

## APPENDIX D

# TRANSIT SERVICE ANALYSIS

The first part of this document provides an analysis of transit operations for the four corridors, including ridership, on-board load, stop spacing, frequency and span, and transit performance. The second part focuses on transit speed and reliability. It provides details on where and when delay is greatest, and provides an analysis of reliability and run time, including comparisons to auto travel times, analysis of headway consistency and dwell time.



PierceTransit  
***Stream***

**Route Alternative Evaluation**

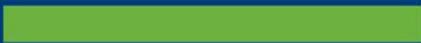
DRAFT v1

November 2021

*The Stream System Expansion Study (SSES) will evaluate four candidate BRT corridors and identify the best candidate for Stream BRT service.*

*This memo analyzes current transit operations. This is a key input to help define how the corridors might fit into the Stream program.*

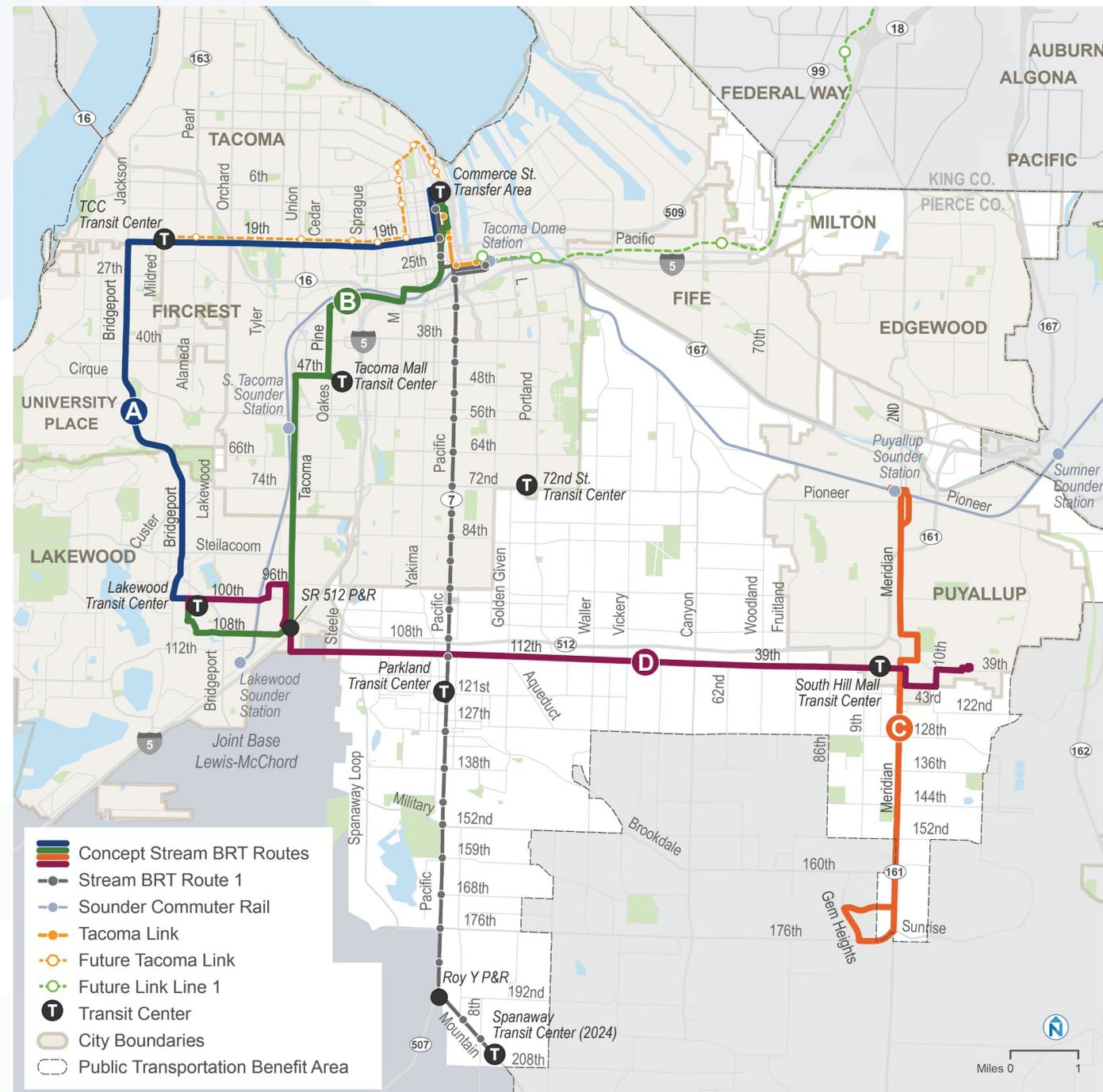
# Overview



- 1 [Ridership](#)
- 2 [On-Board Load](#)
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- 5 [Transit Performance](#)
- 6 [Key Takeaways](#)

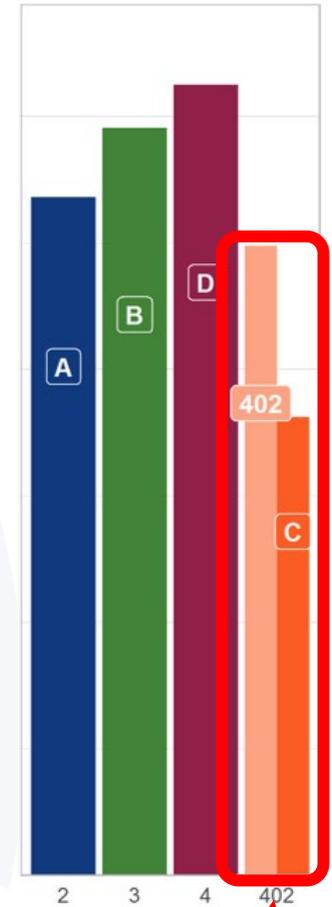
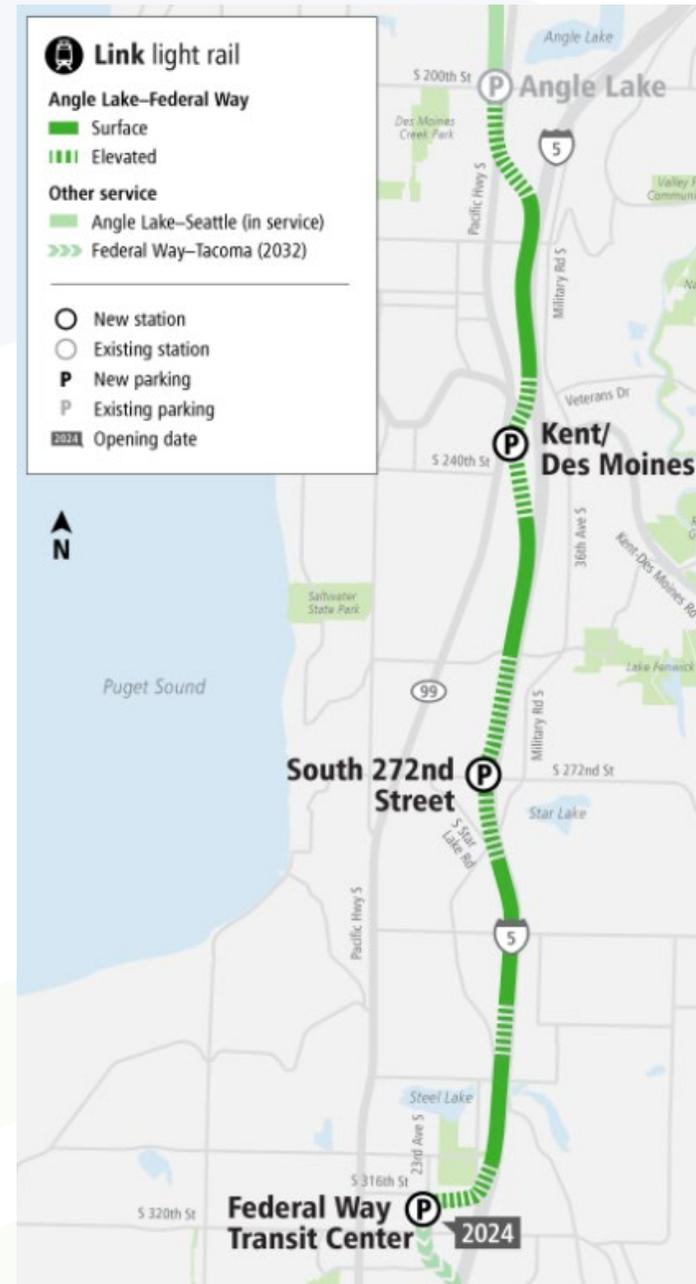
# SSES CORRIDORS

- 4 candidate BRT corridors generally match existing routes.
- Corridor A = Route 2.
- Corridor B = Route 3.
- Corridor C = Portion of Route 402.
- Corridor D = Route 4.



