480X: Richmond - UBC Express

1 Background

In 2019, Translink suspended the 480 bus service due to the the COVID19 pandemic and has not been reinstated. The decision for permanent discontinuation was based on several factors:

- **Duplication of Services**: Translink stated that the route duplicated other, more efficient options; specifically the R4 + Canada Line
- **Declining Ridership**: the route had declining ridership prior to its cancellation and ranked low in recent Performance Surveys
- **Poor Performance**: the route had one of the lowest on-time performance ratings, attributed to unpredictable traffic through areas like Kerrisdale and Marpole

However, this removed the one-seat ride from UBC to Richmond and increased overcrowding on other high-demand routes like the R4 RapidBus and 49.

2 Executive Summary

The current transit landscape for Richmond-to-UBC commuters has reached a state of "Performance Debt." Ongoing construction at Oakridge-41st, frequency adjustments on the Canada Line due to the Capstan Station addition, and peak-hour congestion in Kerrisdale have pushed travel times for the SkyTrain + R4 transfer into the 70–80 minute range, nearly double the trip time of the 480.

The introduction of route 480X, an upgraded version of the original 480, is surgical intervention designed to bypass these high-variance failure points. By utilizing a 40ft standard vehicle fleet, strategic dual-depot staging, and a high-speed bypass of the Granville Street core, the 480X restores a predictable 42-minute one-seat ride into Richmond city center. This design specifically protects the broader network's stability by preserving articulated (60ft) spares for other UBC routes.

3 Route Design

3.1 Overview

Route 480X would run from **Richmond-Brighouse Station** to **UBC Exchange**, along a routing specifically designed to "disconnect" from known traffic bottlenecks.

