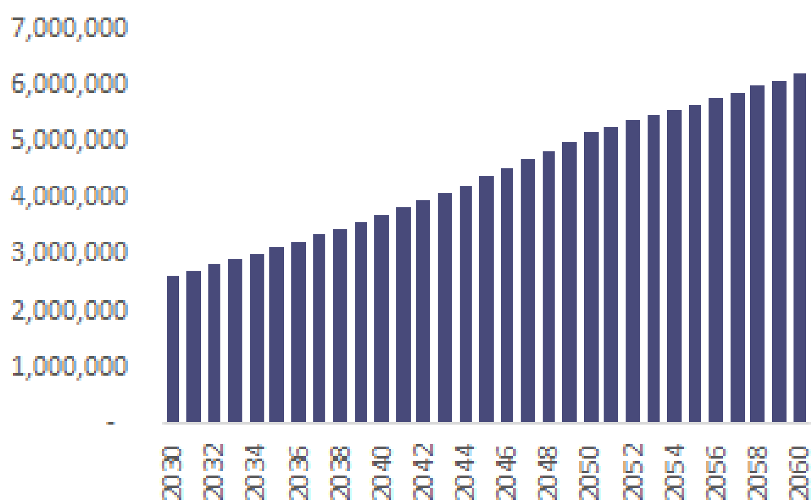
In addition to conducting our own research into publicly available data sources (such as those published by Statistics Canada[6] and Calgary Economic Development[7]) TransPod has also conducted several discussions with major freight players in the region in order to verify our assumptions regarding freight volumes in the region.

The research and analysis behind these projections is described in detail in the full report submitted to Alberta Transportation.

7.2. Calgary-Edmonton

Based on the analysis described above, the TransPod system is projected to achieve a market share (in terms of annual tonnage) of 16.7% of freight services, translating to a volume of approximately 2.6 million tonnes of freight in the first year, and growing steadily thereafter. This is summarized in the figure below.

Figure 7: Projected Cargo Demand for the TransPod system, Calgary-Edmonton (annual tonnes)



6 *https://www150.statcan.gc.ca/n1/pub/50-503-x/50-503-x2018001-eng.htm*

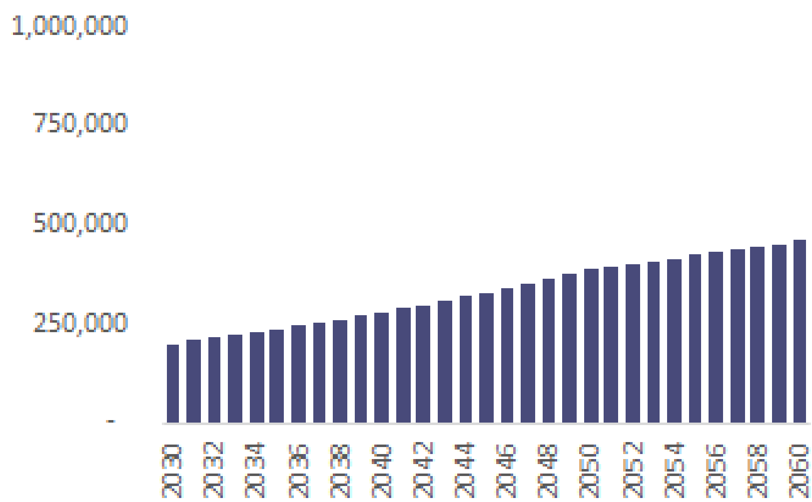
7 *https://www.calgaryeconomicdevelopment.com/dmsdocument/25*

A potentially large source of demand has been intentionally omitted from the analysis, as it is impossible to quantify at this time. Currently, many freight operators serve Alberta by sending flights from their central hub (somewhere else in North America) to Edmonton and sending separate flights from their central hub to Calgary, each day. This creates redundancy; it would be more cost-efficient for freight companies to send fewer, but larger, planes to one centralized location in the province. Upon the introduction of the TransPod system, these freight operators may choose to streamline their operations by sending all of the Alberta-bound cargo by air into one airport, and then using the TransPod system to transfer cargo between cities as necessary. In conversations with freight carriers, they have confirmed their interest in this option. If this occurs, the cargo demand for the TransPod system will be higher than that which has been identified today.

7.3. Calgary-Red Deer

Between Calgary and Red Deer, the TransPod system is projected to obtain a market share of approximately 16.3%, translating to roughly 200,000 tonnes per year in the first year.

Figure 8: Projected Cargo Demand for the TransPod system, Calgary-Red Deer (annual tonnes)

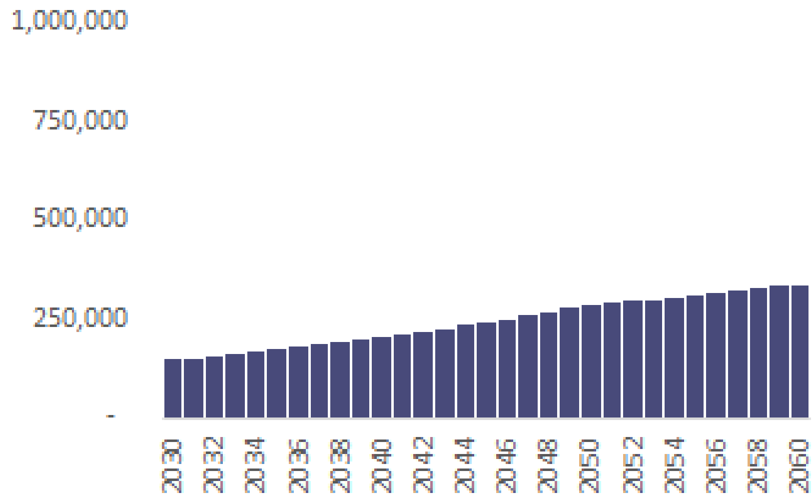


As mentioned in the “Passenger Demand” section, it is worth noting that the introduction of ultra-high-speed transportation such as the TransPod system may motivate people to move to new areas in the corridor. For instance, some Edmontonians or Calgarians may choose to move to Red Deer if they are able to commute in a matter of minutes to the bigger city for work. If this occurs, this will lead to significantly more overall cargo demand in Red Deer than has currently been projected, which would drive estimates higher.

7.4. Edmonton-Red Deer

The demand for the Edmonton-Red Deer cargo transportation is similar to that of the Calgary-Red Deer projections: the TransPod system is projected to garner a market share of approximately 16.3%. That equates to roughly 150,000 tonnes in year one.

Figure 9: Projected Cargo Demand for the TransPod system, Edmonton-Red Deer (annual tonnes)



It is assumed that no cargo will be shipped on the TransPod system between a city and its respective airport (between YYC and downtown Calgary, or YEG and downtown Edmonton). Instead, freight operators are expected to continue using trucks to cover these short-haul distances.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8. Project Costs

The innovation behind the TransPod technology is critical to achieve a lower capital cost compared to building maglev, traditional hyperloop, or other systems. To be able to attract the investment necessary for this project, it is crucial to keep the costs reasonable. Specifically, private investors will demand that the project costs are low enough such that the project at least breaks even, but ideally generates positive returns in the long run.

There are several categories of cost that must be considered. These categories, and the associated cost projections, are outlined below. All cost estimates are currently "Class 5" and continue to be refined to further levels of detail in partnership with infrastructure companies. *Full details of these calculations are contained in the infrastructure cost model which accompanies the full report.*

8.1. Up-Front Costs

The up-front cost to construct the TransPod system in Alberta has been summarized in the table below. These numbers are based on a thorough cost estimate conducted specifically for the Alberta project, by engaging with local and global suppliers and requesting quotes based on the Alberta project specifications.

	Avg. Cost per km (C$ MM)	Total Cost: Alberta (C$ MM)
Costs that vary by kilometer		
Infrastructure Route (Linear)	$39.49	$13,822.28
Infrastructure Systems (Linear)	$3.66	$1,280.22
Infrastructure Facilities (Linear)	$0.39	$136.36
Land (Linear)	$1.56	$545.24
Sub-total - Costs that vary per km	*$45.10*	*$15,784.10*
Costs that do not vary by kilometer		
Infrastructure Systems (Fixed)		$23.97
Passenger Facilities		$983.81
Cargo Facilities		$144.54
Operating Facilities		$19.98
Maintenance and Storage Facilities		$100.77
Rolling Stock		$829.60
General Indirect Costs		$4,572.36
Sub-total - Costs that do not vary per km		*$6,675.03*
Total Project Cost (CAD)	***Per Km: $45.10 million***	***Total: $22.46 billion***

Infrastructure Route (Linear): The infrastructure route is the main physical infrastructure, such as the support pillars and the steel tube. These factors dominate the cost of the project.

