2019 Transit Service Performance Review

Bus, SeaBus, and HandyDART

Data Definitions & Assumptions

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We develop the Transit Service Performance Review (TSPR) using several data sources. The data definitions will help in understanding the key performance indicators (KPIs) in the dashboard. This document outlines the definitions, assumptions, and calculations used in the bus, SeaBus, and HandyDART dashboard at: https://public.tableau.com/profile/translink#!/

General Definitions

Paired routes

We include routes that are paired due to their service design. These routes operate together and data on both routes is needed to understand the ridership and performance trends.

For example, routes 5 and 6 are reported together because they operate as a loop. When the 5 reaches Cambie and Dunsmuir it turns into the 6, then when the 6 reaches Davie and Denman it turns back into the 5. Performance on either side of the loop can impact performance on the other side.

C-routes

In 2018, we completed renaming the C-routes into three-digit numbered routes. This allows us more flexibility to put larger buses on community shuttle routes. See Appendix A for a list of former C-routes and their new names.

Key Characteristics

Metro Vancouver Sub-Region

Formerly called Sub-Region of Primary Service

Bus routes are allocated to one sub-region based on their geographic location (even though they may serve two or more). Metro Vancouver is divided into seven sub-regions:

- Burnaby/New Westminster
- Maple Ridge/Pitt Meadows
- Northeast Sector (Tri-Cities/Anmore/Belcarra)
- North Shore (North Vancouvers/West Vancouver/Lions Bay/Bowen)
- Southeast (North Delta/Surrey/Langleys/ White Rock)
- Southwest (Richmond/South Delta/ Tsawwassen First Nation)
- Vancouver/UBC

We also use these sub-regions in our Area Transport Planning process to recognize regional differences and align local plans with transit planning. Dividing Metro Vancouver into sub-regions allows for enhanced local involvement in transit planning addressing land use, transit supply, and supporting infrastructure within local contexts.

Population/Employment Stop Buffer

Formerly called Population/Employment (400m or 800m buffer)

Population and employment within walking distance are a key contributor to transit ridership. This indicator shows the number of people who live or work within 400 metres of a bus stop (i.e. approx. 5-minute walk) or 800 metres from a station, exchange, or SeaBus terminal (i.e. approx. 10-minute walk).

The indicator uses Census data by MapInfo and is adjusted for census undercounts.

We updated this methodology in 2018 to improve accuracy from line buffers. Stop and station buffers do not double count population or employment in areas where buffers overlap.

Main Vehicle Type

Formerly called Predominant Vehicle Type

The vehicle type is the bus used most for the given route. Some routes use more than one vehicle type. For example, some use a smaller bus on weekends.

Bus vehicle types and average capacities (sitting and standing spaces for people on board) are classified as follows:

Vehicle Type	Seated Capacity	Total Capacity
Standard Bus (40'/12m)	36	50
Articulated Bus (60'/18m)	48	75
Standard Trolley (40'/12m)	31	47
Articulated Trolley (60'/18m)	47	70
Highway Coach	47	50
Mini-Bus/ Community Shuttle	20	24
SeaBus	385	385

Buses can exceed the total capacity (considered overcrowded), but SeaBus cannot as it must comply with Transport Canada regulations.

Average Route Length (km)

Formerly called Average One-Way Trip Length (km)

The average route length is the average one-way trip distance in kilometres for each route, including all route patterns. As an average, this figure may not reflect the most dominant or longest trip pattern. For example, the 9 runs between Boundary Loop and UBC Exchange, but many trips only go from Commercial-Broadway Station to Alma Loop. The average route length will be shorter than the longest trip from Boundary Loop to UBC.

Historical Service Changes

Notes on changes to the service implemented in the last five years. These changes may have an affect on KPIs reported for the route, so they should be considered when interpreting trends at the route-level.