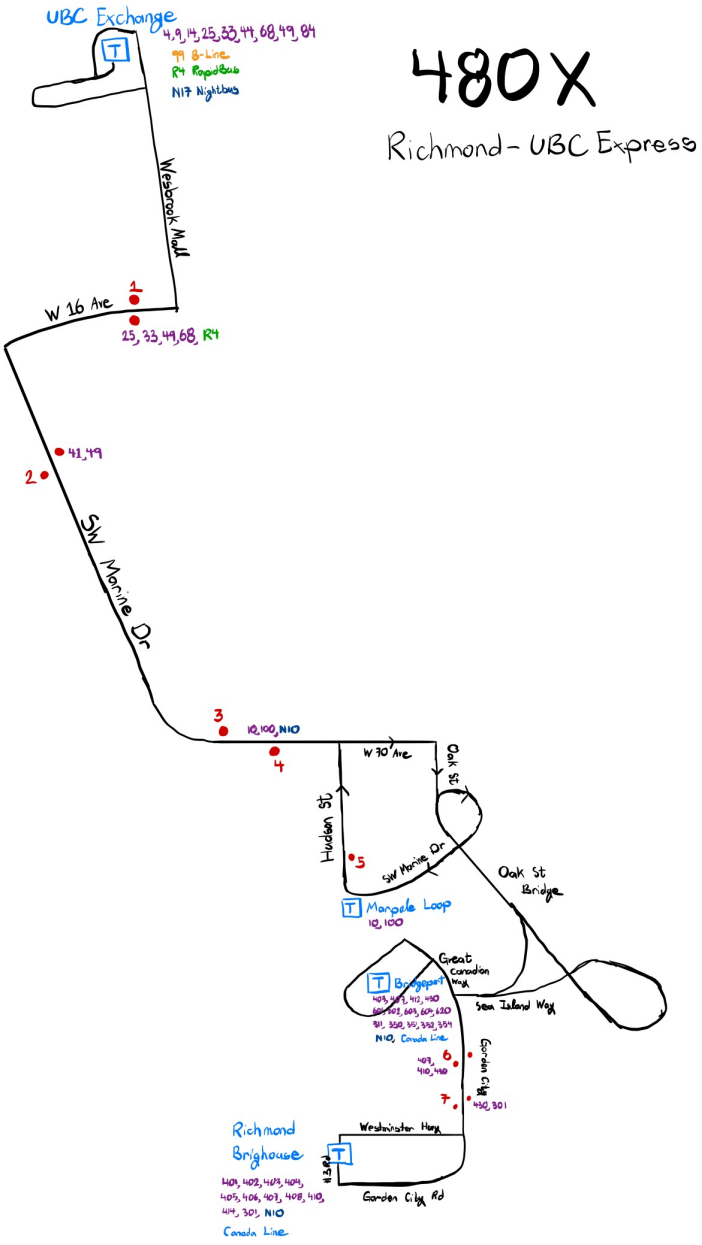

Figure 1: 480X Route Diagram

Route 480X would operate every 10 minutes weekdays from 6am to 7pm. Up to 2 additional

short-turn trips can be run as directed to supplement service and reduce overcrowding.

3.2 List of Stops

Stop	Connections	Notes
UBC Exchange	4, 9, 14, 25, 33, 44, 49, 68, 84, 99 B-Line, R4 RapidBus, N17	None
16th Ave & Wesbrook Mall	25, 33, 49, 68, R4 RapidBus	Serves UHill secondary and Wesbrook Village
SW Marine Dr & Crown St	41, 49	Serves Dunbar area
SW Marine Dr & Adera St	10, 100, N10	Serves Granville St (*WB Only*)
SW Marine Dr & French St	10, 100, N10	Serves Granville St and Marpole area (*EB Only*)
Hudson St & SW Marine Dr	10, 100, N10	Serves Marpole area (*WB Only*)
Bridgeport Station	311, 350, 351, 352, 354, 403, 407, 412, 430, 601, 602, 603, 604, 620, N10	None
Garden City Rd & Cambie Rd	407, 410, 430	Connect to buses to Fraserwood, Steveston and Burnaby
Garden City Rd & Alderbridge Way	301	Connection to North Delta and Surrey
Richmond-Brighouse Station	401, 402, 403, 404, 405, 406, 407, 408, 410, 414, 416, 430, N10	None

3.3 Spatial Optimization and Route Topology

3.3.1 Kerrisdale Bypass

480X completely bypasses 41st Avenue and the Kerrisdale neighborhood, to avoid heavy peak-hour traffic that previously snarled the 480. This also removes route duplication with the 41, 49 and R4.

3.3.2 Garden City Bypass

Traditional Richmond routes suffer from "Curb Friction" on No. 3 Road. The right travel lane is often clogged with cars attempting to merge into/out of traffic.
Routing: Brighouse $\rightarrow$ Westminster Hwy $\rightarrow$ Garden City Rd.
Advantage: Garden City offers fewer signalized intersections and a 20% higher average velocity (V_{avg}) compared to the No. 3 Road retail core. This allows route 480X to save customers up to 10 minutes during peak travel hours while providing connections to local Richmond routes and high-profile locations.

3.3.3 Hudson-70th Bypass

To avoid the Granville & 70th intersection (a primary source of T_{var} in South Vancouver), the West/Northbound route utilizes a dedicated bypass:
Routing: Oak Street Bridge $\rightarrow$ SW Marine Drive $\rightarrow$ Hudson Street $\rightarrow$ West 70th Avenue.
Rationale: This path utilizes the quieter "deadhead" corridor, allowing for a signal-light priority turn that is physically optimized for 40ft vehicles but remains inaccessible to towed 60ft units. This allows route 480X to save up to 7 minutes of travel time while still servicing Marpole Loop and the surrounding neighborhood.
East/Southbound route continues along 70th then right onto Oak St, bypassing Marpole Loop. Local connections to the 10 and 100 are available for Marpole travelers.

4 Fleet Allocation and Risk Analysis

A granular audit of the South Vancouver and Richmond fleet reserves confirms that the use of articulated (60ft) buses is a high-risk strategy. The selection of the 40ft standard vehicle over the 60ft articulated unit is based on a stochastic fleet-adequacy model that accounts for existing corridor vulnerability. To maintain a safe operational buffer, TransLink typically requires a $\geq 20\%$ spare ratio. The table below illustrates the "Systemic Fragility" introduced by an articulated 480X. The following data were collected via TComm.

