Feasibility Study of Intermodal Semi-Truck Transport via Rail: Vancouver to Calgary Corridor

Submission 2

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Executive Summary

The not-for-profit Integrated Travel performed an engineering feasibility study for Triangle Railroad Holding Company to evaluate how existing rail infrastructure could support semi-truck transport between Vancouver and Calgary. The study demonstrates economic advantages and environmental improvements through freight transfer from roads to rails while evaluating two systems: the Eurotunnel-style accompanied trailer system alongside the Modalohr unaccompanied trailer system. Choosing rail transport results in lower costs compared to trucking and generates significant cost savings while also reducing greenhouse gas emissions. The implementation of strategic loading and unloading hubs in Vancouver, Kamloops, Revelstoke, Golden, and Calgary will enhance operational logistics and efficiency. Fixed costs and initial investment estimates determine the breakeven volume when measured by both freight amount and distance covered. To achieve a successful and sustainable transition to intermodal rail transport that improves supply chain operations and environmental performance the study advises infrastructure investment together with strategic partner formation, technological application and risk mitigation development plus acquiring governmental incentives.

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Introduction

Integrated travel can be considered as a not-for-profit organization to make huge profit for their works, yet they are motivated to promote transportation equity across Alberta where through their “Rail For All” approach plays a crucial role in serving diverse communities of Alberta including rural communities and indigenous people. Moreover, they advocate the sustainable, cost-effective and accessible transportation solution for the communities. Apart from that, they believe investing more and retrofitting the existing rail system for enhancing the efficiency, environmental sustainability and affordability must be considered as a better option then high-speed rail system which demands huge investment. To achieve an inclusive and beneficial transportation for all Albertans, Integrated Travel fosters collaboration with infrastructure providers, transportation stakeholders and community organizations. Therefore, Integrated Travel has been tasked with an engineering feasibility study of the Triangle Railroad Holding Company for their research and development. Practicality of utilizing existing rail infrastructure for transporting semi-trucks between Vancouver and Calgary could be considered as a main goal of the study. Based on this, the identification of best option is required for either using accompanied trailer transport like Eurotunnel freight model or an unaccompanied trailer transport as seen in Modalohr system used in France, Spain and Italy aligning with economic and operational feasibility.

As a higher volume of goods are being transported between two major cities through tractor-trailer trucks and single-unit trucks, the Vancouver-Calgary corridor can be considered economically crucial. Furthermore, an effective development of rail based freight solution must require the identification of two optimal start and end points for freight movement and locating loading and unloading hubs strategically. A valuable insights could be gained through answering

the requirements effectively which will lower the transportation cost, environmental effects and enhance the supply chain.

Literature Review

The transfer of freight between different transportation modes like trucks and rail systems has received extensive research attention due to its financial advantages and environmental impact. Rodrigue et al. The study from Rodrigue et al. (2020) showed that intermodal transportation boosts efficiency and diminishes highway congestion through the use of rail's ability to move large volumes of goods at a reduced cost per ton-mile. The Modalohr system in France shows intermodal transport can reduce expenses by 30% alongside better reliability and faster delivery times (Laffont & Caville, 2018). According to Transport Canada's 2023 report North American rail freight runs at CAD $0.026 per ton-mile compared to truck freight which costs CAD $0.143 per ton-mile. Businesses that transition their long-distance freight operations from trucks to rail transport stand to gain substantial financial advantages because rail transportation costs much less than truck transportation on a per ton-mile basis.

The shift from road to rail freight transport becomes more feasible due to its environmental benefits beyond cost efficiency. According to the International Transport Forum (2021) rail freight produces 75% fewer greenhouse gases in comparison to trucking which supports sustainable practices and helps achieve climate action targets. According to a 2019 report from the U.S. Department of Transportation rail transport uses much less fuel per ton-mile than trucking thus reducing freight operations' total carbon footprint. The studies of Canadian National Railway (2023) and Martland (2013) indicated that intermodal rail transport cuts fuel use and supplies chain efficiency through the transport of bigger freight loads across extended

distances with minimal operational interruptions. The results demonstrate that rail transport meets Alberta's objectives for climate action while fulfilling sustainable transportation needs which positions rail as an extremely suitable choice for moving large freight volumes.