## A Note on Corridor C:

- Corridor C includes a portion of today's Route 402.
- Corridor C's northern terminus would be Puyallup Station.
- Sound Transit will extend LINK service to Federal Way – this could provide a new market for travel on Route 402.
- To be inclusive, this document shows both Corridor C and Route 402 analysis.



*Analysis by corridor includes a callout for both Corridor C and Route 402, similar to this example.*

# Ridership

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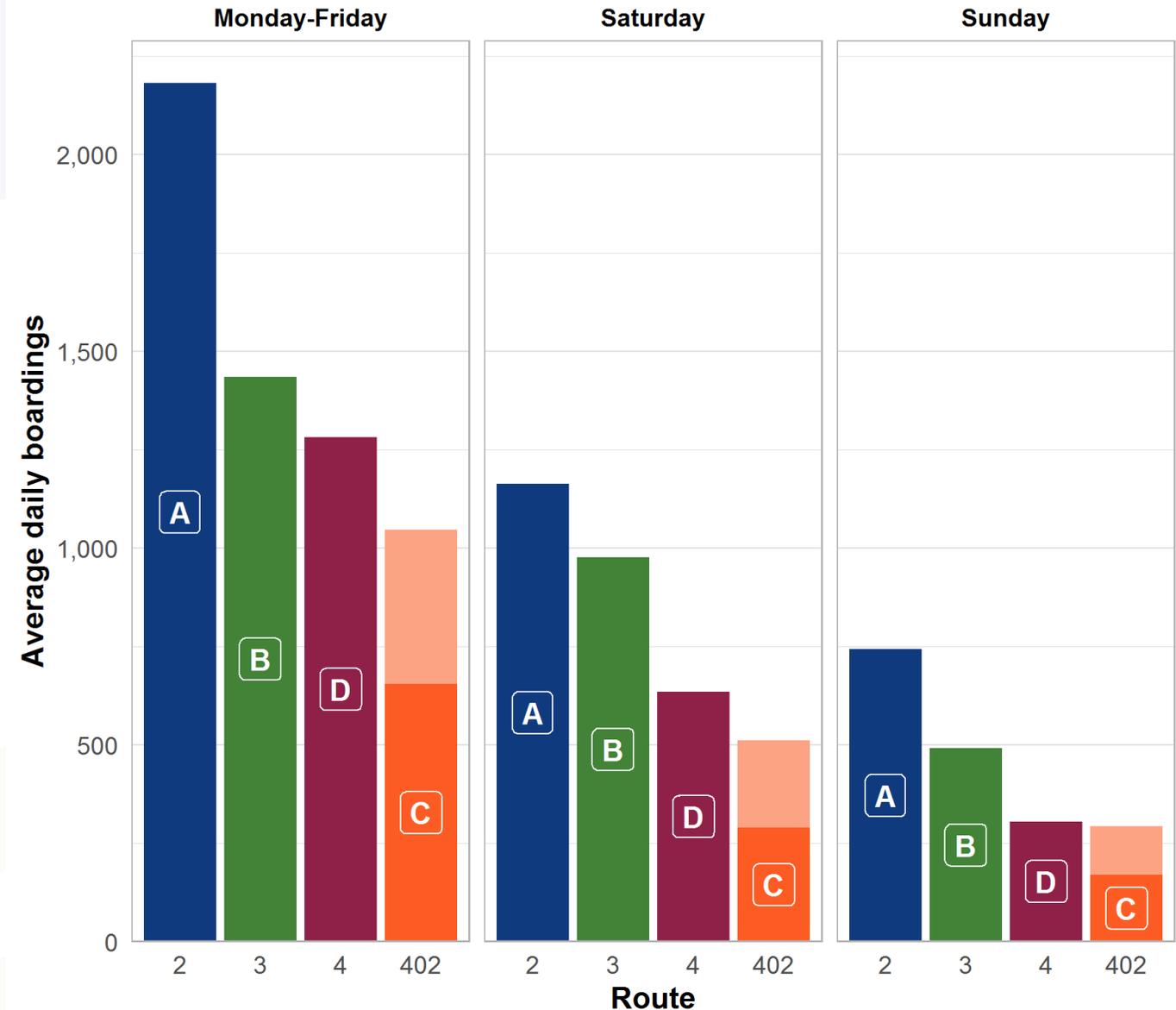
This section summarizes ridership by route and stop using 2019 data (pre-pandemic)

*Ridership is a common metric used to evaluate high-capacity transit services like Stream.*

*Ridership by stop indicates where future Stream BRT stations can reach the most people.*

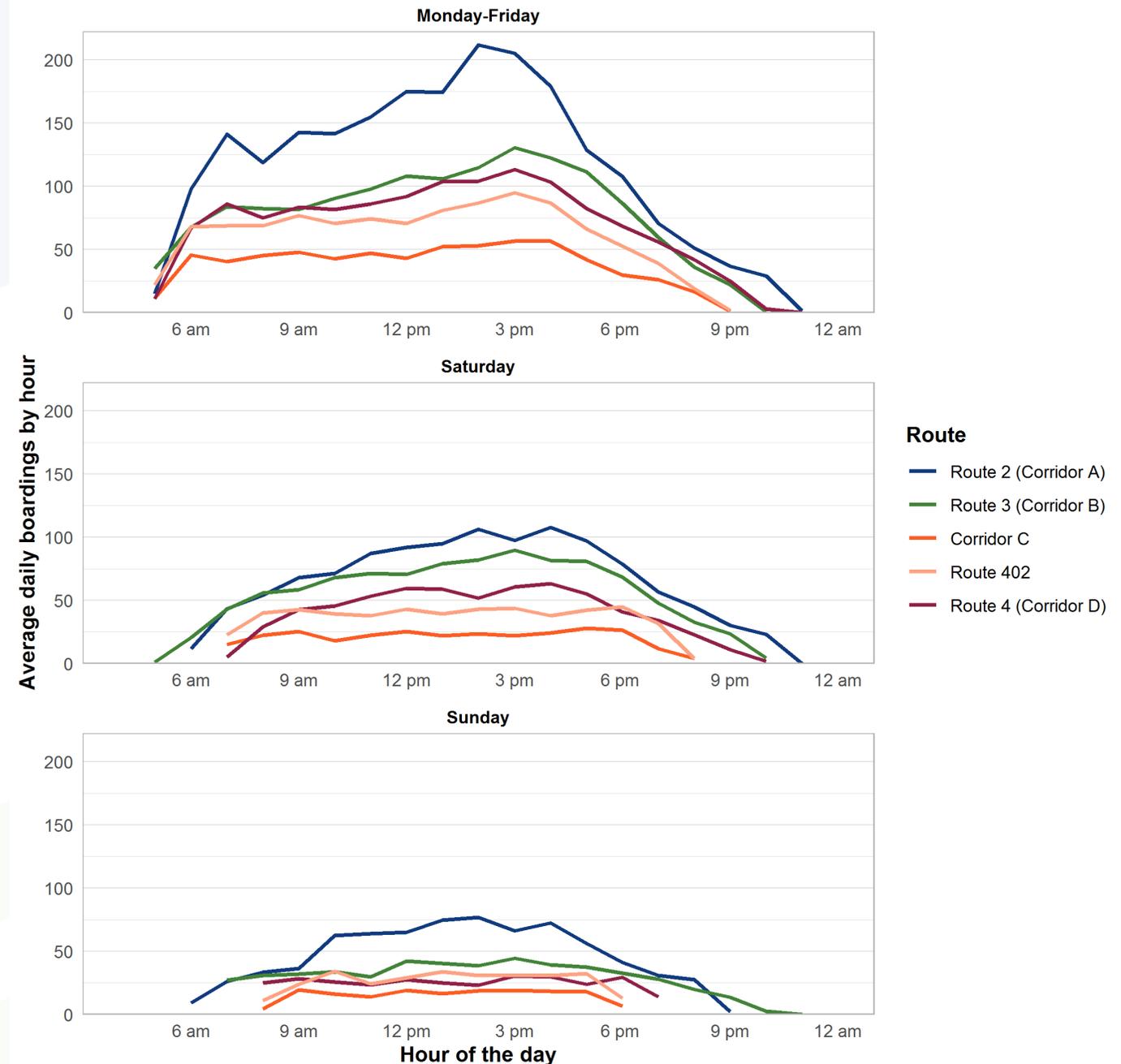
# Ridership by Route

- Route 2 has the highest daily ridership, with approximately **2,200** daily passengers on weekdays, **1,200** on Saturdays, and **750** on Sundays.
- Route 3 has the second highest ridership.
- Routes 4 and 402 have lower ridership.