Service Type

Service levels are classified by the category for each bus route based on its purpose, frequency, and hours of operation. TransLink's 2018 Transit Service Guidelines (TSGs) provide a range of transit service types in seven categories:

Service Type	Characteristics
Rapid	10 minutes or better frequency throughout the day, every day; evening service provided; predominantly uses exclusive right-of-way like a bus-only lane
All Day Frequent	15 minutes or better frequency throughout the day, every day; evening service provided
Peak Frequent	15 minutes or better frequency in peak period and/or in peak direction; less frequent at other times
Standard	15 to 30 minutes frequency throughout the day, every day; evening service provided
Basic	30 to 60 minutes frequency on weekdays; may or may not operate throughout the entire day or 7 days per week
Peak Only – Limited	Service offered only in peak periods and only on weekdays; service frequency may vary
Special	Special services that perform unique purposes; covers NightBus, SeaBus, and West Coast Express

Bus Rankings

Each key performance indicator is ranked for all bus routes. A route with a rank of 1 had the best performance in the system, while a rank equal to the "Out of" column is the worst performance in the system. Ranking excludes SeaBus.

The "Out of" column refers to the total number of routes that had a value for this metric and were eligible for ranking.

If two routes tie for the same rank, then they will both acquire the same ranking for that indicator and no routes will acquire the next rank.

Ridership

Annual Boardings

Formerly called Annual Automated Passenger Count (APC) Boardings

Note bus uses APC data; SeaBus uses turnstile data

A boarding represents each time a customer enters a fare paid zone using Compass fare media or other proof of payment and uses the transit system. We use boardings (and journeys) to indicate ridership on our services.

Transfers are counted as additional boardings. If a customer transfers between two vehicles (including different modes) to reach a destination, then that customer would generate two boardings. The duration of the customers trip, including all boardings, is one journey.

The annual boardings indicator shows the total number of boardings for the year associated with the given route.

Average Daily Boardings (Day)

Formerly called Average Daily APC Boardings by Day Type

Note bus uses APC data; SeaBus uses turnstile data

The average number of passengers using a bus route or SeaBus for each day type, for the days the route operated. This is to account for routes that are only operated seasonally or are introduced mid-way through the year. The day types include weekday (Monday to Friday), Saturday, and Sunday/Holiday.

$$= \frac{Annual\ Boardings\ (by\ Day\ Type)}{\#\ of\ Days\ per\ Year\ that\ the\ Route\ Operated\ (by\ Day\ Type)}$$

Service

Annual Revenue Hours (ARH)

Revenue hours include running time (time on the route) and recovery time at the ends of the route (also referred to as layover), but do not include deadhead (time to and from the depot).

= Running Time + Recovery Time

Annual Service Hours (ASH)

The unit we use to measure the supply of bus service provided. One service hour is equal to one vehicle on the road for one hour. These values include running time (time on the route), recovery time at the ends of the route (also referred to as layover), and deadhead (time to and from the depot).

= Running Time + Recovery Time + Deadhead

We started reporting service hours in 2017.

Utilization

Average Boardings per Revenue Hour

The total service demand compared to the supply of transit service. This indicator measures the productivity of the service.

$$= Annual\ Boardings\ /\ Annual\ Revenue\ Hours$$

It accounts for total boardings and length of time a vehicle is in revenue-generating service; however, it does not consider the size of vehicle or operating cost of the vehicle type. There are different expectations for productivity depending on vehicle size. Boardings per revenue hour should be used in conjunction with other indicators to give a more holistic view of performance.

Average Peak Passenger Load

This indicator measures the average of the highest number of people on board each bus trip. It helps to determine how crowded the bus becomes over the duration of the trip.

This indicator is aggregated for all trips over the entire year. It is better understood using the "Performance by Day Type and Direction" table at the bottom of the bus route summary tool.

Peak Load Factor (PLF)

We use this indicator to measure crowding. It uses the average of the highest number of people on board each bus trip, divided by the capacity.

$$= \frac{Average\ Peak\ Passenger\ Load}{Vehicle\ Capacity}$$

This indicator is expressed as a percentage where 84% or more means the vehicle is **crowded** and 100% or more means the vehicle is **overcrowded**.

This indicator is aggregated for all trips over the entire year. It is better understood using the "Performance by Day Type and Direction" table at the bottom of the bus route summary tool.

Average Passenger Turnover (%)

The total number of boardings compared to the total vehicle capacity. This indicator measures if customers change over the length of the route.

$$= \frac{Avg.\ Boardings\ per\ Trip}{Avg.\ Vehicle\ Capacity}$$

weighted by the number of stops

For example, a route with a turnover exceeding 100% would have enough boardings to fill the vehicle capacity (per the Transit Service Guidelines) more than once. This indicates it is likely customers left the vehicle (alighted) and new customers boarded mid-trip, also known as turnover.