Implementing intermodal freight transport demands resolution of substantial logistical and operational challenges to ensure effective change. According to the Ministry of Transportation and Infrastructure (2025) major investments in loading and unloading facilities are needed to facilitate smooth transitions between truck and rail transportation. Developing intermodal terminals and expanding tracks through infrastructure improvements will enable the rail freight system to handle greater volumes of cargo effectively. Canadian Pacific Railway (2023) points out that regulatory compliance and coordination between truck and rail operators become complicated because of existing contractual obligations and operational discrepancies. TRRHC's 2022 research reveals that successful integration of truck and rail networks depends on strategic planning to bypass obstacles yet achieve peak efficiency and save costs. The possible advantages of lower costs, environmental sustainability improvements, and better supply chain logistics demonstrate that intermodal transportation represents an essential advancement for freight travel between Vancouver and Calgary despite existing challenges.

Company Backgrounds

Integrated. Travel Research and Development

ITRD is a not-for-profit organization based in Alberta, Canada, founded in 2019, devoted to intermodal transport networks for passengers and for freight. By exploring the rail systems' potential, they are devoted to creating innovative, sustainable, and economical transportation

solutions (*Home*, n.d.-b). They are pushing for improved rail infrastructure, such as passenger services and transportation feasibility studies to move freight via rail.

In this study, they guide the engineering and feasibility evaluation for Triangle Railroad Holding Company in assessing the viability of shipping semi-trucks via rail.

Equipment Required for Transporting Semi-Trucks on Rail

Types of Trailer Transport Systems

When moving trailers by both road and rail, there are two main methods: Accompanied Trailers and Unaccompanied Trailers. Each has its own benefits and requires special equipment to work properly. These systems help transport goods more smoothly across different areas.

In the Accompanied Trailer system, the whole truck, driver, trailer, and cab are placed on a train. The driver rides with the truck to its destination. This is practiced in the EuroTunnel that connects the UK and Europe. Trucks drive onto special rail wagons and travel through the tunnel, with the driver staying either in the truck or in a separate passenger area. This system is fast and efficient because no extra work is needed to remove or attach the trailer. Since the driver stays with the truck, there is no need for another truck at the destination. However, it requires special low-floor wagons to fit the trucks and Roll-on/Roll-off (RoRo) ramps to let them drive onto the train. While this system is effective, it needs a high investment in rail wagons and terminals.

In the Unaccompanied Trailer system, only the trailer is placed on a train, while the truck and driver do not travel with it. The trailer is detached from the truck at a train station and loaded onto a wagon from the side. This method is mostly used in France and Italy. It helps save money

because no driver is needed during the journey, reducing costs for wages, rest breaks, and hotels. Since truck cabs are not included, more trailers can fit on each train, making transport more efficient. It is also more adaptable, with a trailer delivered at a train terminal and collected by another truck upon arrival. Side-loading Modalohr wagons and hydraulic lifts are required in this system to load trailers onto wagons without difficulty. Although it also requires special equipment, it is cheaper and more expandable as a method of long-distance shipping, especially where there is heavy rail freight utilization.

Methodology

The report investigates the technical, economic, environmental, and operational viability of using rail transport to ship semi-trailer tractors between Vancouver and Calgary. Primary and secondary research—from government reports, case studies, and industry surveys, to stakeholder consultations, site inspections, and surveys—are combined in a pursuit of both quality and quantity.

This issue covers a wide range of data and regulations, but important aspects will include freight flows, directions in trucking trends, regulatory capabilities, and constraints. Cost-benefit analysis and environmental impact and employment feasibility assessment are all methods of analysis. Some of the indicators are cost comparisons between low-rail transportation and traditional trucking, the environment, and what advantages manual labor has. The history of statistics includes individual files on trucks per year, as well as summary tables, statistics about goods which are divided according to vehicle type.

Inferences from AADT data

Considering the weighted average of AADT data from year 1994 to 2015 for all the routes of British Columbia, the top 50 routes with highest AADT (Annual Average Daily Traffic) are mentioned in Table 1 below.