# Ridership by Route by Time of Day

- Ridership patterns on candidate corridors differ from the traditional commute pattern where ridership peaks in the morning and afternoon.
- On all four corridors, ridership increases gradually throughout the day and peaks in the afternoon. This is especially true for Corridor A.
- High school students form a relatively large share of ridership in the afternoons on Route 2, causing a more dominant mid-afternoon peak.







## Ridership by Stop

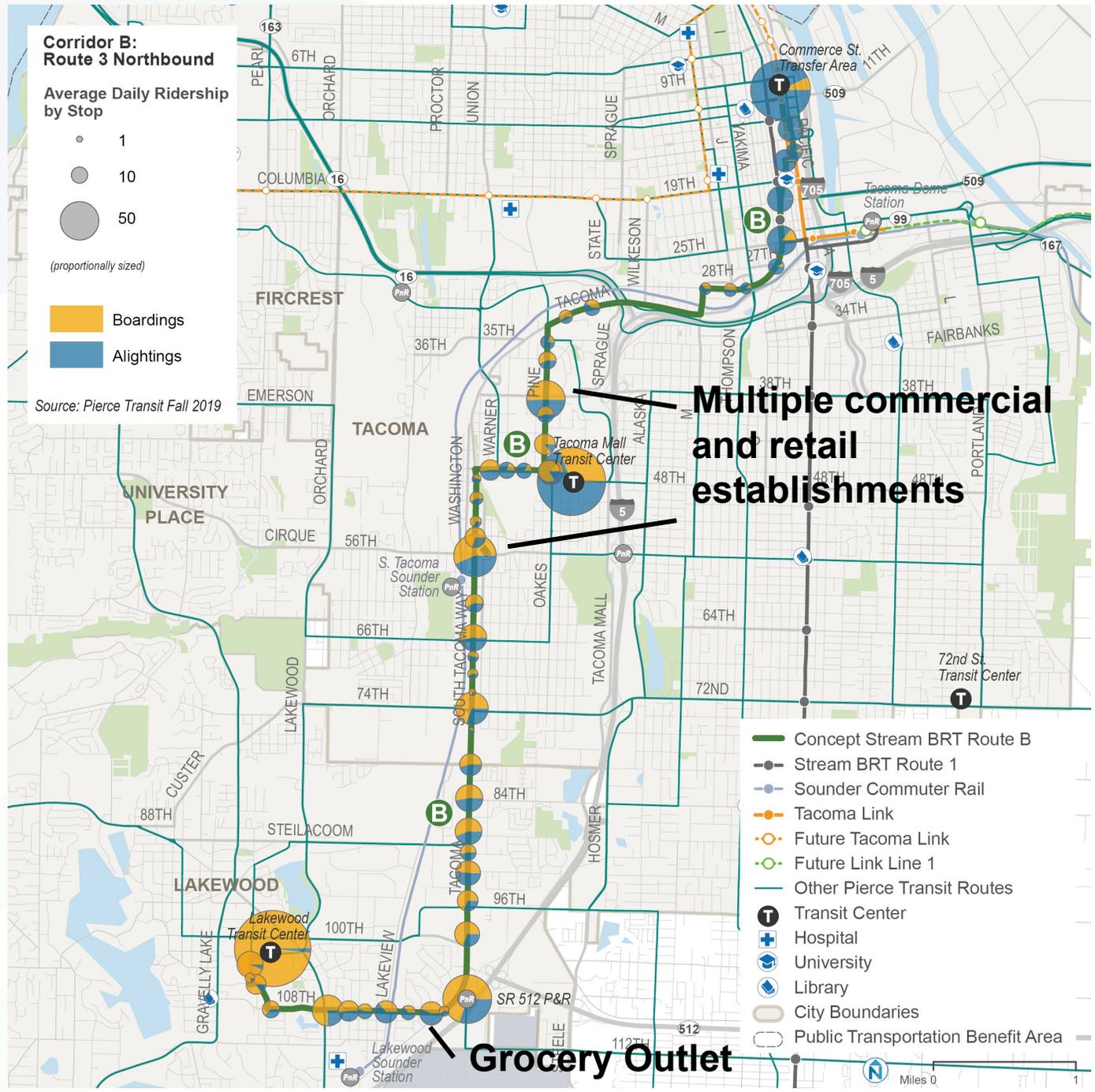
(Route 2 Southbound – Corridor A)

- Southbound travel patterns mirror northbound patterns.



# Ridership by Stop (Route 3 Northbound – Corridor B)

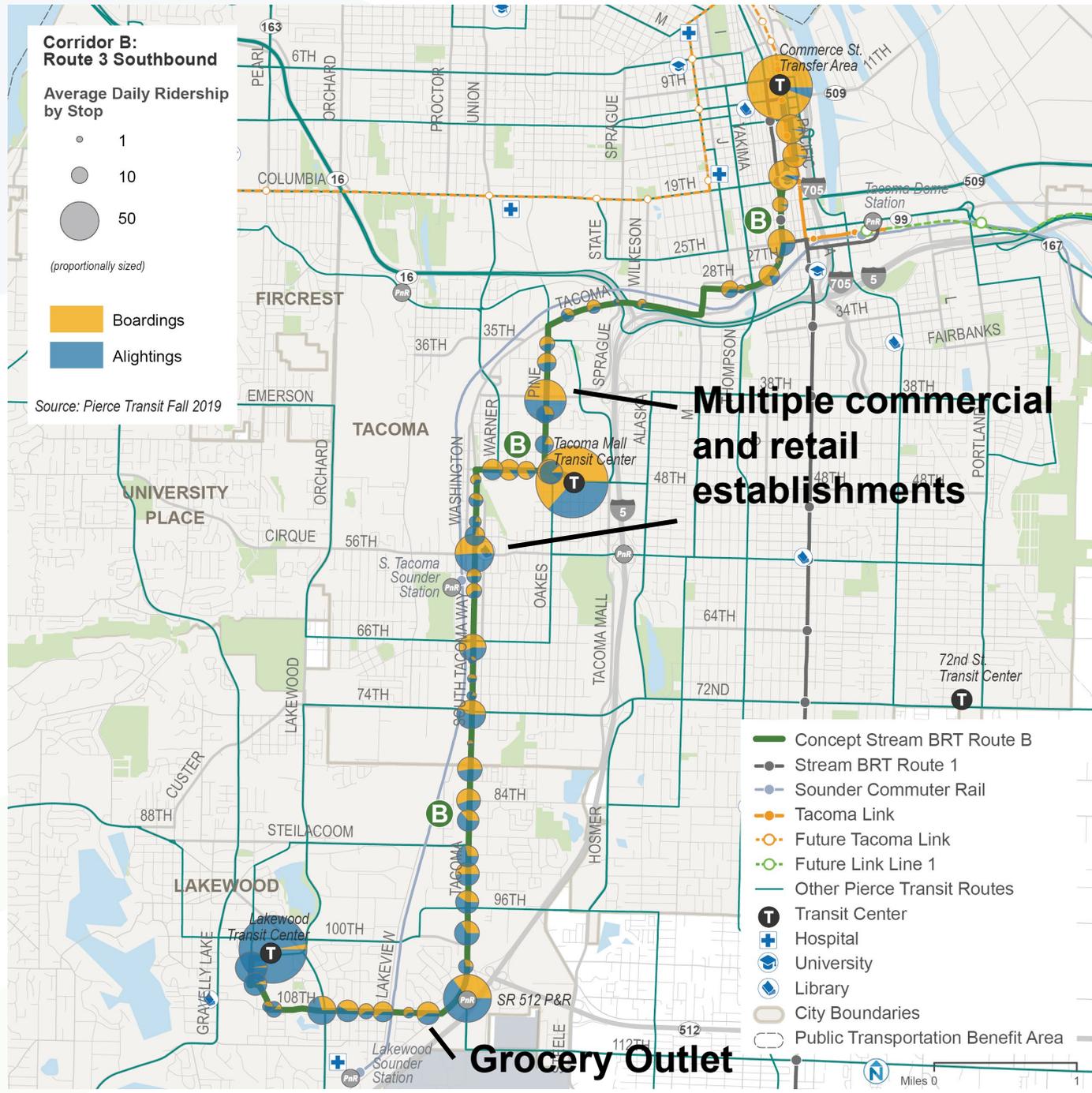
- The highest ridership stops are Lakewood Transit Center, Tacoma Mall Transit Center, and Downtown Tacoma.
- Every stop on South Tacoma Way from 48th to 108th Streets has moderate activity – this is a retail corridor with nearby higher density housing.
- Pine and 38th is also a dense retail location.
- Boardings are low on South Tacoma Way from Pine to Jefferson Avenue— this is an industrial area.



