Feasibility Study: Vancouver Island Rail Corridor Ridership Forecast

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Prepared By: Shivani Chauhan

Project: Ridership Feasibility Study for Vancouver Island

1. Executive Summary

The objective of this study was to develop a defensible, data-driven ridership forecast for a proposed passenger rail service on Vancouver Island. Moving beyond simple population trend analysis, this project employed a **calibrated Direct Demand Model (DDM)** integrated with a **Mode Choice** analysis to reflect real-world travel behavior and competition from private automobiles.

Key Findings:

- **Baseline Forecast:** The model predicts a stabilized annual ridership of **1.86 million passengers**.
- **Network Structure:** The system functions as a **"Two-Hub" network**, with 97% of demand anchored to the **Victoria Hub** (commuting and intercity travel) and a smaller but strategically vital **Nanaimo Hub** (regional connectivity).
- **Risk & Opportunity:** Sensitivity analysis indicates the project is resilient. Even in a "High EV Adoption" scenario (low driving costs), ridership remains above **1.2 million**. Conversely, increasing train speeds by 20% yields a **33% ridership gain**, creating a potential market of **2.5 million annual passengers**.

2. Methodology: A Multi-Stage Analytical Approach

To ensure reliability, the forecast was built through a rigorous four-stage modeling process:

2.1. The Foundation: Fixed-Effects Gravity Model

We began with a Direct Demand Model (DDM) that calculated "Trip Potential" based on population size and distance.

- **Innovation:** We applied a **Fixed Effects** regression derived from historical BC Ferries data to quantify the unique "travel DNA" of each city. This revealed that major hubs like Nanaimo and Victoria generate disproportionately high travel volumes compared to their population size.

2.2. The Refinement: Mode Choice Modeling

We refined the gravity model by introducing competition. Using a **Logit Model**, we calculated the "Generalized Cost" (time + money) of taking the train versus driving for every specific route.

- **Key Variables:** Driving costs ($0.12/km operating cost), Value of Time ($27.36/hr based on average wages), and travel time comparisons.
- **Result:** This transformed the forecast from a theoretical "demand score" into a realistic "market share" prediction.

2.3. The "Bonus" Layer: Terminal Integration

We quantified the ridership captured from major transit nodes. Using 2024 passenger volumes for **Victoria International Airport (1.87M)** and **BC Ferries (4.7M combined)**, we estimated a capture rate of 15% of the addressable market, adding approximately **560,000 annual passengers** to the system.

2.4. Calibration & Validation (The "Rosetta Stone")

To validate our figures, we benchmarked the model against the **West Coast Express (WCE)**. By running our exact model on the Mission-Vancouver corridor and comparing it to real-world WCE ridership (1.56M), we derived a calibration factor. This ensured our final numbers were grounded in actual BC rail performance, not theoretical abstraction.

3. Strategic Analysis of Results

3.1. The "Two-Hub" System

The origin-destination analysis reveals a clear hierarchy in the network:

- **The Revenue Engine (Victoria Hub):** The **Victoria-Nanaimo** and **Victoria-Langford** corridors account for the vast majority of total passenger volume. These are the "Anchor Routes" that drive revenue and justify the capital investment.
- **The Connectivity Engine (Nanaimo Hub):** While only representing ~3% of total volume, the routes centered on Nanaimo (connecting to Ladysmith, Chemainus, Port Alberni) provide critical regional access. This "Mid-Island Regional" service captures a high *market share* (60-70% on some routes) because the train is significantly faster/cheaper than driving for these specific trips.

3.2. Sensitivity Analysis (Risk & Opportunity)

We stress-tested the baseline forecast (1.86M) against two critical future scenarios:

Scenario	Description	Annual Forecast	Impact	Analysis
High EV Adoption	Driving costs drop to $0.04/km	**1.23 Million**	**-33.7%**	**Resilient.** The project remains viable (>1M riders) even if driving becomes significantly cheaper.
Baseline	Current costs & speeds	**1.86 Million**	**0.0%**	**Realistic.** Aligned with peer systems like West Coast Express.
High-Speed Rail	Train travel time reduced by 20%	**2.49 Million**	**+33.8%**	**High Potential.** Speed is a major lever. Faster trains attract ~630k new riders.

4. Strategic Recommendations

Based on these data-driven insights, the following actions are recommended:

1. **Prioritize the "Anchor" Corridors:**
    - Phase 1 construction and service planning must focus on the **Victoria-Langford-Nanaimo** line. This represents the revenue backbone of the system. High frequency (e.g., 15-30 min headways) is essential here to capture the commuter volume.
2. **Adopt a Hybrid Service Model:**
    - Do not run a "one-size-fits-all" schedule. Implement an **Intercity Express** (Nanaimo-Victoria) to serve the high-volume travelers and a separate **Mid-Island Regional** train to serve the high-market-share local trips.
3. **Invest in Speed Updates:**
    - The sensitivity analysis shows a high elasticity of demand to speed (+33% ridership for +20% speed). Capital investments that straighten tracks or remove grade crossings to increase average speeds are financially justifiable.
4. **Seamless Terminal Integration:**
    - Approximately **30% of the total ridership** is driven by connections to Ferries and the Airport. "Last-mile" shuttles or direct platform integration at Swartz Bay and near YYJ are not optional amenities; they are critical ridership drivers.

5. Conclusion

This feasibility study confirms that a passenger rail service on Vancouver Island is a viable transportation project with a robust baseline demand of **1.86 million annual passengers**. By rigorously calibrating our model against the West Coast Express and accounting for future risks like EV adoption, we have produced a conservative, defensible forecast that supports moving to the next stage of detailed operational planning.