Infrastructure Systems (Linear): This category is composed of several systems which must traverse the full length of the infrastructure, such as communications and control systems, and vacuum pumps.

Infrastructure Facilities (Linear): The infrastructure facilities which vary per kilometer are those which occur in regular intervals, such as those which house essential equipment for the TransPod line operations.

Land (Linear): The land for the Alberta line will most likely be secured through long-term easement agreements; the more expensive alternative is for all of the land to be purchased outright. To keep the cost estimation conservative for the time being, the cost of land included above is an estimate of what it would cost to buy, rather than secure via easement, all of the land.

Infrastructure Systems (Fixed): This category refers to some infrastructure systems (such as communications and control, etc.) which are not required to traverse the full length of the TransPod line, and therefore do not vary if the length of the line increases or decreases.

Passenger Facilities: The current cost estimate refers to the cost if five passenger stations are built: Calgary, YYC, Red Deer, YEG, Edmonton. Note that TransPod has recommended putting the Red Deer station on probation pending further review. If the Red Deer station is removed from the plan, the cost of passenger facilities drops accordingly.

Cargo Facilities: The current cost estimate refers to the cost if three cargo hubs are built: YYC, Red Deer, and YEG. Note that TransPod has recommended putting the Red Deer station on probation pending further review. If the Red Deer station is removed from the plan, the cost of cargo facilities drops accordingly.

Operating Facilities: This category refers to general buildings for line operations, such as the control centre and office buildings for staff including training.

Maintenance and Storage Facilities: This category refers to the facility which will be used for maintenance and storage of pods used in the Alberta line.

Rolling Stock: This is the cost to purchase pods.

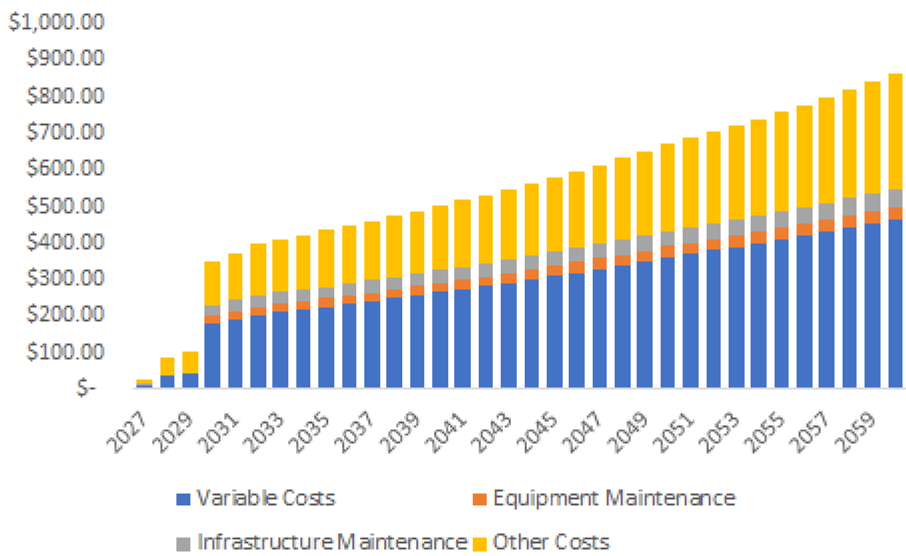
General Indirect Costs: Indirect costs include factors not directly related to the construction of infrastructure, such as permitting, project management, testing, or contingencies.

Overall, the up-front CAPEX for infrastructure, vehicles, and land for the Alberta TransPod project is forecasted to cost a **total of $22.46 billion CAD ($18.41 billion USD** using exchange rates at the time of writing), based on constructing approximately 350 total kilometers of unique track (including some areas where dual-track will be required due to high-speed and low-speed branches near stations) at an average cost per kilometer of $45.10 million CAD ($36.97 million USD) plus an additional cost of $6.68 billion CAD ($5.47 billion USD) for fixed items such as stations and pods.

8.2. Operating Costs

In addition to the up-front costs associated with construction, the TransPod line's profitability will depend upon long-term cost of operations. These costs include various factors such as energy costs to run the line, maintenance on the infrastructure and vehicles, and more. Some of these costs will vary with the number of vehicles sent per hour (for instance, every time a vehicle is sent, energy will be consumed) and some will be fixed (for instance, vacuum pumps will need to run at a constant rate to maintain vacuum pressure in the tube, regardless of how often pods are sent). A summary of the operating costs until 2060 is included below. *Full details of these calculations are contained in the financial model which accompanies the full report.*

Figure 10: Operating Costs of the TransPod line (C$ MM)



Variable Costs: This category includes costs which vary depending on how frequently pods are sent, such as power consumption and pod maintenance costs. Power consumption is the main factor here, making up approximately 90% of the costs associated with this category.

Equipment Maintenance: This category includes all costs related to maintaining TransPod equipment, such as labour, equipment, and materials.

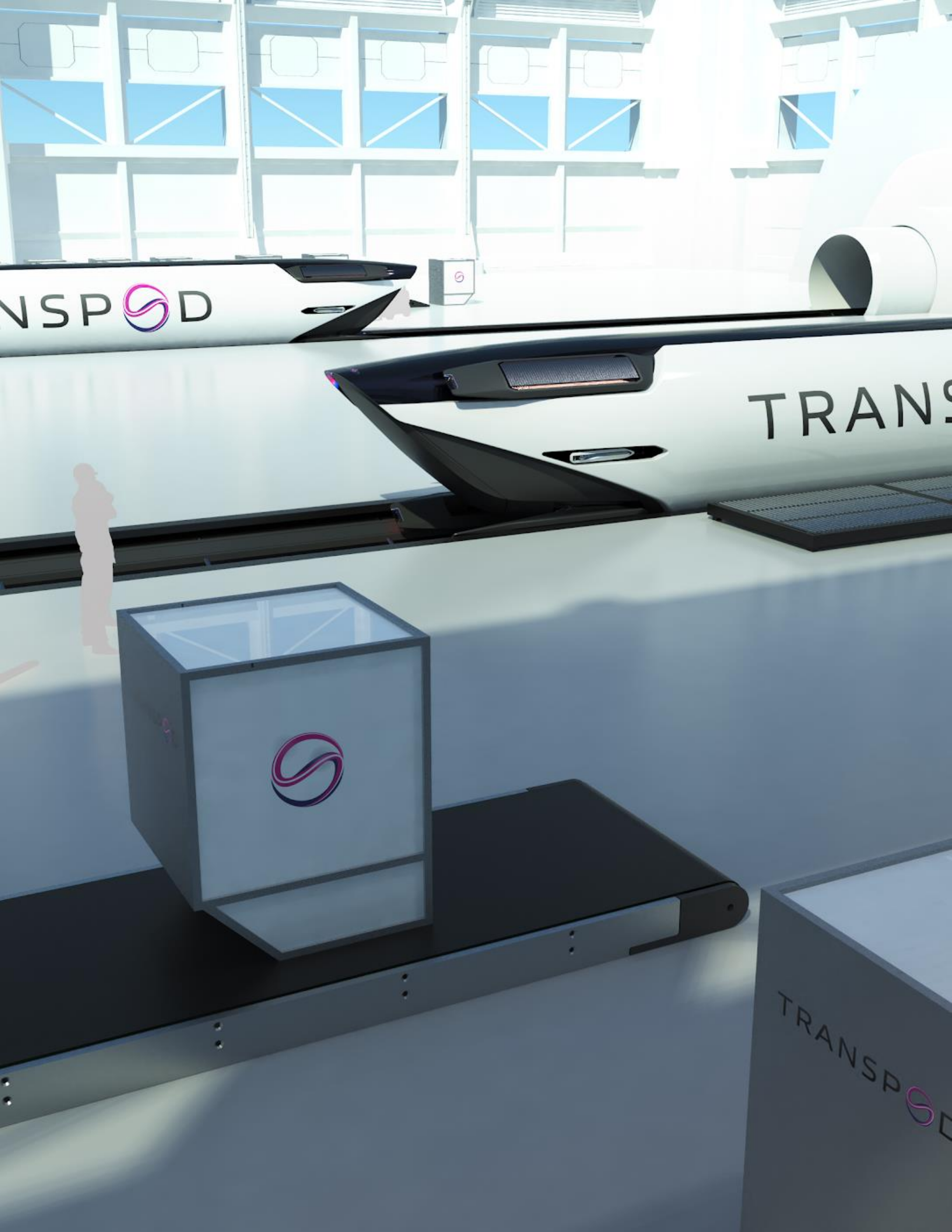
Infrastructure Maintenance: This category includes all costs related to maintaining the physical TransPod infrastructure, such as labour, equipment, and materials.

