



2021 Canadian Consulting Engineering Awards

RAPIDBUS **(BUS RAPID TRANSIT CORRIDORS)**

Transportation



ASSOCIATION OF CONSULTING
ENGINEERING COMPANIES | CANADA

T 2020 RapidBus & B-Line Network



2020 RapidBus & B-Line Network – map courtesy of TransLink

ABOUT THE RAPIDBUS PROJECT

TransLink's RapidBus program is delivering a package of transit enhancements and customer amenity upgrades that supports bus speed and reliability and an improved experience on TransLink's busiest bus routes. The RapidBus project consists of more than 60 km of bus priority infrastructure and over 120 upgraded bus stops across 10 communities in the Metro Vancouver region including West Vancouver, North Vancouver, Coquitlam, Port Coquitlam, Surrey, Burnaby, Maple Ridge, and Vancouver. It also includes another 40km of improvements to existing transit corridors.

The TransLink RapidBus project is the implementation of the first phase of a new vision for rapid transit to be built across the Metro Vancouver region. Phase 1 includes 3 new rapid transit corridors and stop upgrades to 2 existing high-frequency transit corridors touching more than 10 municipal, provincial, regional, and institutional jurisdictions. The RapidBus program is the evolution of the existing B-Line program which features limited stop high-frequency service on multiple corridors, currently with little, or no, transit priority infrastructure.

*RapidBus features high-capacity vehicles, priority over general traffic, and **fast, frequent, and reliable service** beyond what is achievable with conventional transit. This project also supports **climate resiliency** within the transportation network by promoting more sustainable and healthy modes of transportation and providing mobility choices that are viable alternatives to driving.*

PROGRAM GOALS

The RapidBus program goals include:

- Provision of frequent all-day service (3-10 minutes in the peak and 8-15 minutes in the off-peak, or better, from at least 6 am-midnight 7 days per week);
- Increasing speed and reliability of transit services with fewer stops, all-door boarding, and implementation of transit priority infrastructure including bus lanes and signals; and
- Delivery of an enhanced customer experience with larger, more comfortable hybrid articulated-buses, distinctive branding, accessibility infrastructure, and real-time digital and audio bus information at all stops.

Working with TransLink's pre-determined routes, general stop locations, and service characteristics, WSP, Access Planning, and Nelson-Nygaard worked under an accelerated project delivery model to complete planning, design, and construction in less than 24 months. The project team collaborated with and coordinated input from local governments, TransLink, and the Coast Mountain Bus Company to implement street and traffic changes that will decrease bus-travel times, including changes to traffic signals and turn restrictions, introducing dedicated bus lanes, and more. The specific requirements and local contexts of each organization were considered.

Our design team was responsible for delivering:

- Traffic analysis identifying opportunities to reallocate road space for bus priority infrastructure;
- Concept designs and preliminary costing;
- Detailed designs and complete costing to support contractor procurement;
- Procurement support services; and
- Owners' engineer services through construction.

Key challenges and opportunities requiring context sensitive solutions included termini design, local stop integration, and evolving urban areas with established and constrained conditions.



Constructing a new bus pad



Manufacturing Passenger information Display (PID) foundations for sign posts

INNOVATION

The RapidBus program seeks to leverage constrained space by reallocating road right-of-way to transit rather than focusing on expensive, and often infeasible, road widening for new transit lanes. Working within constrained right-of-ways and a tight timeline, the consultant team needed to direct design attention in a way that minimized conflicts with existing utilities and infrastructure to streamline construction and achieve completion for RapidBus program launch. Creative solution-seeking was required by the designers to deliver a context responsive, high-quality urban mobility solution. The RapidBus corridors implemented run through dense urban, evolving suburban, and regional highway environments – one size design did not fit all.

Given the time and resource constraints, it was not feasible to complete detailed corridor traffic analysis and intersection modelling on all corridors. Instead, the team used a combination of data analysis, corridor-level traffic simulation and intersection-level micro-simulation, and professional judgement depending on the conditions, risks, and complexity at various locations throughout the region.

A unique and innovative component of this analysis was the base assumption that transit vehicles are to be given priority over general purpose traffic or parking. In most traditional analyses, modelling focuses on providing a level of service for general purpose traffic first. For RapidBus, our analysis focused on making the case to reallocate road space: a strong case was required to maintain general purpose lane and parking capacity rather than forcing the buses to squeeze into whatever “extra” space was available. This approach was new for TransLink and the local municipalities and required significant engagement to ensure stakeholder partners were comfortable with the analysis approach and solutions being proposed.

When traffic analysis and modelling was deployed in complex areas, the focus was on determining the most feasible, cost-effective changes to the transportation network that would reduce delays for transit users. VISSIM and AIMSUN traffic modeling softwares with visual simulation outputs built specifically for the project helped to obtain collective agreement on the best option design to reduce transit travel time while limiting impacts on general traffic.

During the traffic analysis, transit vehicles were given priority over general purpose traffic and parking – a new approach that required significant stakeholder engagement.