This metric is typically higher for longer services with a greater number of origin and destination stops, which have a greater opportunity to generate boardings.

Total Capacity Utilization (%)

Formerly called Average Capacity Utilization

This indicator measures the total number of passenger-kilometres (spaces used during the total distance traveled) compared to the total capacity-kilometres (spaces available during the total distance traveled). It demonstrates what percentage of the capacity delivered is used by customers over the length of the entire route.

$$= \frac{\sum_{k=1}^{\# \, trips} \sum_{n=1}^{\# \, stops \, (k)} Distance \, to \, next \, stop * Leave \, Load}{\sum_{k=1}^{\# \, trips} \sum_{n=1}^{\# \, stops \, (k)} Distance \, to \, next \, stop * Bus \, Capacity}$$

Total capacity utilization, unlike passenger turnover, measures how available spaces are filled over the length of the route. This metric is typically higher for long, limited-stop services where customers tend to ride from end-to-end, with little opportunity for intermediate boardings and alightings (turnover).

Vehicle spaces may only be fully used for a small portion of the route between major destinations. Therefore, the fullness over the entire trip is typically lower than at the busiest segment.

Due to a lack of Automated Vehicle Location (AVL) data, this indicator is only available starting in 2016.

Overcrowding & Reliability

Trips with Overcrowding (%) [Fall data]

This is a new indicator that measures the amount of bus trips (each one-way along the route) where the vehicle is overcrowded at any point during the trip. Overcrowding is when the bus fullness at any point along the trip is 100% or greater (per the Transit Service Guidelines).

$$= \frac{Trips \, where \, (PLF \geq 100\%)}{Total \, Trips}$$

This indicator does not reveal where along the trip overcrowding occurs; if a trip has overcrowding, then the entire trip is counted.

Annual Revenue Hours with Overcrowding (%)

This indicator measures the amount of service where the vehicle is over capacity on a time (revenue hour) basis. Overcrowding is when the bus fullness at any point along the trip is 100% or greater (per the Transit Service Guidelines).

$$= \frac{ARHs \, where \, (PLF \geq 100\%)}{Total \, ARHs}$$

This indicator does not reveal where along the trip overcrowding occurs; if a trip has overcrowding, then all the revenue hours associated with that trip are counted. Because trips with overcrowding usually have longer running times (due to increased passenger activity and traffic) than trips without overcrowding, this indicator will be higher than trips with overcrowding.

On-Time Departures (%)

Formerly called On-Time Performance

The amount of service that adheres to the schedule. It compares the number of on-time bus departures at bus stops to the total number of scheduled bus departures for the route. A bus is considered on-time if it departs a bus stop between one minute before and three minutes after the scheduled time (inclusive).

$$= \frac{On\text{-}Time\ Bus\ Departures}{Total\ Scheduled\ Bus\ Departures}$$

There are many factors that impact on-time departures such as traffic, construction, collisions, detours, volume of passengers, weather, etc. Routes are monitored in real-time using the Automatic Vehicle Location (AVL) systems.

Bus Bunching (%)

Bus bunching occurs when two or more transit vehicles arrive in the same location at the same time or close to one another. Buses are scheduled to be evenly spaced running along the same route but can bunch when the vehicle in front is delayed.

$$= \frac{Bus\ arrivals\ within\ 25\%\ of\ next\ scheduled\ arrival}{Total\ Bus\ Arrivals}$$

We define bus bunching as a bus arrival within 25 percent of the scheduled arrival of another bus. For example, a route with service every 12-minutes would be classified as "bunched" if two vehicles on the route arrive at a timing point within 3 minutes of one another.

The result is unreliable service and longer wait times than scheduled. Another result can be overcrowded vehicles followed closely by near-empty ones.

Average Speed (km/h)

Average speed is measured for all trips using the route distance and the trip time from the Automatic Vehicle Location systems.

$$= Trip\ Distance\ /\ Trip\ Time$$

Average speed is for all trips at all times of day and includes stop dwell time (time spent unloading and loading passengers). Actual vehicle speed will vary by the volume of passengers, time of day, and day of the week. It is also affected by roadway conditions, such as construction, collisions, detours, weather, etc.