Table 1

Routes with Top 50 Weighted Average AADT Data in BC

Weighted Average AADT	**Description**
68,585.73	Route 1 From Exit To Brunette Avenue N/B To Exit To Lougheed Hwy
65,918.60	Route 1 From Willingdon Avenue U/P To Stormont Avenue
65,528.76	Route 7 From Mary Hill ByPass To Harris Road
65,427.07	Route 91 From Exit To Annacis Island To E/W Connector (North End Of Alex Fraser Bridge)
64,668.70	Route 1 From Stormont Avenue U/P To Entrance From Sprott Street
63,089.51	Route 1 From Stormont Avenue To Exit To Brunette Avenue N/B
61,890.03	Route 1 From 160Th Street U/P To Brunette Avenue
61,272.14	Route 99 From Old Capilano Bridge To Denman Street (Vancouver)
59,370.14	Route 91 From E/W Connector (North End Of Alex Fraser Bridge) To Cliveden Exit
59,006.86	Route 1 From Exit To Main Street (Just N. Of 2Nd Narrows Bridge) To Lougheed Hwy O/P W Abut
58,605.33	Route 1 From Second Narrows Bridge (South Abut.) To Main Street U/P

56,710.95	Route 97 From Spall Road To Junction Route 33
55,890.05	Route 1 From Entrance From Sprott Street To Entrance From Boundary Road S/B
53,846.88	Route 1 From Lougheed Hwy O/P To Willingdon Avenue U/P
53,649.24	Route 97 From Gordon Drive To Spall Road
52,827.76	Route 7 From Harris Road To Dewdney Trunk Road
51,784.56	Route 91 From Nordel Way U/P To Exit To Annacis Island
51,751.12	Route 1 From Entrance From Boundary Road S/B To Lougheed Hwy O/P W Abut
51,601.03	Route 7B From Jctn United Blvd / Mary Hill Bypass To Jctn Mary Hill Bypass / Rte 7 Lougheed Highway
50,453.65	Route 1 From Lougheed Hwy O/P W Abut To Second Narrows Bridge (South Abut)
49,791.07	Route 91 From Cliveden Exit To Nordel Way U/P
49,368.89	Route 17 From Tsawwassen O/H To Ladner O/P (Route 99)
49,321.12	Route 97 From Westside Road To Abbott Street
47,289.87	Route 99 From Marine Drive To Old Capilano Bridge
43,910.65	Route 7 From 150 Metres East Of Coleman Road To 300 Metres East Of United Blvd, Coquitlam
43,856.86	Route 1 From Exit To Lougheed Hwy To 176Th Street U/P
43,225.45	Route 1 From 176Th Street U/P To 200Th Street U/P (Langley)

43,195.84	Route 1 From Main Street U/P To Fern Street U/P
43,193.13	Route 97 From Bartley Road To Westside Road
43,076.88	Route 91 From Knight Street O/P E. Abut To Alderbridge Way O/P
42,330.58	Route 1 From 176Th Street U/P To 160Th Street U/P
42,130.53	Route 91 From Ent From Westminster Highway E/B To Knight Street O/P E. Abut
41,665.36	Route 1 From Lynn Valley O/P To Lonsdale Avenue U/P
41,262.30	Route 99 From Exit To Bridgeport Road To Oak Street Bridge
40,935.13	Route 99 From Route 17 Access To Exit To Steveston Highway
40,864.45	Route 99 From Steveston Highway Access To Exit Ladner
40,550.92	Route 7 From Dewdney Trunk Road To 218Th Street
39,797.02	Route 1 From Fern Street U/P To Exit To Main Street (Just N. Of 2Nd Narrows Bridge)
39,270.66	Route 91 From Knight Street O/P W Abut To Anik O/H W Abut
39,229.75	Route 1 From 200Th Street U/P To 176Th Street U/P
39,180.66	Route 1 From Lonsdale Avenue U/P To Jctn. Rte 1 / Westview Drive
38,710.37	Route 91 From Alderbridge Way O/P To Knight Street O/P W Abut
38,416.21	Route 11 From Route 11 U/P To Bypass Intersection

38,218.07	Route 11 From South Junction Bypass / Route 11 To On Ramp From Route 11 S/B
37,994.53	Route 91 From E Channel Bridge S Abut (Alex Fraser Bridge) To Ent From Westminster Highway E/B
37,989.70	Route 1 From Lonsdale Avenue To Exit To Lynn Valley Road
37,680.50	Route 91A From Exit To Jctn 20Th St / Stewardson
37,245.36	Route 99 From Access From New West Highway To Exit To Steveston Highway
37,157.71	Route 1 From Thetis I/C To Mckenzie Avenue

Note. Data sourced from British Columbia Ministry of Transportation and Infrastructure (2015) traffic volume data set.