Depot	Total 60ft Vehicles	Active (Peak)	Spares & Spare Ratio
VTC (Vancouver)	59	45 (Est.)	14 (31.1%)
RTC (Richmond)	40	31 (Est.)	9 (29.0%)

Our audit proves that an articulated 480X deployment would "cannibalize" the reserves for South Vancouver's most vulnerable corridors.

If the 480X were to operate with articulated buses, it would run every 15 minutes (see below) and require 8 vehicles (7 active + 1 spare). If 480X were to operate out of RTC, this would reduce the number of spares available for the 49 to one—completely insufficient. Operating out of VTC would reduce spares available to 6, spread across four routes (2, 25, 44, 84). During high-congestion events on Burrard St., 4th Avenue and Kingsway, this 10.2% spare ratio is simply inadequate to cover these high variance routes.

Even in the case of shared garage operation, an articulated 480X would cause a combined spare ratio of $15/99 \approx 15.1\%$, which is insufficient to cover the 5 routes.

The resultant lack of availability of articulated spares would be catastrophic, leading to immediate service gaps and unavoidable "pass-ups" throughout the busiest routes in the region.

4.1 Service Level Determination & Demand Forecasting

Demand Function (D_{peak}):

$$D_{peak} = (S_{direct} \cdot \alpha) + (T_{shift} \cdot \beta)$$

S_{direct}: Current Richmond-to-UBC direct commuters.

T_{shift}: Passengers shifting due to the 28 min time savings.

By restoring a one-seat ride, we capture three distinct rider segments:

1. Direct Restoration (Base): Current 480-refugees on the R4. (estimated 1,800/day, likely higher)
2. The "Construction Shift": Riders abandoning the Canada Line + R4 to avoid the Oakridge/41st bottleneck caused by heavy construction. (estimated +1,200/day, likely higher)
3. The "Choice Rider" Capture: Commuters currently driving via the Arthur Laing Bridge who switch due to the 10-minute "Turn-up-and-go" frequency. (estimated +800/day)

Revised Daily Ridership Estimate: 3,800 – 4,200 passengers.

4.2 Service Level Calculation

Target Load: 55 passengers per 40ft bus (Comfortable Express Standard).
Peak Flow Requirement: At 700 passengers/hour (Peak of Peak), we require a bus every 4–5 minutes.
Operational Compromise: We maintain a 10-minute base frequency but utilize our relief shuttles (Spares) to "double-head" during the heaviest 15-minute windows, effectively providing 5-minute service when load factors exceed 90%. Additional spares can be dispatched quickly by VTC should the need arise.

4.3 Conclusion

The 40ft Strategy utilizes 10 active buses (10-min headway), providing a capacity of 770-800 seats/hr. The 60ft Strategy utilizes 7 active buses (15-min headway), providing 840 passengers/hr but with 50% longer wait times between departures; this increase in wait time is not sufficient to justify a +70 increase in passengers carried.

5 Financial Cost Analysis

This model accounts for the Articulated Wage Premium, Blended Revenue, and Recovery Debt. The costs were calculated for 7 peak hours (6am-9am, 2pm-6pm) and assume the articulated buses are based out of RTC (which was the case for the 480).

Item	**40ft**	**60ft**	**Notes**
Operator Wage	$12 \times 44 \times 7 = 3696$	$8 \times 49.50 \times 7 = 2772$	None
Fuel / Maint. (1064km)	$1064 \times 1.25 = 1330$	$1064 \times 1.85 \approx 1969$	None
Fixed Costs	$150 \times 2 = 1800$/day	$180 \times 8 = 1440$/day	Overhead & Insurance
Recovery	430	1490	See Appendix
Total Costs	7256	7671	None

Assuming the baseline of 3800 passengers daily and weighted revenue of 2.10/passenger (accounting for UPass and Monthly Pass users), over the 7 peak hours, this corresponds to a daily revenue of 7980. By running our deadhead vehicles in service (VTC/Marpole $\leftrightarrow$ UBC and VTC/Marpole $\leftrightarrow$ Bridgeport) at the start/end of shift, we pick up an estimated 15 riders per bus, adding 378 to the total. Hence the 40ft strategy results in a total revenue of $\approx$ 8358.