Performance by Day Type

Some indicators presented on an annual basis above, are broken down by day type and time range. These include:

- Revenue Hours by Season
- Service Hours by Season
- Average Boardings per Revenue Hour
- Average Peak Passenger Load
- Average Peak Load Factor (%)

These indicators are filterable by season, using summer (Jun-Aug) data when weekend bus ridership is highest and fall (Sep-Dec) data when weekday bus ridership is highest.

In addition, the following two indicators (not presented on an annual basis above) are presented by day type and time range:

Time Ranges

The periods we use to look at service throughout the day. The time ranges are defined as:

- Early AM – 04:00-06:00
- AM Peak – 06:00-09:00
- Midday – 09:00-15:00
- PM Peak – 15:00-18:00
- Evening – 18:00-21:00
- Late Evening – 21:00-24:00
- Overnight – 24:00-4:00

Trips per Hour per direction

The average number of trips of a given bus route by day type, time, and direction. The average number of trips per hour does not consider hours with no scheduled services. For example, if a route does not run 1:00-5:00 a.m., but runs every 15 minutes 5:00-6:00 a.m., then the average trips per clock hour for the 4:00-6:00 time range would be four trips per hour.

Average Boardings per Trip

Related to the previous indicator, average boardings per trip describes the average number of passengers getting onto a typical bus trip of a given bus route by day type, time range, and direction.

SeaBus has an additional graph for:

Hourly Passenger Volume and Capacity by Day Type, Season, and Direction

This chart shows the average number of passengers who board within the hour compared to the total SeaBus capacity available for that hour. The graph can be filtered by day type, season, and direction. Averages are calculated at the clock hour for all scheduled sailings within that hour. SeaBus capacity is 385 passengers.

HandyDART

Key Characteristics

HandyDART is a custom transit shared ride service for people with disabilities who are unable to use the conventional system without assistance.

HandyDART is a demand-based service, rather than a fixed route service like the conventional system. Because of this, the objective is to ensure we are meeting the demand from customers, rather than increasing overall boardings.

Note: HandyDART data uses *trips* instead of *boardings.* Hover over the (i) for definitions.

Customers with permanent disabilities can also apply for a HandyCard that gives them access to HandyDART alternatives including:
- TaxiSaver coupons; and
- Concession fares on conventional services with an optional attendant travelling free of charge.

HandyDART service is delivered on several vehicle types. The following reflects the maximums for each vehicle but not necessarily what could be accommodated simultaneously.

Vehicle Type	Seated Capacity	Person in Wheelchair Capacity
HandyDART Vehicles		
Midi Bus	12 (max.)	5 (max.)
Micro Bus	6 (max.)	4 (max.)
Non-HandyDART Vehicles		
Accessible Taxi	3	1
Sedan Taxi	3	0

Average Trip Length (km)

The average one-way trip distance in kilometres for each trip. As an average, this figure may not reflect the most dominant or longest trip.

Average Trip Time (min)

The average one-way trip time in minutes for each HandyDART trip. As an average, this figure may not reflect the most dominant or longest trip.

Ridership

Annual Boardings

A boarding represents each time anyone enters a fare paid zone and uses the transit system.

TransLink's system-wide annual boardings includes the total boardings by HandyDART customers, attendants, and companions.

Annual Trips

HandyDART is budgeted for and tracked using *trips* not *boardings.* A **trip** is counted when a HandyDART customer boards a vehicle (an attendant or companion boarding the vehicle does not count as a trip). A **boarding** is counted for the HandyDART customer and an additional boarding would be counted if they were accompanied by an attendant or companion.

HandyDART is tracked by trips because many customers require an attendant or choose to travel with a companion; however, the attendant or companion would not be traveling on HandyDART without the customer's trip. Since we're measuring the level of service we provide to registered HandyDART customers, we consider trips a better metric of how service is provided.

Annual trips includes the total number of trips delivered on both HandyDART vehicles and taxis.

Average Daily Trips (Day)

The average number of times any customer uses the transit service for each day type. The day types include weekday (Monday to Friday), Saturday, and Sunday/Holiday.

$$= \frac{Annual\ Trips\ (by\ Day\ Type)}{\#\ of\ Days\ per\ Year\ (by\ Day\ Type)}$$

Service

Budgeted Trips

The annual number of funded HandyDART trips. Because HandyDART is a demand-based service, not all budgeted trips are necessarily delivered.