# Ridership by Stop

(Route 3 Southbound – Corridor B)

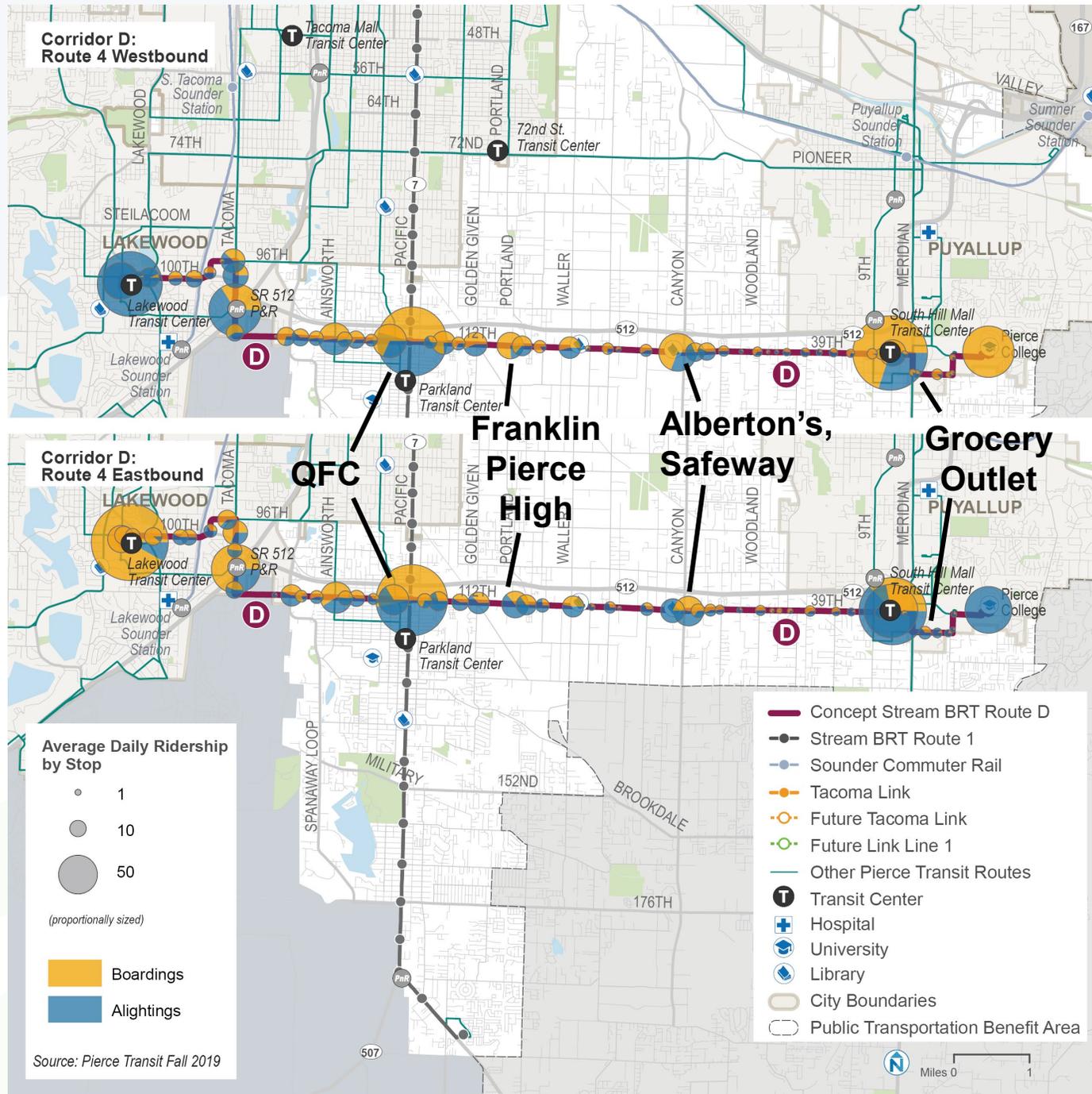
- Southbound patterns generally mirror northbound patterns.
- A high percent of Tacoma Mall Transit Center activity is alightings northbound and boardings southbound. This indicates there is a travel pattern between the Mall and locations along Tacoma Way.





# Ridership by Stop (Route 4 – Corridor D)

- The western portion of the route (between Lakewood TC and Waller Road) has the highest concentration of ridership.
- High ridership at Pacific Avenue likely due to transfers to Route 1.
- 112<sup>th</sup> and Canyon is a retail hub
- Low ridership between Canyon and South Hill Mall Transit Center
- High ridership at Pierce College



# On-Board Load

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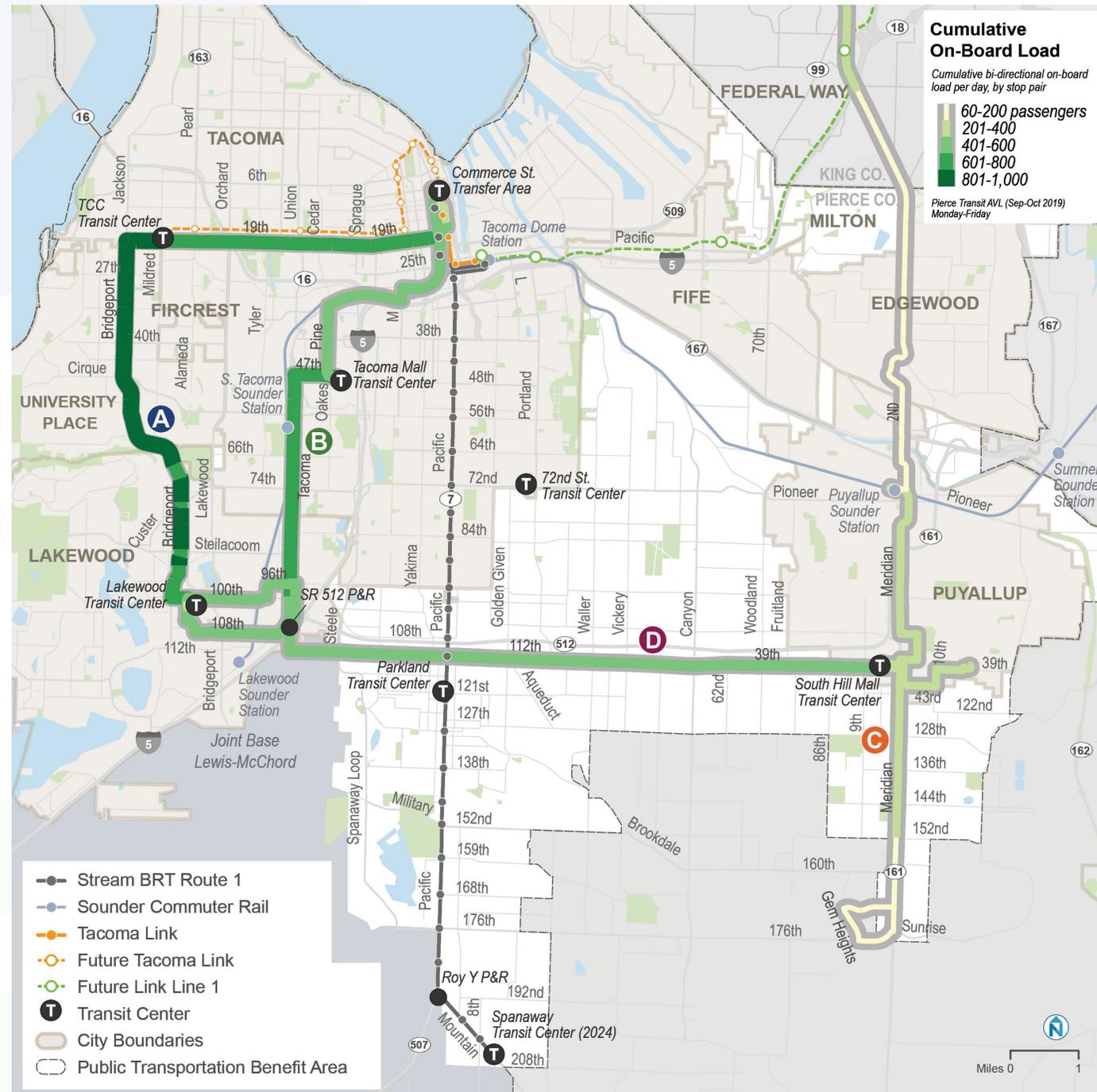
This section summarizes the on-board load along each corridor overall and by time of day, using 2019 data (pre-pandemic).