Route Comparisons

Route 1 is the standout in the table with numerous high-traffic segments, which is a testament to its significance in the network as a primary highway.

Route 91 is also a regular feature but with more variability in traffic density among segments, reflecting diverse usage.

Potential Bottlenecks

Segments with very high AADT values can signify potential bottlenecks or congestion points at rush hour. For example:

- Route 1 in the area of Brunette Avenue and Lougheed Hwy.
- Route 91 in the area of the Alex Fraser Bridge.

Geographic Observations

Urban areas (i.e., Vancouver and Coquitlam) higher AADT due to population and commercialization.

Rural or undeveloped areas contain lower AADT volumes.

Planning Implications

High AADT roads may require upgrading in terms of infrastructure or traffic control systems to accommodate demand.

Lower AADT roads may be evaluated for underuse or potential for development in the future.

This information is beneficial for transportation planning, the detection of congestion points, road maintenance prioritization, and the smoothing of traffic flow throughout the network.

Starting and Ending Points of Freight Movements

The reform we are contemplating involves shipping semi-trucks on rail between Vancouver and Calgary—vital to the supply chain of Canada.

Starting Point: Vancouver

• Vancouver is home to the largest and one of many parts of the Port of Vancouver, which is a major port in Canada. Each day, thousands of trucks leave here for points all over the country.

Today's Transportation:

• Right now these products are trucked across the country in semi-trailers that launch down the Trans-Canada Highway (Highway 1). There are certainly drawbacks. The highway gets congested with traffic, travel is expensive, and fuel costs mount again.

• If part of that freight could be put onto rail, costs would go down and road congestion might ease a little. The environment would suffer less as well. To make the switch work, you must have sites in Vancouver or just nearby it—such as Surrey and Abbotsford, both of them already well served by rail.

Ending Point: Calgary

• With an extensive supply network that reaches beyond Alberta into Saskatchewan and even Manitoba in some cases, we use Calgary as our operating centre.

• Destination Process: Railcars are distributed from the trains to trucks in Calgary for delivery of freight to showrooms and warehouses throughout Edmonton, Red Deer, etc. This also points up aspects of the city's social life.

• Making the freight travel between Vancouver and Calgary will result in lower transportation costs, quicker delivery times, and a greener, less complicated supply chain for both entrepreneurs as well as ordinary people.

Freight Movement Between Vancouver and Calgary

The Vancouver-to-Calgary truck route is one of Canada's busiest. Trucks haul most of the merchandise for most firms. To make a rail system work, thousands of these truck trips—between 6,561 and 15,308 each year—need to switch to rail. This change can conserve fuel, avoid traffic, and reduce road damage.

The majority of the products start in Canada's largest port of Vancouver, and are transported by truck to Calgary, the distribution center, and then proceed by truck to factories, warehouses, and retail outlets. To function effectively, rail requires unique hubs where the trucks can readily load and offload goods. Such hubs ought to be well connected with rails and highways so that transport is not disrupted, and the cost is kept minimal.

Suitable Locations for Loading and Unloading Hubs

For this system to work, we need special terminals where trucks can easily board and alight from the train. They need parking space, loading ramps, and good rail connections. They

need to be placed close to major highways and railways to facilitate trucks' easy access to them. There must be sufficient space for the trucks to move freely. If the location is too crowded or small, loading and unloading will take longer. Good locations save time and fuel, and therefore transport is quicker and cheaper. Quality planning makes it possible for companies to transport goods quickly and at a low cost.

Key Locations for Loading and Unloading Hubs

To move goods from trucks to trains, special hubs need to be built. These hubs need space for trucks to park, machines to load and unload goods, and direct links to trains. They should be placed in areas where trucks can easily drive in and out without traffic problems. Good hubs will help move goods faster, lower costs, and make transport better.

Vancouver (Starting Point)

Vancouver is important because many goods come by ship. Right now, trucks take goods from the port and drive far. A rail hub in Vancouver would let trucks drop goods there, saving time and fuel. Surrey and Abbotsford are also good options.