Asphalt Paving



TransLink's RapidBuses

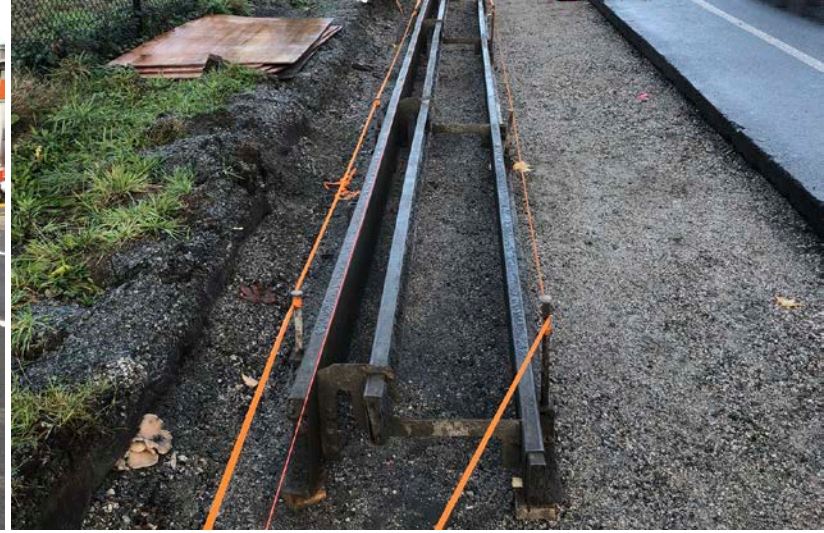
COMPLEXITY

To complete the RapidBus project, with its accelerated schedule and multiple major stakeholders (with potentially conflicting goals and objectives), the team had to navigate several complex issues, including:

- **Accelerated schedule:** An accelerated planning, design, and construction schedule was required to meet TransLink's commitment to launch four of the five RapidBus corridors in parallel by January 2020, with the last corridor launching in shortly after. The project schedule was split into three phases: conceptual design, detailed design, and construction. A 17-month construction period began early 2019 and ended in mid 2020 after completion of all five corridors.
- **Complex stakeholder engagement/coordination:** The design team worked with 10 road authorities (cities and districts) in the Metro Vancouver area including BC Ministry of Transportation and Infrastructure (BCMoTI) and UBC. Ongoing coordination with road authorities during construction was critical to the success of this project and allowed for seamless corridor integration across a wide geography where design efforts had to comply with each municipality's standards along the corridors.
- **Adaptivity:** Our team adapted quickly to evolving conditions on site and engaged relevant stakeholders in approving roadway, structural, electrical, and utility designs changes after appropriate engineering analysis in-house. We also accommodated, where possible, adjacent city-led or private sector-led projects, including allowances for future roadside projects such as local developments during the construction of the RapidBus corridors.
- **Permitting:** The overall RapidBus program extended through 10 local municipalities and other major stakeholder jurisdictions that required a development permit application and final approval prior to the construction phase. Our team of experienced engineers worked together with the local jurisdictional representatives through the design development phase to ensure a clear project vision and successfully achieve the project schedule. Weekly interactive sessions were scheduled to ensure conformance with the design and permitting requirements from different municipalities and other stakeholders.



Landscaping on new median



Concrete curb preparation

SOCIAL AND/OR ECONOMIC BENEFITS

Improved public transportation has well-demonstrated social and economic benefits. Benefits specific to the RapidBus project include:

- **Increasing people's access to jobs, schools, cultural institutions, and recreational spaces:** By reducing transit travel times along key corridors. The economic benefits of improved access to key destinations has been demonstrated time and again in transit businesses cases: improved access to opportunities across Metro Vancouver through RapidBus supports a healthy economy, job mobility, and lifestyle choice.
- **Reducing existing corridor travel times by 20%:** The new RapidBus corridors resulted in faster travel times, saving tens of thousands of person-delay-hours for all road users during peak periods. These savings were achieved through a diverse arrangement of transit priority measures, each tailored to suit local stakeholders' preferences and tolerances.

The design team ran their model through various simulations based on different scenarios for corridors on Marine-Main, Lougheed, and UBC/41. The models used are VISSIM (Marine Main) and AIMSUN (Lougheed), and SYNCHRO/SIMTRAFFIC (all the corridors). In total, the model predicted travel time shows a reduction by 20% in comparison conventional bus travel times along the corridor, which is equivalent to a reduction of 10-25min for each of the corridors. These results significantly improve the existing bus corridor conditions and save valuable time for transit users.

- **Extending connectivity and increasing efficiency:** RapidBus extends the connectivity of the Lower Mainland's transit system (bus – SkyTrain) and increases efficiency of public travel. CBC Reporter Justin McElroy tested the system in January 2020, driving from the Joyce-Collingwood SkyTrain station to UBC while a friend took the RapidBus, and the RapidBus was faster.¹

All RapidBus corridors developed by our team have fewer stops, with all-day service up to 20% faster than local buses (10 min in peak times and 15 min off peak times).