*On-board load is the number of passengers that are on board the bus at a particular location. Load can be expressed as a cumulative value, or as an average per trip.*

*Load can be used to identify where future Stream BRT corridors may carry the most people.*

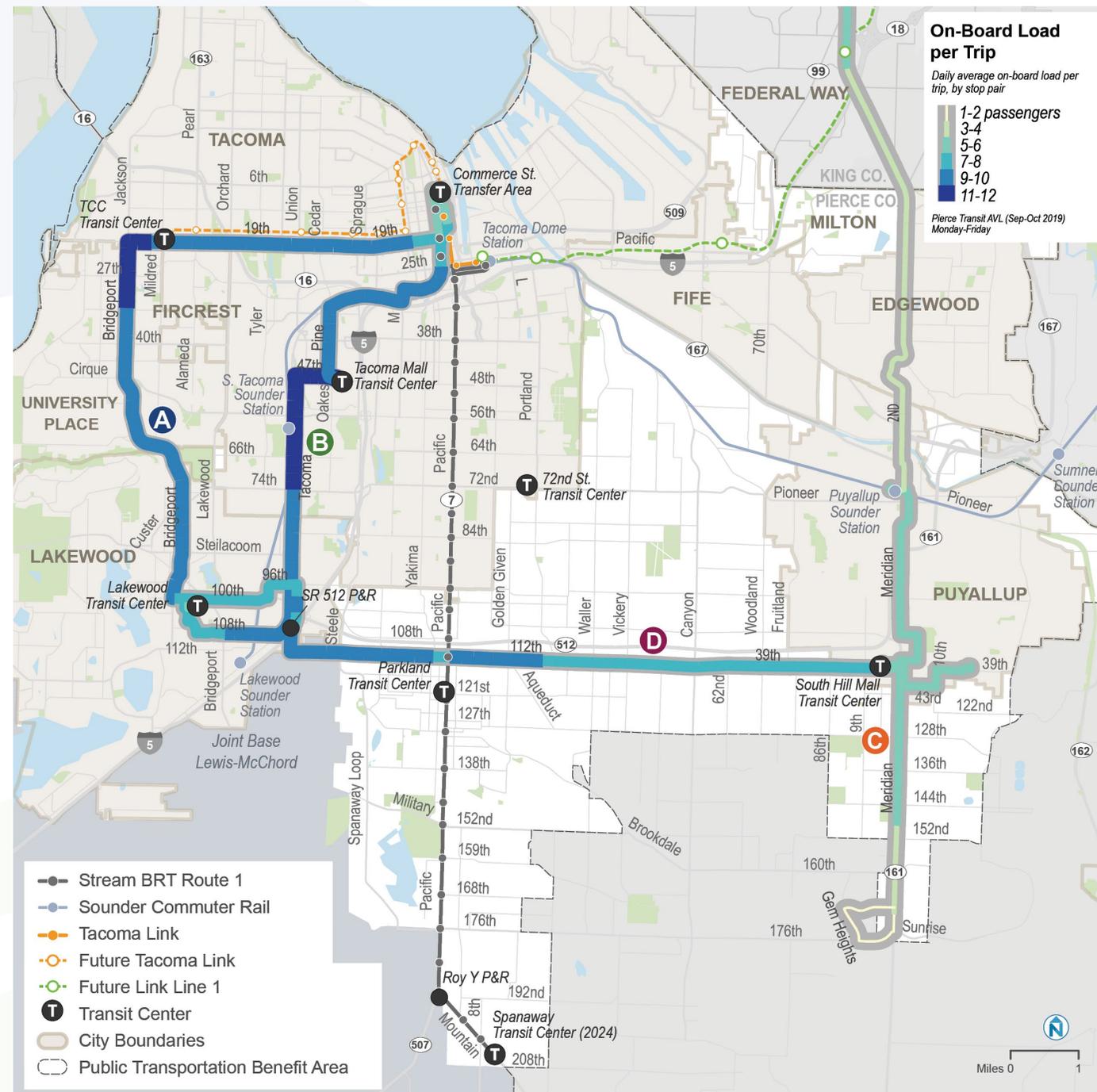
# On-Board Load (Daily Cumulative)

- Daily loads are highest along Corridor A (Bridgeport Way), between Tacoma Community College and Lakewood Transit Center.
- Corridor B's highest loads are south of Tacoma Mall.
- Corridor C's highest on-board load is between Puyallup Station and 152nd Street.
- Load on Corridor D is consistent throughout the route.



# On-Board Load (Average per Trip)

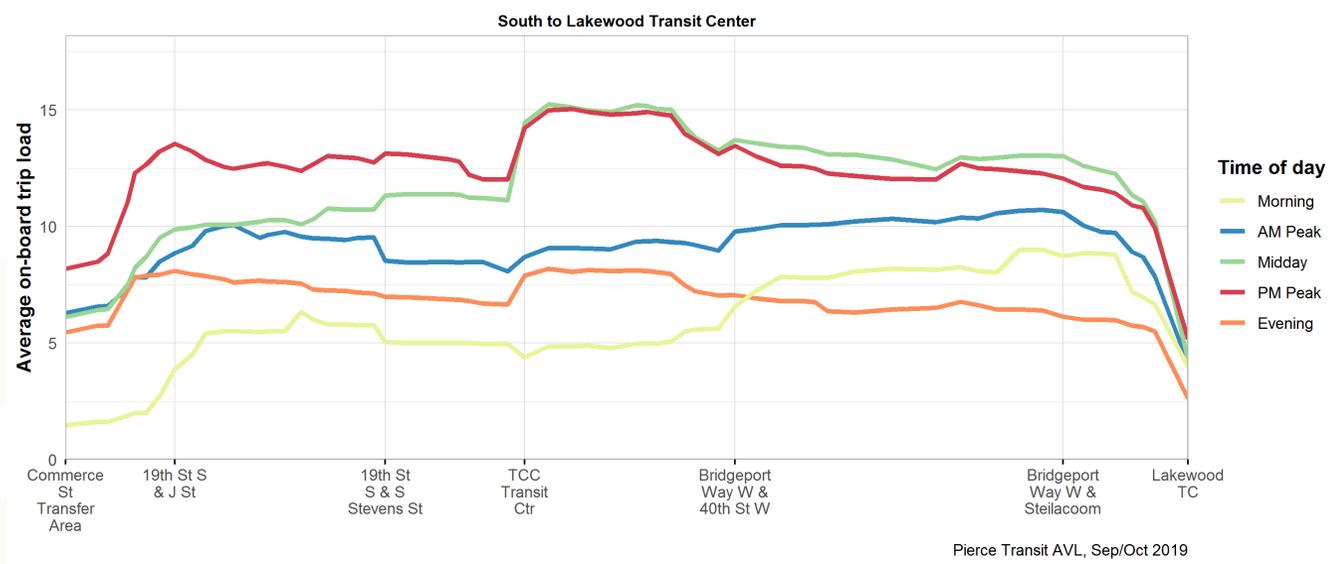
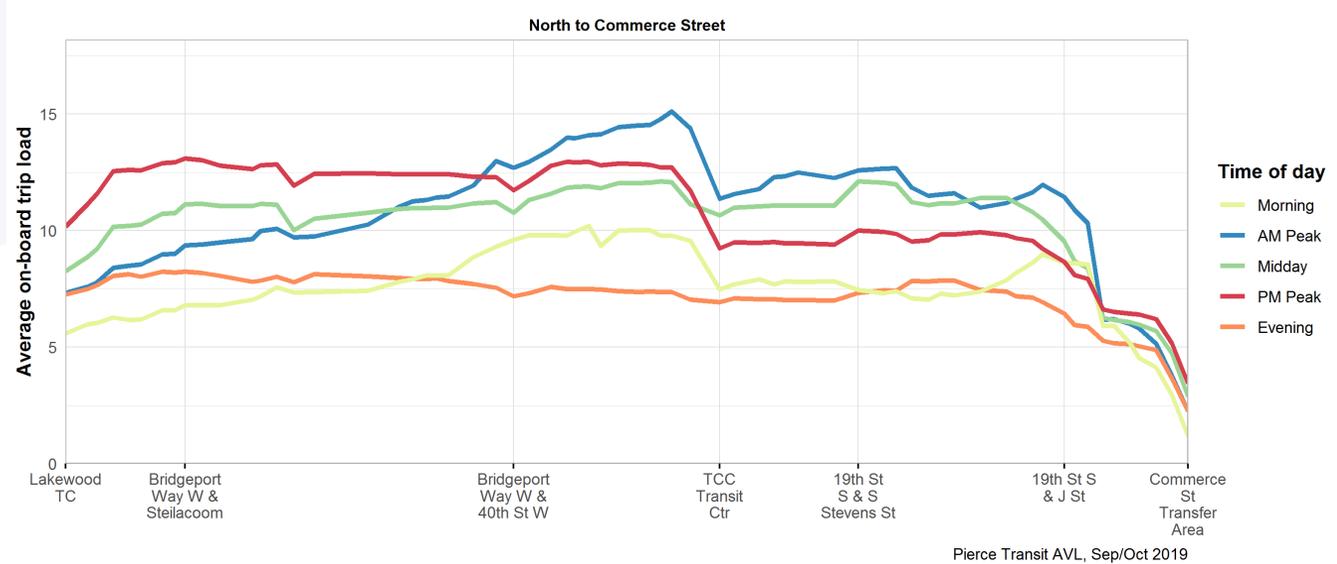
- Highest loads per trip occur between Tacoma Community College and 35th Street (Corridor A), and between Tacoma Mall and 74th Street (Corridor B).
- Other high load sections include the remaining sections of Corridor A (19th Street and Bridgeport Way) and Corridor B.
- The highest loads along Corridor D are west of Portland Avenue.