Kamloops (Middle Point)

Kamloops is halfway between Vancouver and Calgary. It has two big train companies (CN and CP). A hub here would cut costs and save fuel. It can also collect goods for shorter trips, reducing long truck journeys.

Revelstoke (Small Middle Hub)

Revelstoke is smaller but can be helpful too. It can offload cargo from trucks onto trains, and B.C. deliveries are made simpler. It also averts traffic and weather delays.

Golden (Near Alberta Border)

Golden is close to Alberta. A hub here would let trucks drop goods before crossing the border. This would reduce the number of trucks on highways and make transport smoother.

Calgary (Final Destination)

Calgary is a big transport center. A hub here would bring goods by train instead of trucks. Smaller trucks can then take goods to cities like Edmonton and Saskatoon.

Why These Locations Were Chosen

These places are near railways and highways, making it easy to move goods. Trucks and trains can work together, reducing delays and making deliveries faster. Since trucks travel shorter distances, companies save fuel, trucks last longer, and goods arrive quicker. Less travel also means less pollution.

Having many hubs helps during congestion or weather conditions. If one hub is jammed, trucking can be redirected to another. Products transfer easily from trucks to trains as well. Trains are cheaper over long distances and carry more than trucks. Having both road and rail transportation helps companies save costs and deliver goods on time.

How many tractor-trailer trucks and single unit trucks travel between Vancouver and Calgary:

To get the estimation or the nearest perfect number of the tractor-trailers and single-unit trucks travel between Vancouver and Calgary can only be possible through analysis of freight traffic data on this corridor. The corridor of Vancouver and Calgary could be considered as one

of the busiest routes in Canada due to huge number of goods transported by trucks (Canada, 2023).

Based on the research for the tractor-trailer truck travel between Vancouver and Calgary corridor, then it could be said that it is difficult to get the exact number for the trips yet according to Actran Consultants in 1998 around 15% of the traffic was occupied by the transportation sectors and has been increased as per the demand grows for the various products and materials withing past 2.5 decades. Therefore, it indicates a huge amount of goods being transported between Vancouver and Calgary. Whereas it also includes the single-unit trucks which travel between these two economic hubs, however single-unit trucks are mostly being utilized for shorter trips and lighter loads. Moreover, these trucks are mostly used for the deliveries (Actran Consultants, 1998).

Maximum Weight limit per truck set:

To figure out the feasibility of transporting semi-trucks via rail must require maximum weight limit for a truck set which includes tractor unit + trailer + cargo. Therefore, due to strict rules in North America for maintaining road safety, weight limits are being regulated by both federal and provincial authorities. Based on the information and the strict rules it might also affect the budget of a company to transport the semi-trucks via rail.

In United States the maximum gross vehicle weight (GVW) is already defined by the government of US which is 80,000 pounds (36.3 metric tons), however this limit was enforced and applied in the law for safety and prevent excessive wear on infrastructure. Apart from that, most to near the same regulations are being applied in Canada as well (U.S Department of Transportation Federal Highway Administration, 2015).

When it comes to British Columbia particularly then it can be said that it is double then United States which is 63.5 metric tons. Similarly, it was established by the BC Ministry of Transportation and Infrastructure for facilitating the higher loads for some particular industries including forestry and mining (Ministry of Transportation and Infrastructure, 2025).

Maximum number of truck sets that can be hauled per train set:

Determination of maximum number of truck sets per train set can be executed based on various factors including the weight limit of railcars, the length of the train and the type of the railcars used for transportation.

- **Weight limit per railcar:**

Based on the research and information gathered it can be said that the standard axel load for heavy-haul railroads in North America is about 32.5 metrics tons per axel which directly resonates with GVW of up to 130 metric tons per railcar for four-axel configuration. Whereas 91.6 metric tons limit was established as the most common load limit per railcar as a flatcar mostly used in intermodal transportation (D. Martland, 2013)

- **Train Length and capacity:**

As per the research Canadian National Railway a typical freight train contains 80 to 100 railcars. Furthermore, based on the information gained the given flatcar can accommodate one semi-trailer(in the trailer-on-flatcar or TOFC model) or two large size container limiting to 40 foot(in the container-on-flatcar or COFC model).

Financial feasibility and Breakeven Analysis

Financial viability of the project will be analyzed as well for the project for better pre-planning. This will include the cost-benefit analysis of rail transport and truck transport for potential savings where the breakeven point will be calculated as well in terms of ton-miles, number of truck set and train set required.