Other Costs: This category includes a wide variety of other costs typically expected in transportation infrastructure projects, such as staff wages or insurance claims.

Overall, operating costs are relatively low considering the scale of this project, at consistently below $1 billion per year. The main factors which dominate the cost of operations are energy consumption and wages. As such, there is an opportunity to significantly decrease operating costs if TransPod chooses to power the TransPod line with energy produced by solar panels along the infrastructure rather than with energy from the Alberta electrical grid.

8.3. Summary

The costs for the project are dominated by the infrastructure construction cost, as expected. A key success factor for the project will be to avoid cost overruns and keep the construction within budget, which will require diligent project planning and project management. Once the construction is complete and the line is operational, costs are low as compared to the revenue, as is summarized in the next section of the report. As a result, the project becomes a strong cash-flow generator after the construction has been completed, and investors are able to recoup their high up-front investment relatively quickly.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9. Economic Analysis

9.1. Ticket Price (Passenger)

The table below provides an overview of the base fare structure used in this study.

	Distance (km)	Economy Class (CAD)	Business Class (CAD)
Calgary-Edmonton	300	$90	$150
Calgary-Red Deer	147	$50	$90
Red Deer-Edmonton	153	$50	$90
Downtown Calgary-YYC	16	$12	$20
Downtown Edmonton-YEG	30	$12	$20

In addition to the Economy and Business Class options, additional fee structures may be explored in the future. For example, individuals or companies may be able to request a private pod in the same way that some currently use private jets. However, these concepts are strictly hypothetical right now and therefore are not included in this analysis.

9.2. Ticket Price (Cargo)

The table below shows a preview of the fees for TransPod cargo services.

	Distance (km)	Cost per tonne-kilometer (CAD)	Cost per Tonne (CAD)
Calgary-Edmonton	300	$0.48	$144.00
Calgary-Red Deer	147	$0.48	$70.56
Red Deer-Edmonton	153	$0.48	$73.44

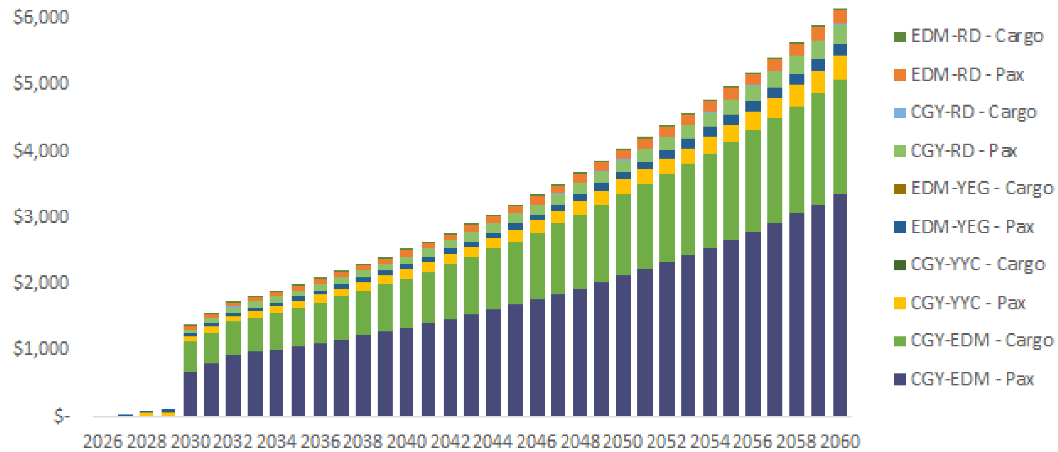
9.3. Profitability Analysis

9.3.1. Revenues

Passenger and Cargo Revenue

The primary revenue sources from the TransPod line include passenger revenue, on a per-passenger basis, and cargo revenue, on a per-tonne-kilometer basis. The revenue projections for each origin destination pair are summarized in the figure below. *Calculations behind these figures are shown in more detail in the full report submitted to Alberta Transportation and the accompanying financial model.*

Figure 11: Full TransPod line Revenue Projections, 2027-2060 (C$ MM)



In total, based upon the current ticket prices, travel trends, and demand projections, TransPod estimates that early operation of the airport connection lines will drive approximately $32 million in revenue in 2027, operations of the full line will lead to over $1.36 billion in revenue in 2030 (year one of operations), and this revenue will consistently rise each year thereafter until the line reaches capacity. By 2060, the TransPod line will be generating almost $6 billion in annual revenue.

Alternative Revenue Streams

In addition to revenue from line operations, there are four key revenue streams which TransPod expects to realize upon the construction of the line, which have not been included as part of the above revenue projection.

1. Solar Electricity Sales

TransPod intends to install solar panels along the length of the tube infrastructure, in order to generate clean power for the province of Alberta. There are two options for how to treat this solar electricity; either it can be used directly to power the TransPod system, or it can be sold back to the Alberta electric grid operators, in which case the regular grid can be used to power the TransPod system. Based on discussions with several Albertan energy advisors, TransPod is planning to follow the second option, selling the solar energy back to the grid.

2. Utility Corridor Services

Given that a corridor of land will need to be created for the TransPod line, this land can also be used as a utility corridor. There are several services which could hypothetically benefit from utility corridors, such as transmission lines, telecommunications lines, wastewater and sewage lines, pipelines, and others. Based on the characteristics of the TransPod corridor and the needs in Alberta, TransPod foresees the main opportunity in offering the corridor to telecommunications and power transmission companies.

3. Power Grid Stabilization

Power grid instability is an increasingly pressing problem, particularly as renewable energy sources such as solar and wind (which are inherently unstable, as wind energy is not generated on still days, and solar energy is not generated at night or on cloudy days) become increasingly common. To prevent grid instability, there are several methods currently in the market which provide power grid stabilization. One of the most common is the use of batteries, which can store excess power generated by solar or wind when these resources are plentiful, and then remit this excess stored power back to the grid during times when the amount of energy generated is lower.

TransPod's energy requirements necessitate that it implement significant energy storage capabilities along the line in regular increments, which provide energy to each passing pod throughout the day. There will be downtime for these energy storage systems whenever pods are not passing by, during which time this energy capacity will not be needed to power the TransPod system at that location; in these times, it can be used to stabilize the grid, similar to a typical grid stabilization technology that relies upon energy storage.

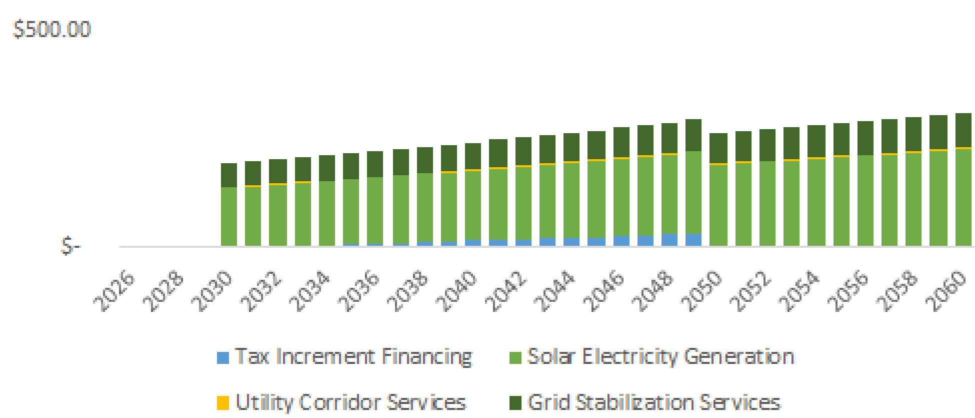
4. Tax Increment Financing

If additional stations are added to connect more small or medium-sized cities in Alberta to the TransPod system, it would be unlikely that the new demand would offset the cost of the added infrastructure cost. However, with tax increment financing, it may become possible to add additional stops along the line. A typical tax increment financing arrangement lasts for twenty years and is based on future real estate market increases that are caused by the infrastructure project. That is, if property values rise in the area near the TransPod station due to transit-oriented development, a portion of these increased property tax revenues can be used to offset the financial losses caused by building the additional TransPod station.