¹ [I raced TransLink's new RapidBus to UBC by car — and lost](#)



Red-painted bus lane on Marine-Main corridor



New curb and gutter installation

ENVIRONMENTAL BENEFITS

The RapidBus program helps combat climate change and improves the sustainability of transportation in Metro Vancouver by encouraging the shift to public transit and away from the use of single occupancy vehicles. By increasing the capacity of the transit system to accommodate more travellers, the RapidBus program makes it easier and more attractive for customers to choose bus travel for their daily needs, reducing the per capita carbon footprint for transportation in the region.

Although it is primarily a transit project, the RapidBus corridors also help promote Active Transportation: the project developed 40km of new and revitalized cyclist lanes that contribute to the overall cyclist network within the 21 municipalities in Metro Vancouver. The overall length of bikeways in the region tripled from 1,700km in 2009 to 4,600km in 2019, and the RapidBus project is an important contributor to this stellar achievement. The new cycling facilities include dedicated lanes and pedestrian-friendly, fully illuminated multi-use pathways.

An analysis of transit bus emissions from various service improvement strategies has shown a significant reduction in travel time and GHG emissions when an express bus on a reserved lane is introduced, as is the case with the RapidBus program. As shown below, when a service improvement of an express bus on a reserved lane is introduced, there is an average travel time reduction of 23% and average GHG emissions reduction of 38% (Alam et al., 2014).²

Combinations	Avg. travel time reduction (%)	Avg.GHG emissions reduction (%)
Regular bus (67) & reserved lane	2.13	18.01
Express bus (467) & regular lane	20.39	23.29
Express bus (467) & reserved lane	23.04	37.84

² Alam, A., Diab, E., El-Geneidy, A.M. & Hatzopoulou, M. (2014). A simulation of transit bus emissions along an urban corridor: Evaluating changes under various service Improvement strategies. *Transportation Research Part D: Transport and Environment*, 31, 189-198.



MEETING THE NEEDS OF TRANSLINK

Project Goals

TransLink's goals for the RapidBus program included:

- **Provision of frequent all-day service** (3-10 minutes in the peak and 8-15 minutes in the off-peak, or better, from at least 6 am-midnight 7 days per week)
- **Increased speed and reliability** of transit services with fewer stops, all-door boarding, and implementation of transit priority infrastructure including bus lanes and signals
- **Delivery of an enhanced customer experience** with larger, more comfortable hybrid articulated-buses, distinctive branding, accessibility infrastructure, and real-time digital and audio bus information at all stops

New Services and Future Improvements

The project addressed immediate required works to launch the new service in January 2020, while also planning for future incremental improvements to further upgrade the corridors during RapidBus implementation phases to follow. The success of this project can be attributed in part to the extensive complex multi-jurisdictional engagement coordinated by the consultant team through all phases of planning and project delivery.

The overall project perfectly aligned with the accessibility principles to ease people movement between places or opportunities using all modes of transportations (transit, cyclist, pedestrian)

Enabling Active Transportation

The RapidBus project enables active transportation by providing a safe and efficient cycling network for cyclists of all ages and abilities, along with safe and comfortable opportunities to walk. In support of this project objective, the project team developed new, modernized fully illuminated multi use pathways (cyclist and pedestrian) These accomplishments align with TransLink's mission in *"connecting the region and enhancing its livability by providing a sustainable transportation network embraced by our communities and our people."*

Improving Level of Service

Steps taken by the project team to improve the level of service include:

- ✓ Implementing fewer overall stops, maintaining approximately 1km between each
- ✓ Providing Improvements to the existing bus stops and constructing new stops to accommodate longer articulated buses
- ✓ Implementing an all-doors boarding procedure
- ✓ Introducing live public information displays at each bus rapid stop

Enhancing Brand Image

To elevate bus travel in the region, TransLink required an upgraded visual brand image for the RapidBus corridor. To meet this initiative, the consultant team delivered the following:

- Upgrades to shelters in terminus areas with significantly increased capacity
- Custom-designed passenger digital and auditory information totems at all stops along the routes
- Tactile surface walking indicators to assist those with visual impairments more easily navigate the transit system



Dedicated bus lane



TransLink's new RapidBuses at July 23, 2019, news conference

PROJECT SUCCESS

The guiding principle for this project were to prioritize transit over other motor vehicles in order to reduce transit person-delay in the short term. This approach facilitates mode shift, leading to the long-term reduction of person-delay across all modes.

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The RapidBus project is providing numerous benefits to TransLink, end-users and citizens of the Metro Vancouver region, and the three benefits that best exemplify the success of the project are:

- Smarter road design has led to improved function for all buses, pedestrians, cyclists, and general traffic travelling these corridors.
- Complex multi-jurisdictional engagement helped the team satisfy the needs and objectives of all stakeholders
- This complex project was completed in less than 24 months, bringing rapid relief to frustrated commuters facing long delays whether travelling by transit or car, and facilitating an increase in active transportation.

"The RapidBus program plays an important part in connecting the Metro Vancouver region through high-quality bus service."

Jeff Deby, Manager, Rapid Bus Program, TransLink