Cost Assumptions

The financial feasibility study is based on the following assumptions:

Factor	Value
Trucking Cost	CAD $0.143 per ton-mile (Statista, 2024)
Rail Transport Cost	CAD $0.026 per ton-mile (Government of Canada, Statistics Canada, 2024)
Savings per Ton-Mile	CAD $0.117(Statista, 2024)
Truck Load Assumption	20 tons per truck set (average cargo weight for a 53-foot trailer) (Statista, 2024)
Distance Assumption	100 miles (reflecting the distance between small towns and major cities) (Statista, 2024)
Train Capacity	80-100 truck sets per train set (Statista, 2024)

The transition from trucking to rail transport will produce major cost reductions per ton-mile which will lower total freight spending. The long-term economic sustainability of intermodal logistics benefits from rail transport's fuel efficiency improvements.

Initial Setup Costs

The initial setup costs include the purchase of equipment and infrastructure upgrades. The following table summarizes the estimated costs:

Category	Item	Unit Price (CAD)	Quantity	Total Cost (CAD)
Loading & Unloading Equipment	Rail-Mounted Gantry Cranes (RMGs)	$420,000 (Government of Canada, 2024)	4	$1,680,000 (Government of Canada, 2024)
	Ramps	$12,000 (Government of Canada, 2024)	1	$12,000 (Government of Canada, 2024)
Train Equipment	Locomotive	$2,000,000 (Statista, 2024)	1	$2,000,000 (Statista, 2024)
	Flatcars	$50,000 (Statistics Canada, 2024)	100	$5,000,000 (Statistics Canada, 2024)

Total Initial Setup Costs				**$8,692,000** (Government of Canada, 2024)

The use of rail-mounted gantry cranes and ramp systems provides an effective solution for loading and unloading semi-trucks onto railcars. The procurement of locomotives and flatcars builds essential infrastructure needed for dependable freight transport between Vancouver and Calgary.

Annual Maintenance Costs

Accurately estimating annual maintenance costs for rail infrastructure is crucial for assessing the financial feasibility of semi-truck transport via rail. These costs include routine inspections, repairs, and necessary replacements to ensure safe and efficient operations.

The annual maintenance costs are estimated at 50% of the annual amortization amount (McKinsey & Company, 2018). The amortization is calculated over a 20-year depreciation period.

Category	Annual Amortization (CAD)	Annual Maintenance (CAD)
Loading & Unloading Equipment	$84,000	$42,000
Ramps	$600	$300
Locomotive	$100,000	$50,000
Flatcars	$250,000	$125,000

Total Annual Maintenance Costs		**$217,300**

Railway infrastructure and rolling stock investments necessitate planning for maintenance over an extended period. The Government of British Columbia states that proactive maintenance programs are crucial for sustaining rail system longevity and safety (Government of British Columbia, 2024). Maintenance cost estimates for each year correspond to sector benchmarks and investment patterns observed in Canadian railway companies including CN and CP (Railway-News, 2018).

Employee expenses:

When it comes to the employee expenses then it could be said that crane operators and train conductors are the essential roles for the efficient loading, unloading and transportation of semi-truck via rail in the intermodal rail system. Therefore, the annual salaries of these roles are considered as an important factor.

Positions	**Annual Salary (CAD)**	**Number of Employees**	**Total Cost (CAD)**
Crane Operators	$75,494	4	$301,976
Train Operators	$99,956	2	$199,912
Total Annual Employee Cost			$501,888

Justification:

Crane Operators: It is understandable as the salary of CAD $75,494 is a good salary because it requires a lot of skills to be able to operate equipment that do heavy lifting like the RMG. The cranes that load and unload semi-trucks and trailers are critical for intermodal movement from origin to destination as the performance of the intermodal rail system is directly impacted by the effectiveness of the crane (indeed, 2025).

Train Operators: Train conductors get paid a salary of CAD $99,956, and it makes sense as they have to ensure that freight is transported safely and on time. They are critical in keeping the rail system running smoothly, and their pay reflects the skills and responsibilities that accompany the position (indeed, 2025a).

Total Annual Fixed Costs:

The total annual fixed costs of the project will include the amortization, maintenance costs and employee costs which are necessary considerations for the operations and sustainability of the intermodal rail transportation.