Summary of Additional Revenue Streams

The total revenue expected to be generated from these four additional sources is summarized below. These revenue streams are expected to bring in an additional $191 million in 2030 (a 14% revenue boost above and beyond 2030 ticket sales), rising to $307 million in 2060 (a 5% boost). The projected revenue falls in 2050 due to the disappearance of Tax Increment Financing, as these arrangements historically last for twenty years.

Figure 12: TransPod line Projected Additional Revenue Streams, 2027-2060 (C$ MM)

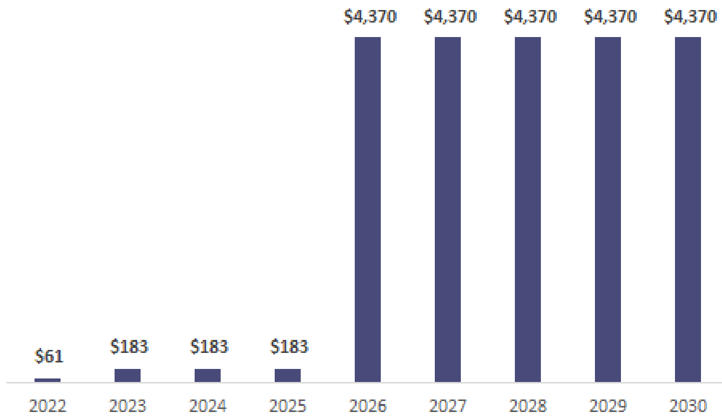


9.3.2. Investment Costs

As outlined in the "Project Costs" section of the report, the up-front investment required prior to being able to operate the TransPod line will be approximately $18.41 billion USD, or $22.46 billion CAD.

In line with the construction plan, these costs will be incurred in phases from 2022 to 2030. Specifically, the phasing of the up-front investments is summarized in the figure below.

Figure 13: Up-Front Investment Costs for the TransPod Alberta line (C$ Million)

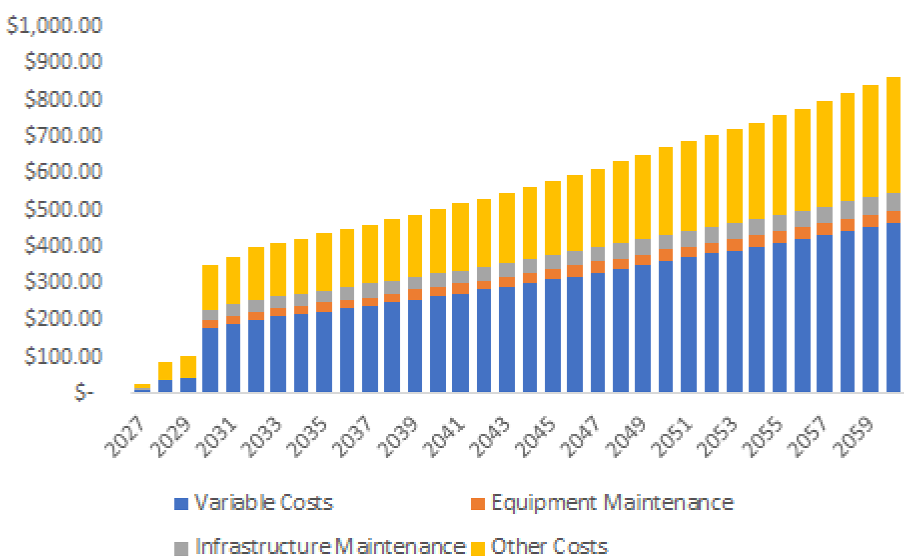


The cost over the first four years is relatively low, as these years will be dedicated to building the first phase of the project, which will be a 20-kilometer segment near the city of Edmonton, at a budget of approximately $500 million USD, or $610 million CAD based on exchange rates as of May 6, 2021. The logic behind this first phase is explained in further detail in the "Implementation Plan" chapter of this document. In 2026, the full construction project is triggered, which causes a sharp rise in the infrastructure costs until the construction project is finished in 2030. Note that the distribution of CAPEX in the years 2026-2030 may vary, pending the timing of the pod orders and the amount of construction completed each year; however, the total CAPEX in that 5-year period is projected to average $4.37 billion CAD per year.

9.3.3. Operating Cost

As outlined in the "Project Costs" section of this report, the cost of operations for the TransPod system is relatively low as compared to the revenues generated. The figure below shows how the operating costs progress over the first thirty years of operations.

Figure 14: Operating Costs for the TransPod Alberta line (C$ Million)



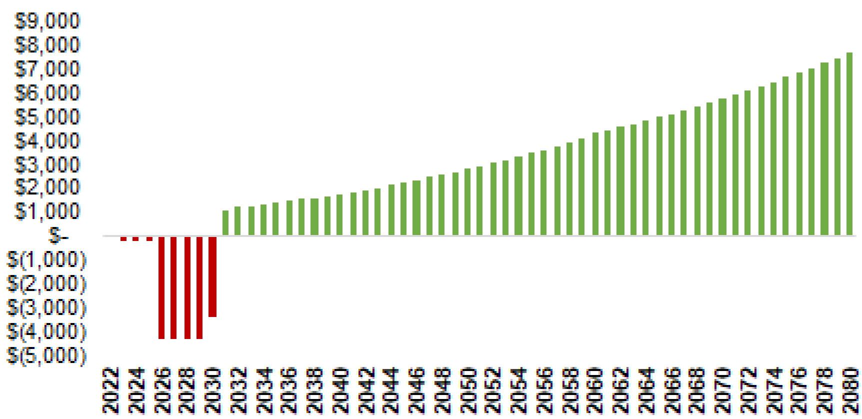
Throughout the full projection period, operating costs are quite low as a percentage of revenue, and continue to decrease: in 2030, the system has an EBITDA margin (earnings before interest, tax, depreciation and amortization) of 77.5%, and this increases steadily, reaching 86.4% by 2060.

9.3.4. Summary of Financial Analysis

With all of the revenue streams, up-front costs, and operating expenses, the overall financial performance of the TransPod line in Alberta can be determined. Despite the high infrastructure costs, the project generates strong profits to fully repay the infrastructure and operating costs. This is largely due to the fact that the TransPod line benefits from multiple revenue streams, in contrast to the typical high-speed rail system which heavily skews towards passenger transport. By focusing on filling the capacity of the TransPod system as a whole, rather than focusing on filling each individual train as is typically done by train operators, TransPod achieves a higher return on investment and more quickly pays off the costs of the infrastructure.

A summary of the cash flow for the TransPod line is included below. The annual cash flows are negative during the construction period, but sharply turn positive as soon as construction is finished.

Figure 15: Free Cash Flow of the TransPod Line, 2022-2080 (C$ Million)



Overall, the internal rate of return ("IRR") - the average annual financial returns that will be generated by owners of the TransPod line - for the lifetime of the project is 9.51%, and the net present value ("NPV") of the project is $145.60 billion. This is higher than a typical infrastructure project, and will be high enough to compel outside investors to get involved in the project, meaning that the Canadian and Albertan governments will not need to provide financial support if they are not interested. It should be noted that, if the Red Deer station is removed (as proposed for further discussion), the project NPV drops to $135.23 billion, but the IRR jumps to 9.79% due to the lower infrastructure cost. This may be more attractive to investors. Additionally, a sensitivity analysis was conducted, *as shown in the full report*, which demonstrated that even if costs increase by 50% or revenues decrease by 50%, the project should be profitable except in the absolute worst case scenario with both high cost overruns and significant revenue shortfalls.