# On-Board Load by Time of Day

## (Route 2 – Corridor A)

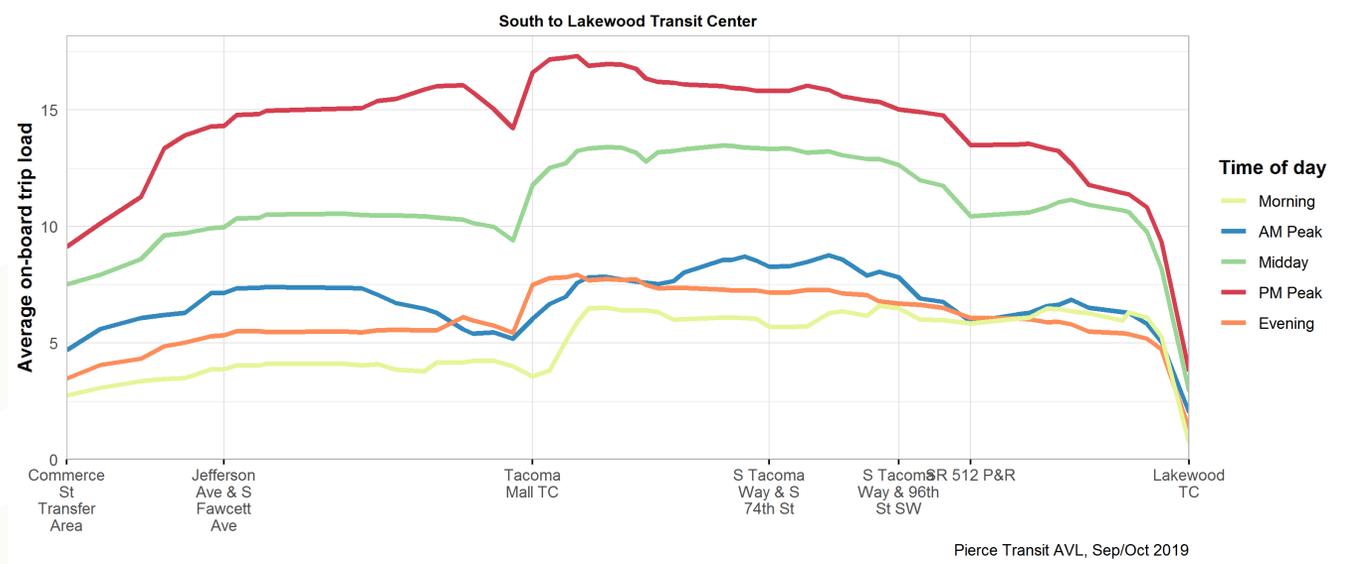
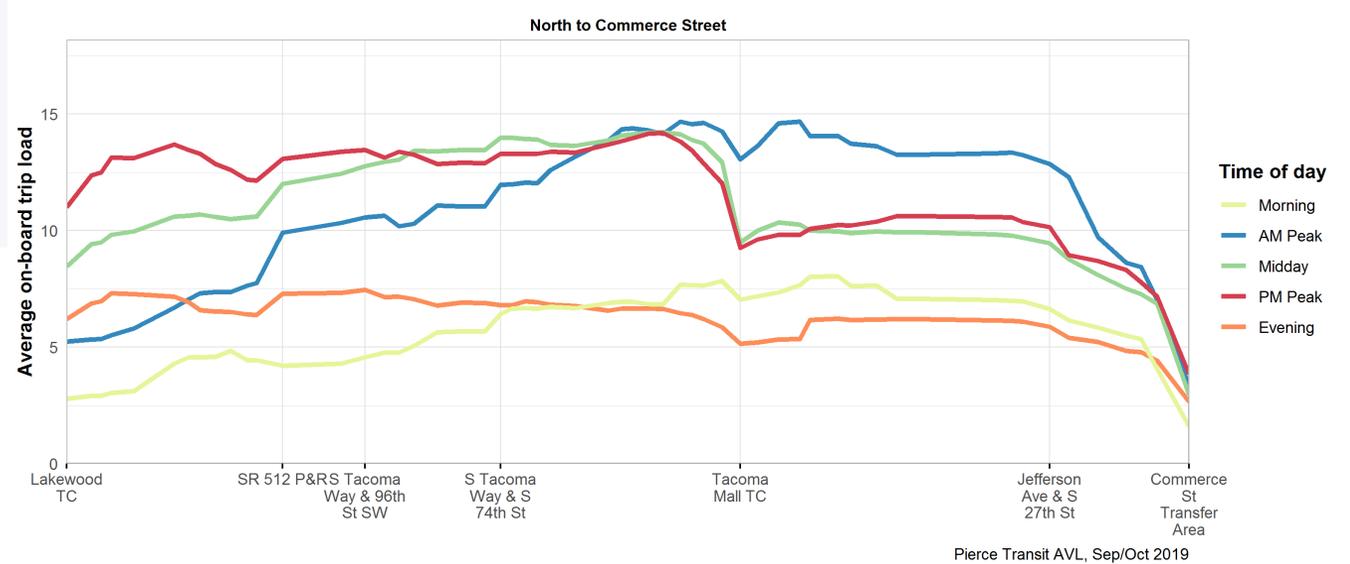
- In the **northbound** direction, loads reach their highest level in the AM peak between Bridgeport and 40<sup>th</sup> and Tacoma Community College.
- In the **southbound** direction, loads are highest during the midday and PM peak.
- The highest loads are typically between Tacoma Community College and 40th St.
- The average number of passengers on board does not exceed 15 at any point in the day.