Category	Annual Cost (CAD)
Amortization	$434,600
Maintenance	$260,769
Employee expenses	$501,888
Total Annual Fixed Costs	$1,197,257

Justifications:

Amortization: This step includes the allocation of the initial capital investment of assets, such as mentioned equipment, infrastructures and other applicable requirements in the initial stage to start the project. Moreover, the Amortization cost will be calculated using the straight line method over their useful life span of 20 years. Apart from that, based on the research it could be said that the life span calculation of rail equipment are complex due to several factors therefore the average lifespan has been considered as 20 years for each equipment (Statistics Canada, 2015).

Amortization = Initial Investment / Useful life of Asset (Years)

Amortization = $8,692,000 / 20 years = $434,600

Maintenance Costs: To keep the inter modal transportation system seamless, it is important to have the maintenance effectively and regularly including routine inspection, repairs and servicing of the equipment mentioned above. These costs can be varied but they are often estimated as a percentage of the capital costs. As per the industry regulations, annual maintenance and repair costs are ranging from 3% to 5% of the total capital costs (Saba, n.d.).

Maintenance Costs = $8,692,000 * 3% = $260,769

Employee Expenses: For the safe and efficient inter modal railroad transport it is necessary to have the employee salary based on the industry trends for crane operators and train conductors. However, the detailed breakdown has been mentioned earlier.

Breakeven Analysis:

Breakeven Analysis includes the analysis or figuring out of the point at which the total revenues from the intermodal rail system equal to the total costs which eventually conclude in

neither profit nor loss. This analysis assist in identifying the minimum cargo, volume, mileage and number of truck sets required to cover the costs.

Breakeven Point (Ton-Mile) = Total Annual Fixed Costs / Savings per Ton-mile

Breakeven Point (Ton-Mile) = $1,197,257 / $0.117 = 10,232,965.81 ton-miles

Financial Benefits

Moving freight from trucks to trains saves a lot of money. Trains use less fuel and can carry more goods at once. This project estimates a cost reduction of CAD $0.117 per ton-mile by using trains instead of trucks. Over long trips, these savings grow quickly. For example, by moving 6,561 truckloads a year, the system can break even at 9,454,000 ton-miles, leading to big long-term savings for freight companies.

Less truck traffic also means lower costs for road repairs. Fewer trucks on highways cause less damage, saving public money on maintenance. Businesses save on labor too, as trains need fewer drivers than long-haul trucks.

Environmental Benefits

Trains are cleaner than trucks. This project can lower carbon emissions up to 75%, and Alberta can use it to achieve its climate goals. With less pollution comes cleaner air and a smaller carbon footprint. This is beneficial to government green policy and can make the project eligible for tax credits or grants.

Transporting cargo to trains also reduces traffic congestion and accident potential since there are fewer trucks on the roads. These aspects contribute to cleaner and safer rail transportation for society.

Operational Efficiency

The use of trains causes the supply chain to run at a faster and more effective rate. Trains can carry more products at a single time, and this helps businesses to fulfill delivery deadlines and avoid delays. Unique terminals in urban areas like Vancouver, Kamloops, Golden, and Calgary will help with faster loading and unloading. The terminals allow for the speeding up of products being moved from trains to trucks, thus deliveries are quicker. The system also supports just-in-time (JIT) delivery, which is highly relevant for companies that need products at the earliest without having to wait. The system can save time, eliminate delays, and help companies stay on time with their deliveries.

Risk Assessment

Operational Risks

Rail transportation problems may cause delays and slow down the entire supply chain. When loading and unloading are too lengthy, deliveries are delayed, and deadlines are missed, and customers get dissatisfied. Equipment failures, e.g., problems with the loading machines or rail cars, may also bring operations to a standstill. That is especially worse at busy terminals where several trains move in and out. Poor traffic management can result in congestion and more delays. In order to avoid these issues, upkeep is required in order to repair small issues immediately. Having backup plans, i.e., having alternative routes available in case a route is shut down, can also ensure on-time delivery. Standby teams need to be ready to attend to unforeseen issues. Computerized tracking is easy because it gives real-time movement of the freight, making it possible to locate and correct delays in time (Qin & Jia, 2019)

Financial Risks

Financial risks can harm rail transport projects if not controlled. One of the most significant risks is having a continuous flow of shipments. If fewer goods are transported, the project will not earn enough money. Market fluctuations also affect profits. For example, increased fuel prices raise costs, and an economic downturn can lower demand for rail services. To manage these risks, companies can use flexible pricing to attract more customers. Offering unique services like express delivery can also draw more clients. Having long-term agreements with large customers provides consistent revenue and minimizes the risk of losing clients. Continuing to monitor financial performance helps businesses adjust prices or services in order to be profitable (Sweeney, 2019).