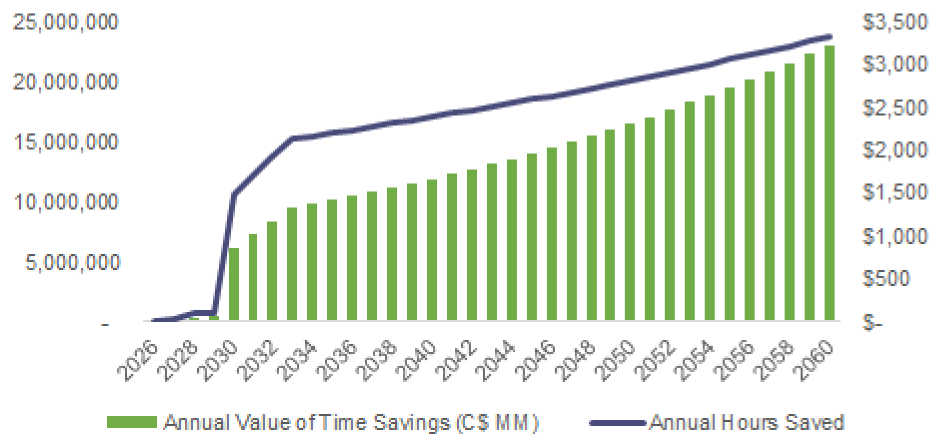
9.4. Socio-Economic Analysis

In addition to the financial returns that TransPod expects to produce, the TransPod line is expected to create significant positive social externalities in Alberta.

9.4.1. Travel Time Savings

Due to the ultra-high-speed nature of the TransPod system, there will be significant time savings for users of the system. Based on the travel times shown in section 3 of this report, the passenger diversion shown in section 6, and the known value of time savings based on prevailing wages in Alberta, the total number of travel hours saved can be calculated, along with the economic value of these time savings. The results of these calculations are shown in the figure below.

Figure 16: Total Hours Saved and Cumulative Value of Time Savings for Albertans due to the TransPod Line (C$ MM)



On average, roughly 18 million travel hours per year will be saved for Albertans between the first year of operations and 2060, amounting to over 591 million hours of travel time between now and 2060. Based on the “value of time” used in previous studies in Alberta, of almost $70 per hour in 2021 dollars, this results in a total value of time savings for Alberta’s economy equal to $64.8 billion by 2060, or an average of $1.9 billion per year.

9.4.2. Congestion Reductions

Traffic congestion can lead to significant problems for Albertans, including inconsistent travel times which make travel unpredictable; reducing congestion helps make the driving experience better for people who continue to drive. Based on the ridership projections for the TransPod system that were described previously, it is projected that approximately one-third of cars driving between Calgary, Red Deer and Edmonton will be removed from the roads upon the adoption of the TransPod system, in addition to roughly one-fifth of cars travelling between each city and its airport.

9.4.3. Road Safety Improvements

As passengers adopt the TransPod system, an equal drop occurs in passenger flight, bus, and car ridership - transport modes which often lead to accidents causing property damage, injury, or at worst, fatalities. Due to the safe, autonomous driving of the TransPod system, and the fact that the TransPod vehicles are operating in a protected tube environment, passenger safety is greatly enhanced.

In the five most recent years with data available, Alberta experienced the following traffic accident statistics:

- 6.1 fatal accidents per billion kilometers driven
- 326.1 accidents leading to injury per billion kilometers driven
- 2,326.2 accidents leading to property damage per billion kilometers driven[8]

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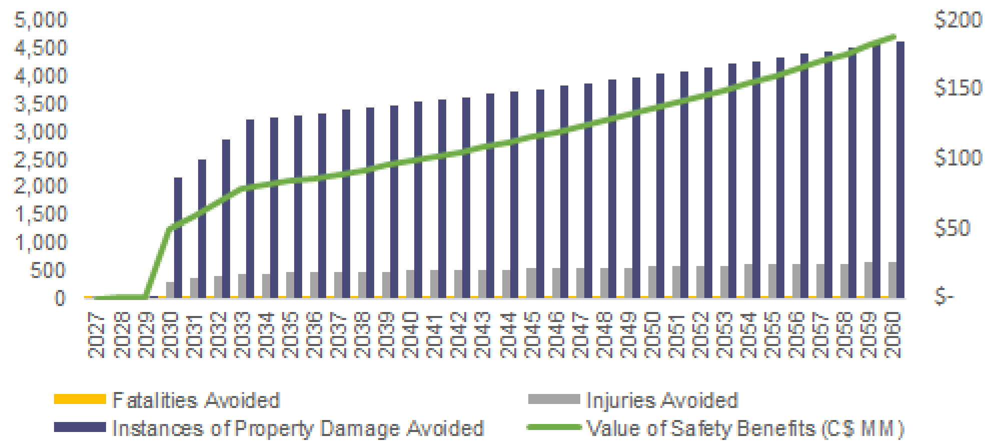
[8] *https://open.alberta.ca/publications/0844-7985*

These vehicle accident statistics pose a high cost to society. Previous traffic safety studies have estimated that a motor vehicle death costs society on average almost $1.5 million; each injury costs over $27,000; and each instance of property damage costs an average of $9,700.[9] More important than the economic impacts, these vehicle accidents cause a deep emotional toll on those affected.

With these figures, and the projected ridership diversion from each transport method, the total number of fatalities, injuries, and instances of property damage avoided due to the introduction of the TransPod system can be estimated, along with the monetary value to society of this accident avoidance. The results of these calculations are shown below.

Figure 17: Total Value of Safety Benefits for Albertans due to the TransPod Line (C$ MM)



In sum, the introduction of the TransPod system into Alberta is projected to prevent a total of 292 traffic fatalities between now and 2060, along with over 15,000 injuries and over 112,000 car accidents resulting in property damage. In total, that results in a net economic benefit to Alberta of $3.58 billion by 2060, or an average of approximately $105 million per year.

9.4.4. Environmental Benefits

The main environmental benefits of the TransPod system come via:

- Greenhouse Gas (GHG) emissions reductions caused by replacing gas-guzzling car, bus, and plane trips with sustainably-powered TransPod trips;
- Solar power provided by the TransPod system to the Alberta grid, making the overall make-up of the electricity used in Alberta more sustainable.

GHG Emissions Avoidance

The TransPod system is powered by electricity, which comes from the Alberta grid. Alberta's energy mix is made up of natural gas (49%), coal (43%), wind (6%), solar (3%) and other sources (1%)[10]. With this mix, energy in Alberta leads to approximately 0.64 tonnes of "CO_2e" (CO_2 equivalent, meaning the amount of CO_2 emissions which would have an equivalent environmental impact) emissions per MWh of electricity consumed, on average. This is the assumed emissions per MWh of energy consumed by the TransPod system in Alberta.

TransPod will divert riders from three competing transport modes:

[9] *https://www.nhtsa.gov/*

[10] *Source: Canadian Energy Regulator (Government of Canada)*

- Car: 0.19 kg CO_2e per kilometer
- Bus: 2.94 kg CO_2e per kilometer
- Plane: 26.82 kg CO_2e per kilometer[11]

Based upon the ridership diversion estimates, total emissions avoidance thanks to the TransPod system can be calculated: emissions avoided is equal to the total emissions reduced as a result of sidelining cars, buses, and planes, minus the total emissions caused to power the TransPod system. With the Government of Canada's planned carbon price, the monetary value of this emissions avoidance will be calculated below.

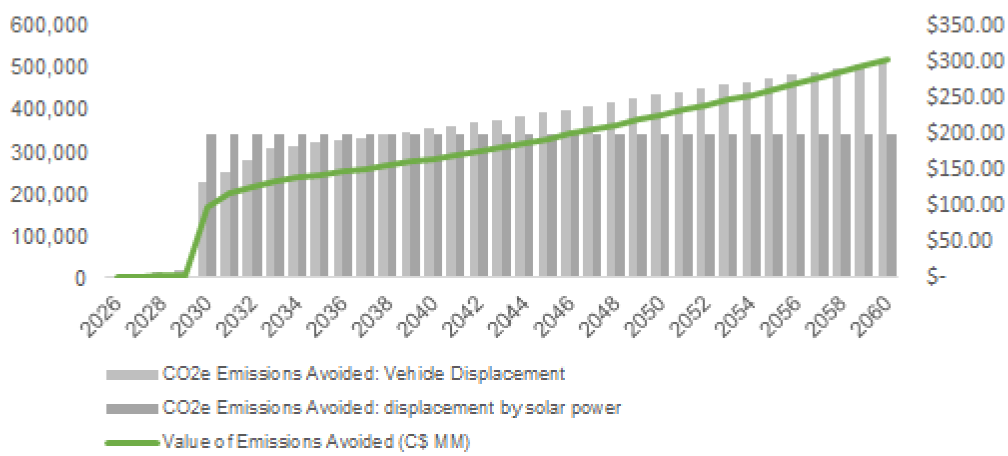
Solar Power Generation

In addition to emissions avoided by moving passengers from highly-polluting transport modes into the TransPod system, TransPod will also create positive environmental effects due to solar power generation by panels installed along the TransPod line. In total, TransPod expects to be able to generate slightly more than 570,000 MWh per year of electricity if solar panels are installed along the infrastructure. Energy from solar photovoltaics produces an estimated 0.05 tonnes of CO_2e per MWh, meaning that energy generated by the TransPod system can be used to replace energy generated in less sustainable methods, removing CO_2e emissions from Alberta's energy supply.