# On-Board Load by Time of Day

## (Route 3 – Corridor B)

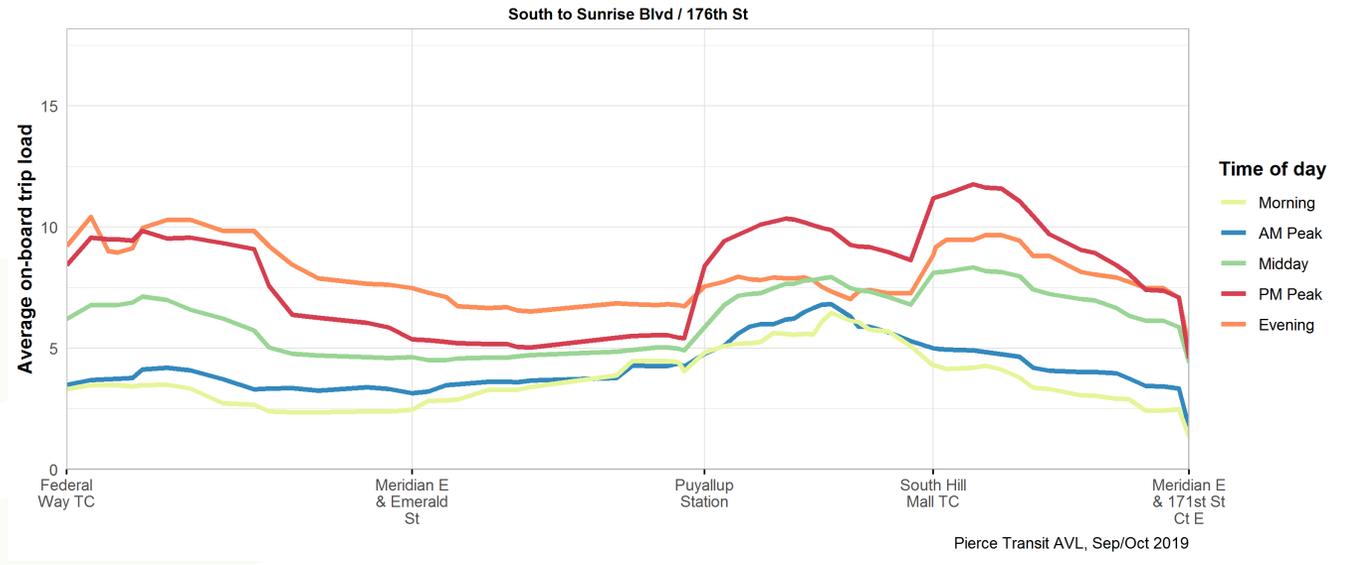
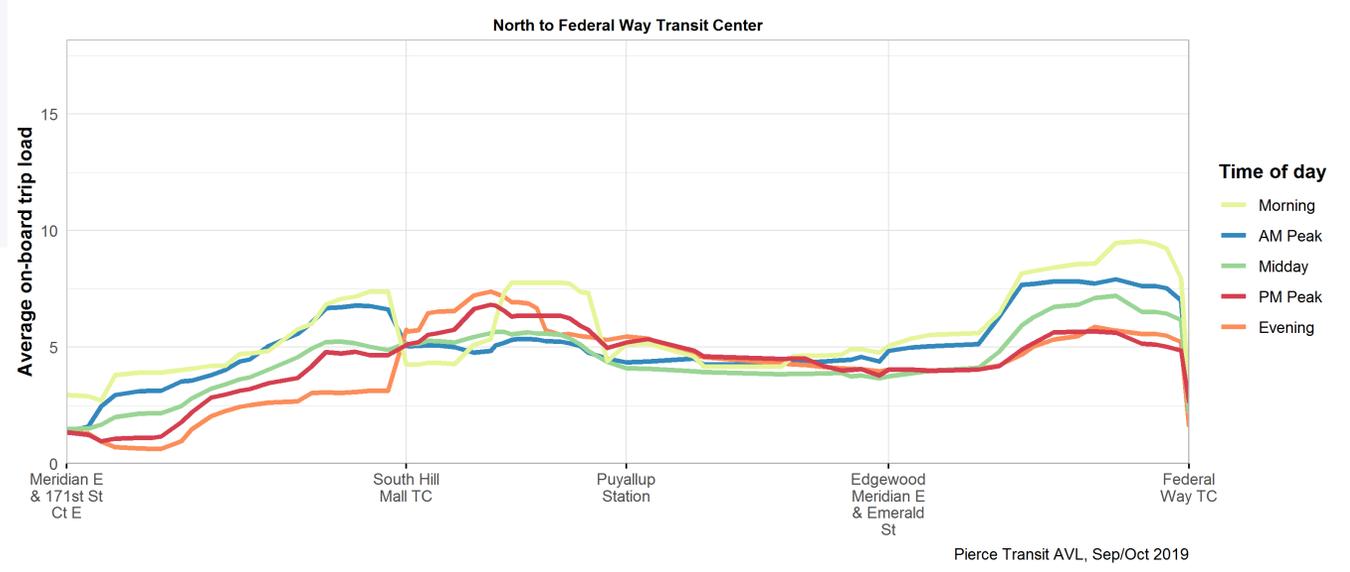
- In the **northbound** direction, loads are highest in the southern portion of the corridor during the midday and PM peak. In the northern part of the corridor, the AM peak is usually the busiest, with lower loads at other times of day.
- In the **southbound** direction, loads are highest during the PM peak.
- The average number of passengers on board peaks at 17 southbound in the PM peak.



# On-Board Load by Time of Day

## (Route 402 – Corridor C)

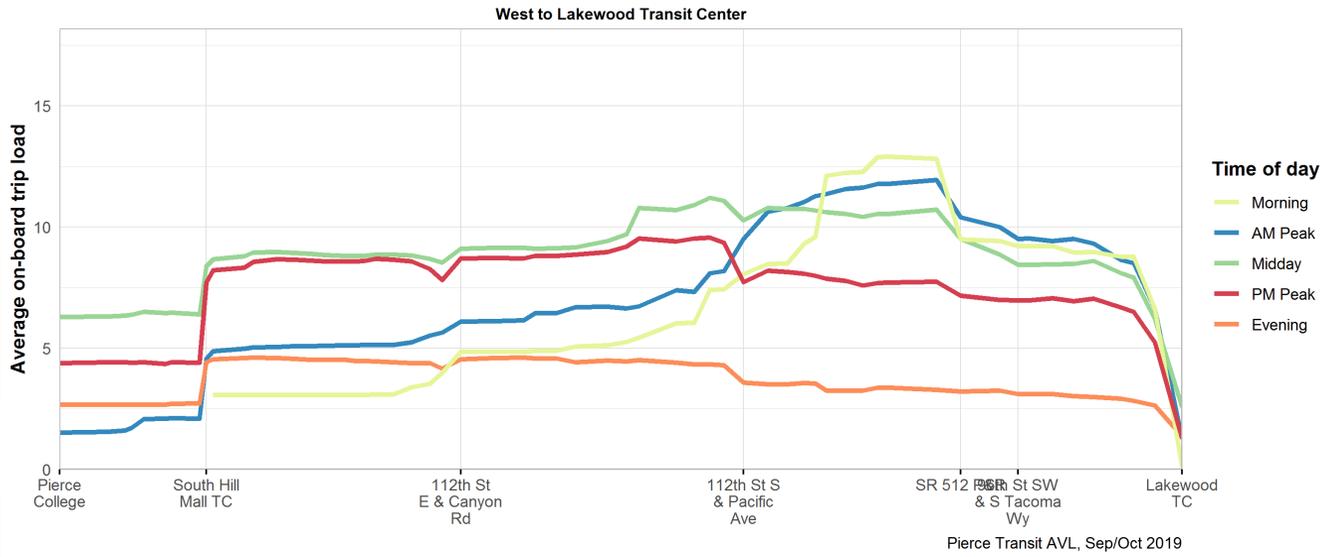
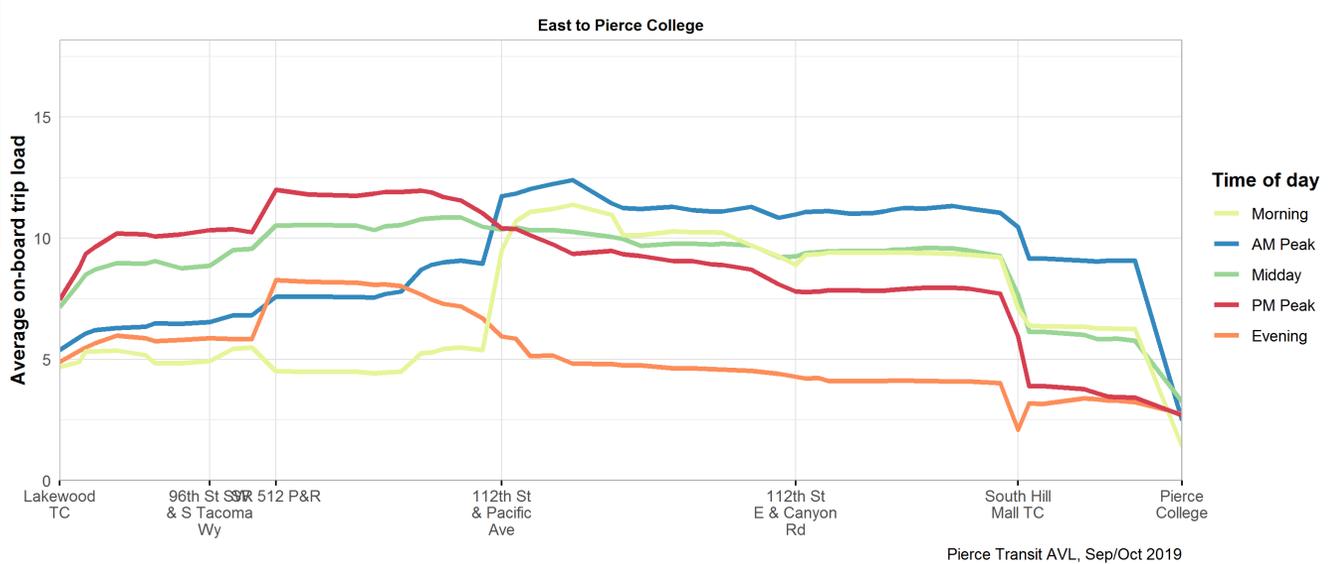
- There is little variation in on-board load by time of day, indicating consistent ridership with little to no peaking.
- Load tends to be highest near Federal Way and between Puyallup and the airport.
- Lower on-board loads north of Puyallup and through Edgewood suggest a limited market for transit service between Pierce County and Federal Way.
- The average number of passengers on board does not exceed 12 at any point in the day.