Environmental Risks

Environmental factors can also cause trouble for rail transport. Poor weather conditions, including snow, storms, or floods, can damage tracks and affect delivery of services. Snow, for example, can fill up rails, while floods can make tracks unsafe. Rail traffic can even affect surrounding communities by generating noise pollution. To avoid such threats, companies can invest in weather-proof systems. Heated tracks prevent snow from piling up, and better drainage prevents flooding. Monitoring weather in real-time guarantees that companies reschedule to avoid delays. It is also important to communicate with the locals. Explaining how rail transport reduces road congestion and air pollution can promote better relations (Wang et al., 2020).

Recommendations

To make intermodal rail transport work, businesses need to invest in infrastructure. Building terminals in places like Vancouver, Kamloops, Golden, and Calgary will make it easier for trucks to switch to rail. These terminals should have advanced loading systems to save time and improve efficiency. By setting up such facilities, businesses are able to reap the maximum advantage of rail transport in terms of cost and environmental conservation. It is also important to choose key locations so freight does not have to travel far by road. Such investment helps in making rail transport grow and become reliable (Canadian Railways Association, n.d.).

Another recommendation is forming partnerships with major freight companies. Signing long-term contracts will help to ensure a steady demand for rail services and therefore reduce capital risks. It will also allow firms to collaborate with one another in a bid to improve logistics and address changing market needs. Tight integration with the trucking and rail sector will lead to smoother operations, fewer disruptions, and higher customer satisfaction. Such partnerships can also divide the cost of infrastructure investments, making it easier to maintain reliable service(Sweeney, 2019).

Using technology is crucial to improving intermodal transport. Real-time tracking technology will allow companies to more accurately track shipments. Automated loading units will save time and reduce errors in truck-to-train transfers. Route optimization through data analysis will save fuel and cut costs. All these advances will improve operations, ensuring

delivery on schedule and more satisfaction from customers. Upgrading to new technology is vital to remain competitive and deal with the growing requirements of logistics (Qin & Jia, 2019).

To manage risks, businesses should have backup plans. These plans should include alternative rail routes and emergency teams to handle problems. Being prepared for issues like equipment failures, weather delays, or labor shortages will help minimize disruptions. Open communication with stakeholders is crucial to settling things quickly, and good risk management ensures that rail transport does not lose faith (Sweeney, 2019).

Government aids are useful as well. Companies should ask for grants, subsidies, and tax relief on infrastructure and technology expenditures. Collaboration with the policy makers makes it easier to switch to rail transport (Transport Canada, 2023).

Finally, public education of the benefit of intermodal rail—being cost-effective and eco-friendly—will win over people's trust and prove earnest about being sustainable (United Nations Environment Programme, 2022).

By following these steps, businesses are able to conduct intermodal rail shipping successfully, saving costs, being greener, and optimizing supply chain functions, resulting in an environmentally friendly future.

Conclusion

Studies on shipping semi-trucks by train from Vancouver to Calgary show many benefits. Shipping through existing train tracks can be economical, reduce traffic on highways, and reduce pollution. There are two ways of doing this: the accompanied trailer system and the unaccompanied trailer system. The accompanied system, like the Eurotunnel, is faster but involves expensive equipment. The unaccompanied system, like the Modalohr, is cheaper and

can carry more trailers in a train. Strategically positioned points of unloading and loading are Vancouver, Kamloops, Revelstoke, Golden, and Calgary. They are main railroad and highway city sites and facilitate the smooth exchange between trains and trucks.

This network is expensive to plan and fix when something goes wrong. In the long run, it can be affordable, eco-friendly, and provide more reliable deliveries. Overall, freight shipping by rail is an inexpensive and environmentally friendly solution for increasing transport in Canada.

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