Summary of Environmental Benefits

The total environmental benefits caused by the TransPod line are quantified below, based on Canada's established carbon price, which is $50 as of 2022 and is set to rise sharply between now and 2030[12].

Figure 18: Total Emissions Avoided and their Associated Value (C$ MM)



In total, over 22 million tonnes of CO_2e emissions are avoided as a result of the implementation of the TransPod system during the study period between the commercial launch date and 2060, coming to a total value of over $6 billion based on Canada's projected carbon price[13]. That equals an average of 636,000 tonnes of CO_2e per year.

For perspective, 636,000 tonnes of CO_2e is equivalent to the amount of carbon sequestered by 780,000 acres of forest per year[14], which is roughly 4 times larger than the city of Calgary.

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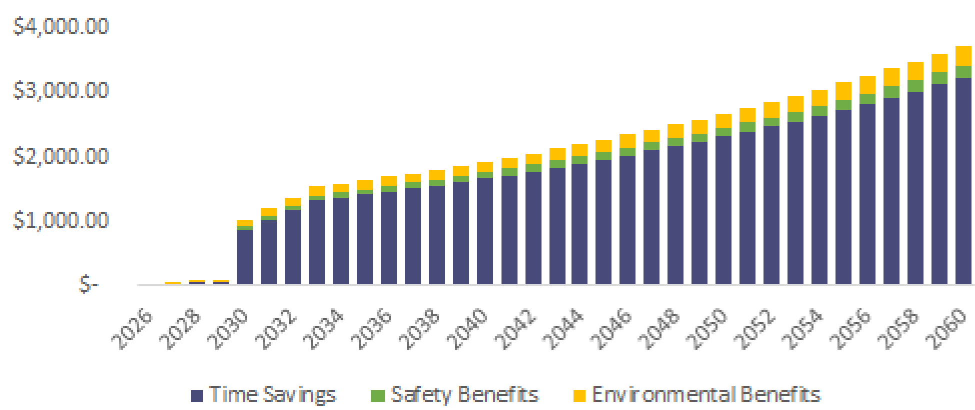
[11] *Source: Transport Direct*
[12] *https://www.energyhub.org/carbon-pricing/*
[13] *Source: Government of Canada*
[14] *https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator*

9.4.5. Summary of Socio-Economic Benefits

The total economic value of the time savings, safety, and environmental benefits for Alberta upon introduction of the TransPod line is highlighted in the figure below.

Figure 19: Total Value of Socio-Economic Benefits in Alberta (C$ MM)



Overall, the positive socio-economic value of the TransPod line will be immense to Alberta. From the moment the line starts full operations, Alberta will see over $1 billion of annual socio-economic benefits, and that number will consistently increase to almost $4 billion per year by 2060. In that study period, the total value of time savings is over $64.8 billion; the total value of safety improvements is over $3.5 billion; and, the total value of the environmental benefits is over $6.0 billion. Together, that equates to $74.4 billion in added value to the province of Alberta, directly as a result of the TransPod project.

9.5. Economic Impacts Analysis

This section summarizes the economic impacts of the construction project to build the TransPod line, using a traditional input-output methodology along with data from the Canadian government[15].

9.5.1. Input-Output Analysis

Economic Output

Economic output can be defined as the value of goods and services produced by establishments, excluding “intermediate” goods and services consumed by the same establishment during the production process (e.g. electricity produced for own consumption). Output includes goods and services sold in the marketplace as well as goods added to inventory.

For the TransPod project, there are two relevant segments of output to evaluate: the economic output caused in Alberta, and that caused in the rest of Canada. These values are shown in the figures below.

Figure 20: Economic Output in Alberta due to the TransPod project (C$ MM)

15 *https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610059501*

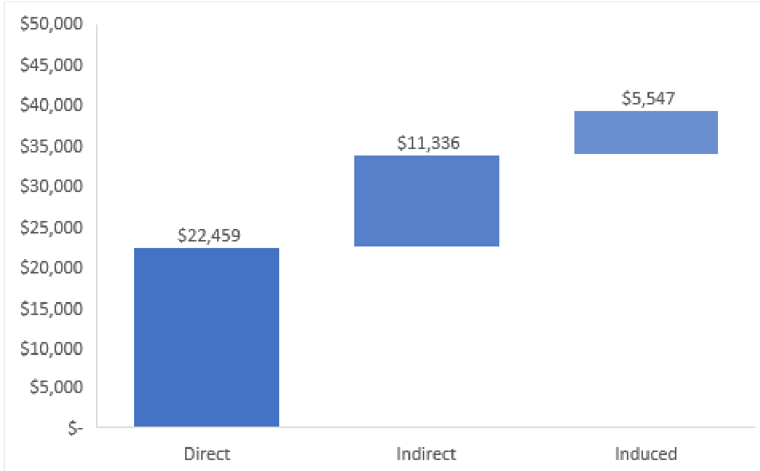
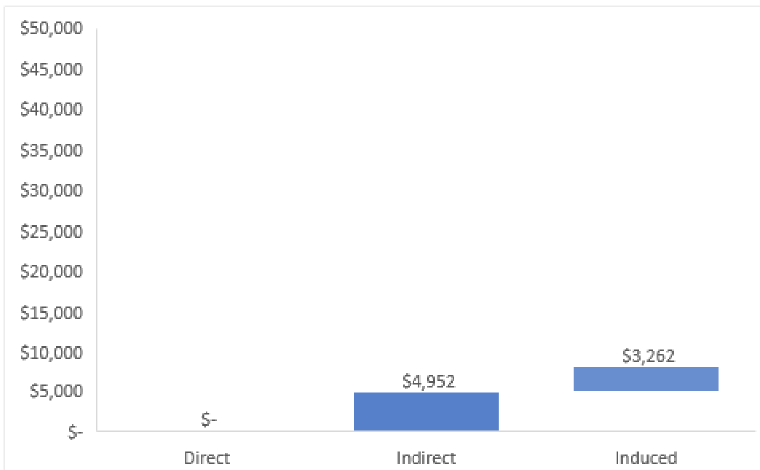


Figure 21: Economic Output in the rest of Canada due to the TransPod project (C$ MM)



With an initial investment of approximately $22.5 billion, the project will create an additional output of roughly $39.3 billion in Alberta and $8.2 billion in the rest of Canada. These benefits are realized over the course of the construction period (from 2022-2030), proportional to the amount of expenditures each year.

Gross Domestic Product

GDP is the “total unduplicated value of goods and services produced in the economic territory of a country or region during a given period”. GDP includes household income from current productive activities (wages, salaries and unincorporated business income) as well as profits and other income earned by corporations. In the context of our study, GDP serves as a measure of the total economic value-added resulting from the capital investments and associated operations of a project. The figures below outline the GDP impacts.