Note that the 10-Year Vision service expansion is for budgeted trips available on HandyDART vehicles.

Utilization

Trip Denials (%)

The percentage of the total number of HandyDART trips requested that are not accommodated.

Denials occur because requests for trips cannot be accommodated in the schedule when they are received close to the desired travel day, for peak travel times with high demand for service, or for long trips that are difficult to serve.

Trip Refusals (%)

The percentage of the total number of HandyDART trip requests that are refused.

Trip refusals occur when a requested trip time is unavailable and an alternative time is offered up to an hour before or after the requested time. If the proposed trip is not agreeable to the customer, the trip is considered refused.

Overcrowding & Reliability

Customer Satisfaction (%)

The rating customers give to HandyDART services on TransLink's annual HandyDART Customer Service Performance survey. Customers select their satisfaction with the service delivered on the scale of 1 to 10.

On-Time Performance (%)

HandyDART trips are scheduled with a 30-minute pick-up window. This means that the customer can be picked up within 15 minutes on either side of the scheduled trip time. On-Time performance is the percentage of trips where the customer is picked up within the 30-minute window.

Data Sources

Bus, SeaBus, and HandyDART data for this TSPR was collected from the following data sources:

Bus APC and AVL Data

Most data was collected from the Automated Passenger Counting (APC) and Automatic Vehicle Location (AVL) systems. APC technology is used on buses (~33% of the existing fleet).

Why not Compass Data for bus?

Both the APC and Compass datasets are incomplete. Bus APC data is a sample on the route level and Compass does not require bus tap-offs. We continue to use APC data on the bus route level because it also includes alightings (exits/tap-offs). In the future, we will switch to a new database that considers both data sources.

SeaBus Turnstile Data

Passenger count data was collected from passenger turnstiles at both SeaBus terminals. Data was collected for every SeaBus sailing, encompassing the complete calendar year (January 1 to December 31) for each year included in this report.

Why not Compass Data for SeaBus?

SeaBus turnstile data is nearly 100% complete, since customers must pass through the turnstiles to board and alight the vessel. Some customers with strollers, wheelchairs, etc. are permitted to enter and exit through the doors by staff at Waterfront.

On the other hand, Compass taps at Waterfront are mixed with Expo Line and West Coast Express data. This makes it difficult to isolate SeaBus customers only. Some SeaBus customers may also make a round trip without exiting and re-entering the faregates between trips, but they are required to pass through the turnstiles a second time.

HandyDART Trip Data

HandyDART trip data was collected through scheduling software. This included trips, boardings, denials and on-time performance, among other things.

Customer satisfaction was determined through TransLink's annual HandyDART Customer Service Performance survey.

The annual operating budget and total cost of the service was provided by CMBC finance.

Service Schedule Data

For determining revenue and service hours, service schedule data was used. This is generated from the program used to schedule buses.

Population/Employment Data

Population and employment numbers are estimated from the Canadian Census by MapInfo and are adjusted for census undercounts. All demographic data is rounded.

Transit Service Guidelines

TransLink's latest Transit Service Guidelines (TSGs) are used to guide some of the indicators in the TSPR, such as Service Type, Vehicle Type, and Revenue Hours with Overcrowding.

Limitations of the Analysis

This performance review does not consider external factors that may impact transit ridership including fare increases, fuel prices, economic conditions, and others.

Appendix A: C-Route renumbering

Original Number	New Number
C1	131
C2	132
C3	103
C4	105
C5	148
C6	146
C7	147
C8	103
C9	109
C10	280
C11	281
C12	262
C15	215
C18	68, 70
C19	42
C20	68, 70
C21	23
C23	23
C24	180
C25	181
C26	179, 182
C27	183
C28	184, 185, 186
C29	187
C30	189
C36	170
C37	171, 172
C38	173, 174
C40	175
C41	719, 722
C43	743
C44	744

Original Number	New Number
C45	745, 746
C46	745, 746
C47	733, 741
C48	748
C49	749
C50	360
C51	361
C52	362
C53	363
C60	560, 561
C61	560, 561
C62	562
C63	563
C64	564
C70	370
C71	371
C73	373
C75	322
C76	310
C84	614
C86	616
C87	617
C88	618
C89	619
C92	412
C93	413
C94	414
C96	416
C98	418