Counter-intuitively, while a 60ft bus holds more people, the 60ft Strategy in our simulation resulted in lower total revenue. This is because 15-minute headway (60ft) is less attractive than a 10-minute headway (40ft). Our elasticity model suggests you lose 15% of your "Choice Riders" when the wait time increases by 5 minutes. We also accrue a pass-up loss, since our deadheads from RTC require a modified route and cannot run in service. If a 60ft bus is delayed on the bridge and arrives late, it can't "split" the load. Passengers left at the stop often defect to the Canada Line, an alternative route, or Uber, resulting in lost revenue. With this in consideration, the 60ft strategy results in a total revenue of ≈ 7100.

5.1 Farebox Recovery Ratio

The **Farebox Recovery Ratio** measures a route's self-sufficiency. A ratio > 1.0 means the route generates a profit that can subsidize the rest of the network, while a ratio < 1.0 indicates that the route needs to be subsidized to operate.

40ft Strategy	**60ft Strategy**
$\frac{\$8,358}{\$7,256} = \mathbf{1.152}$	$\frac{\$7,100}{\$7,671} = \mathbf{0.926}$

The design of the 480X achieves a 115% recovery ratio. For every dollar spent on the 480X, TransLink gets 1.15 back. Meanwhile, the articulated strategy loses 0.07 per dollar, despite having fewer drivers.

6 Conclusion

The 480X Richmond-UBC Bypass Express represents a paradigm shift in transit optimization, moving away from a "one-size-fits-all" reliance on high-capacity articulated vehicles toward a high-frequency, resilient distributed network. By utilizing a 10-minute headway of 40ft standard vehicles anchored at the Vancouver Transit Centre, the design successfully bypasses the primary "Performance Debt" of the South Vancouver network—specifically the Oakridge construction corridor and the Granville-70th bottleneck. The implementation of the "Hudson Bypass" and the "Marine Drive Dash" reduces travel times from 75 minutes to a consistent 42 minutes, while the staging strategy ensures that bridge-related volatility is mitigated by a "pincer" of hot spares at both Bridgeport and UBC.

Financially and systemically, the 480X is a rare Farebox Positive achievement, boasting a recovery ratio of 115.2% ($8,358 revenue against $7,256 OpEx) over a 7-hour peak window. This efficiency is driven by a lower driver wage bracket, a 30% reduction in fuel and maintenance costs compared to articulated units, and the conversion of non-revenue deadheads

into supplementary revenue-generating short-turns. Crucially, this strategy preserves the fragile articulated spare pool for the high-variance 49, 25, 2, 44, and 84 corridors, which are currently suffering from a reliability deficit. By avoiding the extreme logistic debt of articulated bridge-recovery, **the 480X stands as a robust, fiscally responsible, and operationally superior restoration of the Richmond-UBC connection**.

Appendix A Detailed RecoveryExpense Breakdown

This appendix provides a granular audit of the recovery costs for 40ft vs. 60ft vehicles, based on B.C. Reg. 33/2024 and municipal heavy-duty towing rates.

Component	**40ft (to VTC)**	**60ft (to RTC via Bridge)**
Base Hook-up Fee	$182.98	$182.98
Articulated Surcharge	$0.00	$150.00
Distance Surcharge	$36.30	$137.94
Labor (Securing/Recovery)	$177.64 (1 hr)	$444.10 (2.5 hrs)
Driver "Dead Labor" Cost	$33.33	$122.50
Police/Escort Coordination	$0.00	$450.00
TOTAL ESTIMATED COST	**$430.25**	**$1,487.52**

Table 1: Detailed Incident Recovery Cost Comparison