Figure 22: GDP Impact in Alberta due to the TransPod project (C$ MM)

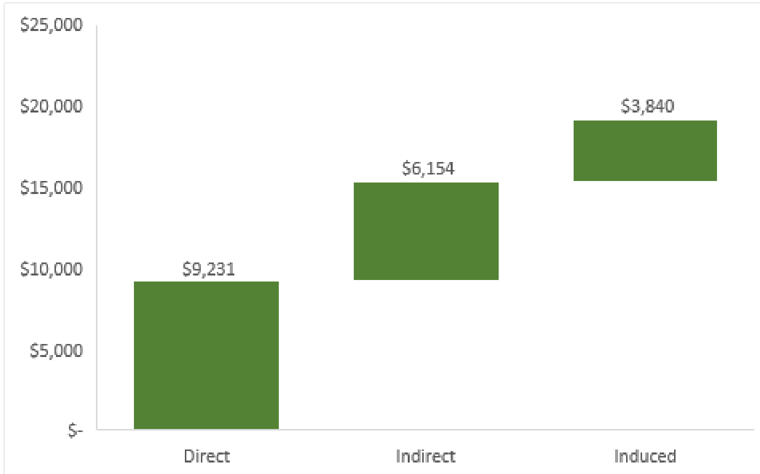
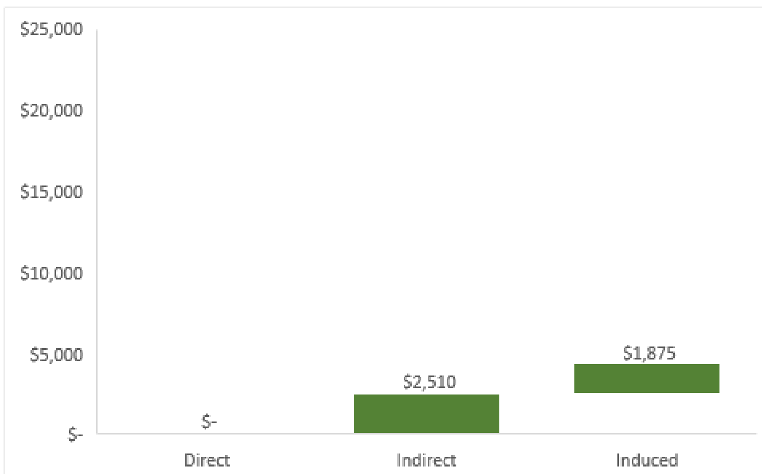


Figure 23: GDP Impact in the rest of Canada due to the TransPod project (C$ MM)



Overall, the project has a significant positive impact on the GDP in the region. Specifically, Alberta's GDP is projected to see a $19.2 billion boost over the construction period, and the rest of Canada can expect a $4.4 billion GDP boost over the same period. For additional context, Alberta's GDP in 2020 was equal to $307.1 billion; a $19.2 billion injection is equal to 6.25% of the current annual GDP.

Job Creation

This study measures the employment impact in terms of full time equivalent (FTE) positions for ongoing employment (i.e. employment impact associated with annual expenditures), an approach consistent with standard statistical terminology. The figures below outline the projected job creation in the country thanks to the project.

Figure 24: Jobs created in Alberta due to the TransPod project

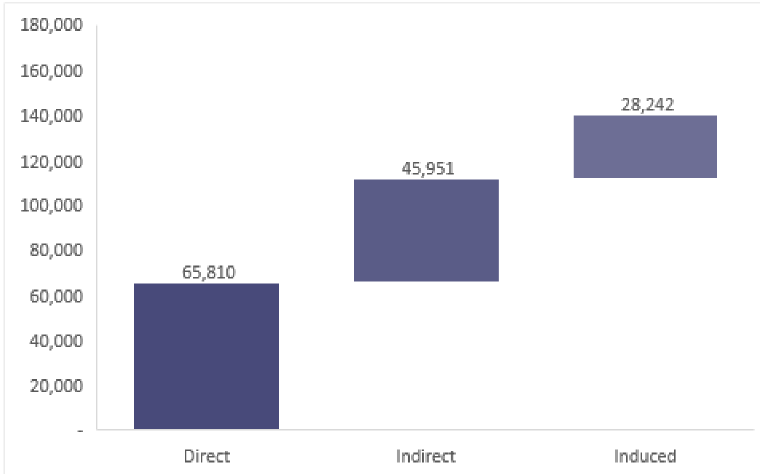
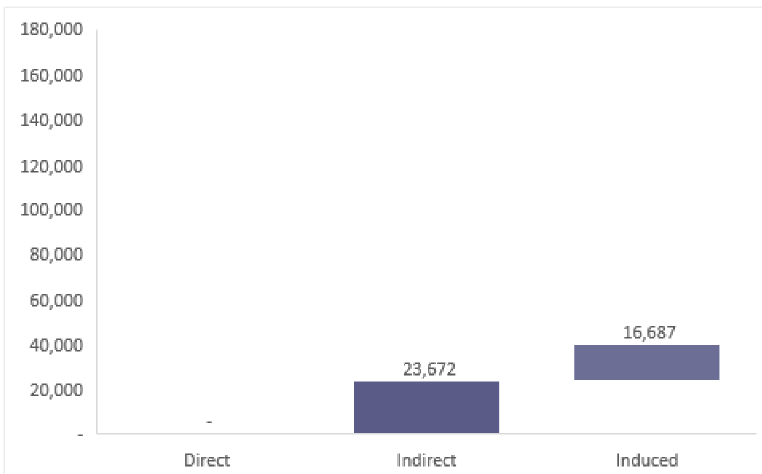


Figure 25: Jobs created in the rest of Canada due to the TransPod project



The project is expected to be a very significant driver of jobs. In Alberta, over 140,000 FTE-years worth of jobs are expected to be created, or an average of 15,556 per year over the nine year period. Meanwhile, another 40,300 jobs are expected to be created in the rest of Canada, or an average of 4,480 per year for the nine years.

9.5.2.Summary of Economic Results

This project has the potential to be a major contributor to Alberta's economy in the coming years. In Alberta alone, over 15,500 jobs per year are expected to be created by the construction project, along with a GDP boost of almost $20 billion and a total economic output of roughly $40 billion. By implementing this project, Alberta has a unique opportunity to diversify its economy, reduce dependence on the oil and gas industry, and help stimulate a strong economic recovery as we emerge from the crisis caused by the Covid-19 pandemic.


TRANSPOD

10. Regulations

10.1. Context

As we move forward in constructing a TransPod line in Alberta, an important consideration will be to ensure that the proper regulatory framework has been established. The TransPod system is a net-new technology, so there is currently no regulation that is exactly applicable. Starting to work proactively on regulations now is essential, to ensure that the regulatory framework is ready as soon as the technology is ready to begin operations.

10.2. Current Status of the Regulatory Framework

In Canada, a regulatory framework has not yet been drafted and work has not yet started with the relevant regulatory bodies. However, a regulatory framework is already in development in Europe, as several public and private organizations work together to prepare Europe for the inevitable construction of ultra-high-speed systems in the continent. This work began in 2018, and has been progressing consistently since.

Specifically, TransPod is working with several relevant organizations to develop the European regulatory framework:

- Industry experts from TransPod, Hardt Hyperloop, Zeleros Hyperloop, and Nevomo (previously Hyper Poland);
- Regulatory / standardization bodies from across the continent, including AFNOR from France, NEN from the Netherlands, UNE from Spain, and PKN from Poland;
- The Directorate-General for Mobility and Transport in Europe ("DG-Move")

10.3. Next Steps

Moving forward, it is essential that Canada takes a proactive approach modelled after that which has been started in Europe in order to begin drafting regulations. Specifically, TransPod proposes to work with the relevant regulatory bodies in Canada - including Transport Canada and the Alberta Ministry of Transportation - to establish a regulatory framework. To accelerate this process, TransPod can bring Canadian regulators into the conversations being held with Europe, so that Canada is not left starting from scratch. Canada and Europe could work together (alongside industry experts and along with any other countries who may soon be interested) to develop regulations so that there is international regulatory consistency, and so that duplicate efforts are not required by governments around the world.

11. Implementation Plan

Given the positive economic and socio-economic impacts of the project and the strong financial returns, it is imperative that we move forward with a good implementation plan to ensure that the project is successful. This section outlines the methods that are expected to be used in construction and financing of the line.

11.1. Construction Phasing

Since Alberta is expected to be the home of the first TransPod corridor, there is still some technology risk which adds complexity to the project. That is, the technology is not yet proven to operate anywhere else in the world, and is not yet certified by Transport Canada. In order to minimize the technology risk, the construction is going to occur in two phases, with a contingency plan in case the technology is not certified after the first phase. This construction plan has been devised to ensure safety and minimize the risk of financial losses for investors in the TransPod project.

Phase 1

The first phase of the project will consist of building a roughly twenty-kilometer segment of TransPod line between the Edmonton Airport and the southern city limits of Edmonton, in currently undeveloped land.

Preliminary works for this segment of the line are set to begin in early 2022, with construction occurring from approximately 2023-2025. Then from 2025 until 2027, this segment will be used as a testing and demonstration track in order to prove the efficacy of the technology and obtain Transport Canada certification for cargo and passenger transportation. Once the first certification is obtained (expected in 2026), the second phase of construction will be triggered. Additionally, the segment built in Phase 1 will quickly be connected to stations at the Edmonton International Airport and in Edmonton city centre, so that this segment can begin operations quickly after certification is obtained (and before phase 2 is completed).

Phase 2

The second phase of the project will consist of building the remainder of the line. In other words, phase 2 involves building roughly 280 kilometers of track running from the Edmonton airport to Calgary along with all the requisite stations. When this phase begins, the technology risk will already be removed from the project, as this phase will not be triggered until the technology is already certified.

With the current project plan, it is expected that this phase will commence in 2026 upon cargo certification from Transport Canada, and will last 5 years, wrapping up by 2030. As construction of each segment between stations is completed, that segment can start operating (e.g. when the segment from downtown Calgary to Calgary airport is completed, that segment can operate, even if other portions of the line near Red Deer are still under construction). With this approach, the line can begin commercial operations earlier than if all operations did not start until the entire construction project was complete.

Risk Reduction Plan

To mitigate the technology risk during the first phase of the project, TransPod has created a contingency plan for investors to complete the project at lower risk. *Please see the full report for details.*

11.2. Financing Plan

The TransPod project has been designed such that both the construction and the operations can be privately financed rather than relying on taxpayer subsidies.

Phase 1

The first phase of the project is the phase in which investors are exposed to the most risk, since this is the only phase where TransPod technology is not yet certified. To make an investment in this phase more appealing, TransPod has structured its pitch to investors such that most of the investment would be equity, and only a small portion of it would be debt financing. This way, investors would benefit from any upside if the TransPod technology is certified, since they will hold an equity stake in the TransPod Alberta line. The requirements for the first phase are approximately $500 million USD ($610 million CAD as of May 6, 2021).

Phase 2

The second phase of the project can be structured like a typical infrastructure project, since at this point the technology risk is gone. As a result, investors in this phase will have full confidence that the TransPod technology works and will be more comfortable providing most of the funding in the form of debt financing. The typical infrastructure project financing follows a debt-to-equity ratio of between 70:30 and 90:10, and TransPod plans to finance the second phase of the project in line with these norms.

Risk Reduction Plan

In the event that the TransPod technology is not certified and the contingency plan is invoked after phase 1, the amount of financing required will be drastically reduced compared to the amount of financing that would be required for Phase 2. TransPod has already discussed the financing of this backup plan with each of the prospective investors described below, and each of them have expressed their interest in remaining involved in this phase of the project pending certain conditions being met.

Financial Partners

Several potential financial partners have already been identified. TransPod has already received a term sheet from a private institution to finance Phase 1, and accordingly is in the process of fulfilling the necessary conditions to secure Phase 1 financing. This same organization has also requested the right to invest in Phase 2 and has expressed their interest in staying involved in the project even if the contingency plan is triggered. Additionally, a major institutional investor in Canada has expressed interest in participating in the Phase 2 financing if their investment is needed. The names of these organizations cannot yet be shared due to confidentiality agreements.

11.3. Delivery Options

To ensure the successful delivery of this project, TransPod is working with leading construction, infrastructure, and engineering partners from the region. Several have already contacted TransPod to express their interest in supporting the project, and some have even supported various aspects of this feasibility study, such as validating the infrastructure cost estimate and providing input into infrastructure designs. The names of these organizations cannot yet be shared due to confidentiality agreements; however, the nature of these organizations are summarized below:

- Two global infrastructure and construction companies.
- One institutional infrastructure investor and operator.
- One trade union with tens of thousands of skilled workers.
- Three local steel tube fabricators and one steel tube coating supplier.
- One leading architecture organization.

- One local sustainable energy supplier.

In addition to construction, there are several other aspects of project delivery that will require support from local experts. The organizations who have reached out so far are summarized below:

- One local First Nations organization.
- Two cargo operators (one with national operations, one global).
- Two land acquisition advisory organizations.
- Two land management / environmental assessment / enabling works organizations.

TransPod will assemble relevant organizations in all the necessary fields of expertise to make sure that this project is delivered successfully, on budget, and on time. TransPod will take charge of developing the infrastructure development plan, securing applicable approvals to move the project forward in concert with select partners, and providing the technology and intellectual property required to successfully implement the project.

11.3.1. Timeline

The figure below outlines the expected timeline for the TransPod Alberta project.

Figure 26: Project Timeline


TRANSPOD

12. The Way Forward

Tube-transportation is considered as the natural extension of air transportation on the ground, covering medium to long distances. The TransPod technology will redefine freight and passenger transportation as we know it by shrinking distances and making high speed transportation available to the masses due to reduced construction and maintenance costs.

This feasibility study demonstrates that a TransPod line in Alberta would bring significant benefits. Namely, it would provide a socio-economic boost via job creation, reduced greenhouse gas emissions, faster and safer travel, and reduced congestion; it would confirm Alberta's place as a technological leader and a trailblazer in the ultra-high-speed transportation industry; and it would be profitable for outside investors, meaning that the Alberta taxpayers would not be required to provide any up-front or ongoing financial support.

Additionally, TransPod Inc. has the capabilities in place to ensure the successful delivery of this project. Financing options have already been lined up, industry experts have been reaching out in hopes of collaborating on the infrastructure project, and TransPod holds the key intellectual property to bring it all together.

Given these overwhelmingly positive results, the imperative next step is to begin the formal project planning. TransPod Inc., with support from the Government of Alberta, must work to gain public support for the project, secure the financing from outside investors, and begin preliminary works to enable the construction project to commence soon. Moving forward will ensure that this project comes to fruition, and with it, a strong future for Albertans.

Appendices

Appendix I: Economic Definitions

Input-output modelling: Input-output models (I-O models) are used to simulate the economic impact of an expenditure on a given basket of goods and services or the output of one of several industries. Input-output analysis uses data on the flow of goods and services among various sectors of the economy, and attempts to model how an expenditure, increase in demand, or investment ripples through a region's economy. This is done by mapping the production of products and services by each industry, and identifying the intermediate inputs used in the production of each final product or service used by consumers, sold as an export, or purchased by the government. The model can then aggregate all of the employment and value-added impacts generated in the supply chain as commodities are produced. I-O models also consider the role of imports, which tie the supply chain to the global economy. This data is combined into a single model of the economy which can be solved to determine how much additional production is generated by a change in the demand for one or more commodities or by a change in the output of an industry.

Direct Impacts: Direct economic impacts represent the economic value-add directly associated with capital investments and associated operations. For example, they include the employment and income of employees and contractors directly involved in a project, as well as the associated product, production and income taxes paid.

Indirect Impacts: Indirect economic impacts represent the economic value-add resulting from the demand for materials and services that the project generates in supplier industries. For example, they represent economic activity generated in the manufacturing, wholesale trade, transportation and professional service sector as a result of demand for materials and services generated by a project.

Induced Impacts: Induced economic impacts are general income effects associated with the spending of salaries and wages earned as a result of the project on consumption. For example, induced economic impact includes instances when workers engaged in a project purchase goods and services (at a household level) with their earnings.

Output: The value of goods and services produced by establishments, excluding "intermediate" goods and services consumed by the same establishment during the production process (e.g. electricity produced for own consumption). Output includes goods and services sold in the marketplace as well as goods added to inventory.

Gross Domestic Product (GDP): GDP is the "total unduplicated value of goods and services produced in the economic territory of a country or region during a given period". GDP includes household income from current productive activities (wages, salaries and unincorporated business income) as well as profits and other income earned by corporations. In the context of our study, GDP serves as a measure of the total economic value-added resulting from the capital investments and associated operations of a project.

Employment: This study measures the employment impact in terms of full time equivalent (FTE) positions for ongoing employment (i.e. employment impact associated with annual expenditures). This approach is consistent with standard statistical terminology.

Labour Income: Labour income represents the total earnings of employees (including employees of suppliers to the projects), consisting of wages and salaries as well as supplementary labour income (such as employer's contributions to pension funds or employee welfare funds).

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Amendment of any of the assumptions identified throughout this report could have a material impact on our analysis contained herein. Should any of the major assumptions not be accurate or should any of the information provided to us not be factual or correct, our analyses, as expressed in this report, could be significantly different.

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