# On-Board Load by Time of Day

## (Route 4 – Corridor D)

- In the **eastbound** direction, the portion of the route west of Pacific Avenue is busiest in the PM peak, whereas the eastern portion of the route is busiest in the AM peak.
- In the **westbound** direction, the pattern is the opposite.
- In both directions, the highest loads generally occur between SR 512 P&R and Canyon Road.
- The average number of passengers on board does not exceed 13 at any point in the day.



# Stop Spacing

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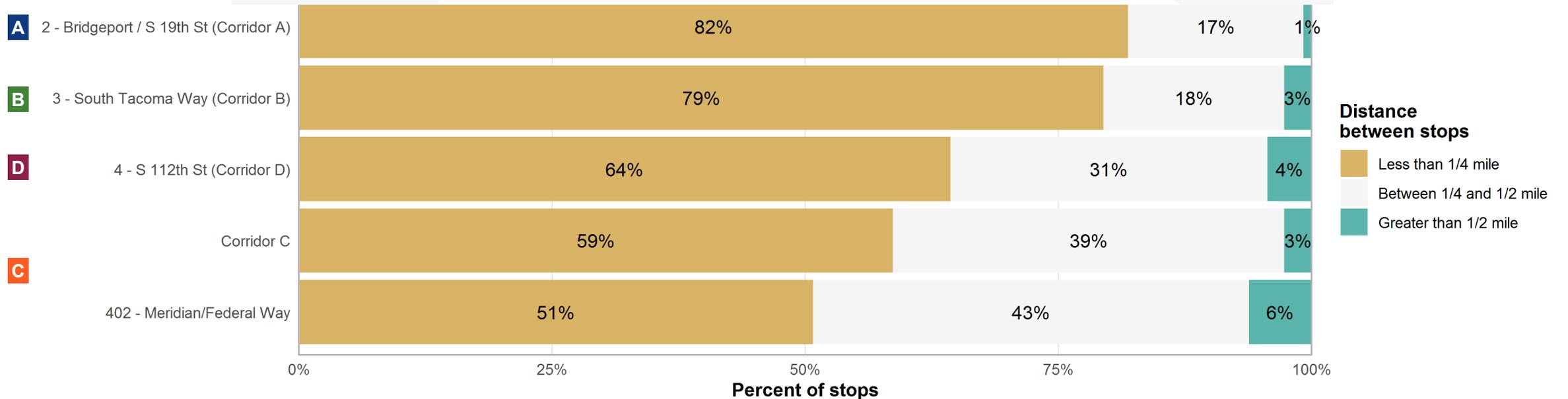
This section summarizes the stop spacing for each route overall, and the individual distances between stops on all four corridors.

*Stop spacing is the distance between consecutive stops in the same direction of a route. Stop spacing is a common metric to evaluate access and is a factor influencing bus speed along transit corridors.*

*Stop spacing can be used to identify where stop consolidation may be needed for future Stream corridors.*

# Stop Spacing (by route)

- More than half of stops along all routes are spaced less than 1/4 mile apart. Spacing on Routes 2 and 3 are the shortest, with more than three-quarters of stops less than 1/4 mile.
- Stream 1 station spacing is every 1/2 mile. All corridors would need to close approximately half their stops to be aligned with the Stream standard.
- Average spacing per route:
  - Route 2 (Corridor A): 988 feet
  - Route 3 (Corridor B): 1,067 feet
  - Route 4 (Corridor D): 1,285 feet
  - Route 402: 1,515 feet
  - Corridor C: 1,249 feet.



# Stop Spacing (by stop pair)

- The map shows the distances between each stop pair along the four corridors.
- There are many stop pairs that are less than 1/8 mile, particularly along 19th Street, Bridgeport, and Tacoma Way.
- Stop spacing of 1/8-1/3 mile (light brown and grey) is common.
- There are few locations with stop spacing greater than 1/3 mile. Only 11 stop pairs are spaced farther than 1/2 mile.



# Frequency and Span

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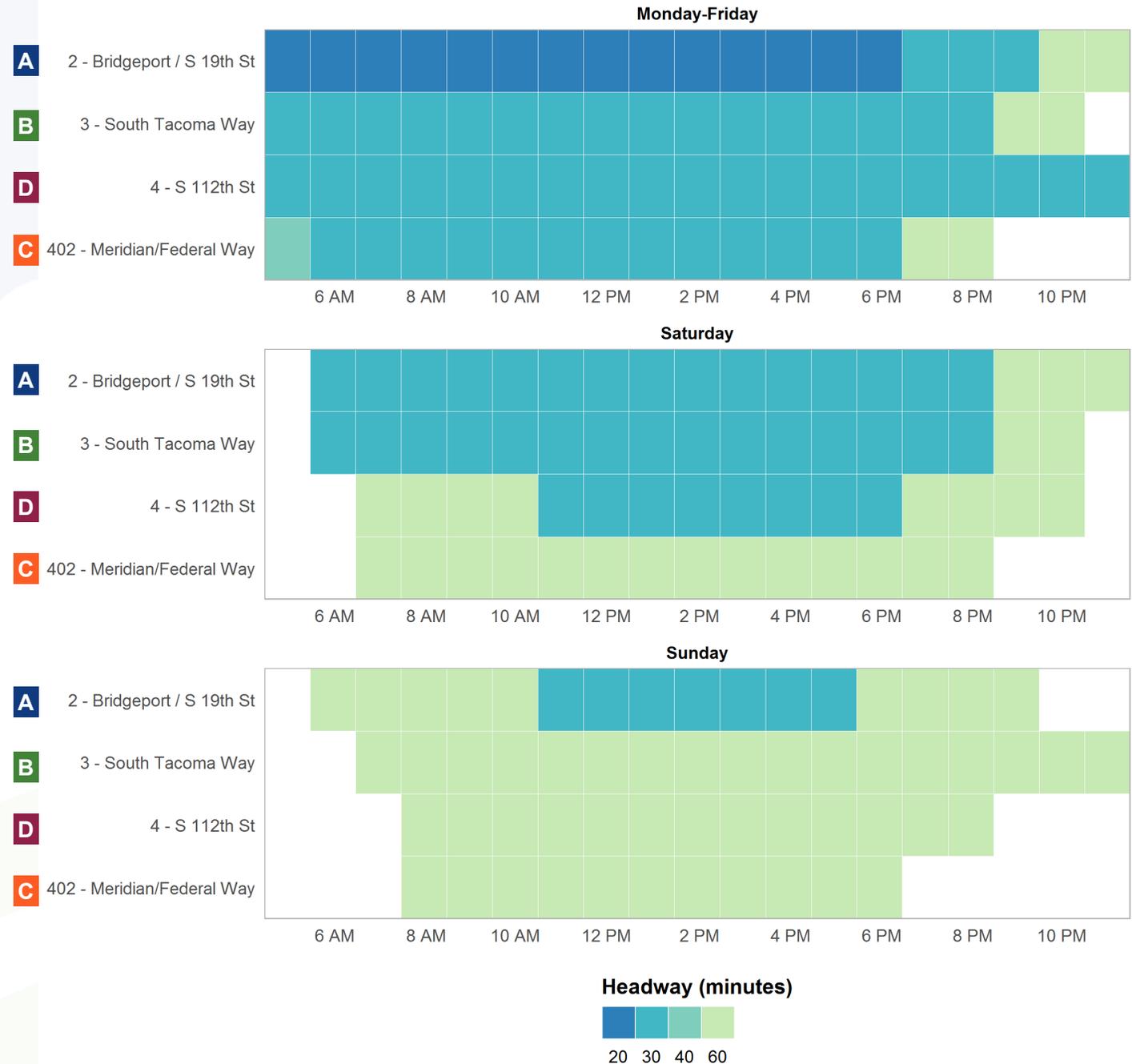
This section displays the span of service and frequency by hour for each corridor by day of the week.

*Frequency is a measure of how often a bus arrives. It is related to headway, which is the time between consecutive buses on the same route.*

*Span of service is the measure of how many hours during the day transit operates.*

# Frequency

- On weekdays, Route 2 operates the most frequent service, with buses **every 20 minutes** during most of the day. All other routes operate **every 30 minutes** on weekdays.
- On Saturdays, Routes 2 and 3 operate **every 30 minutes** during most of the day. Route 4 operates **every 30 minutes** in the middle of the day. Route 402 operates **every 60 minutes** all day.
- On Sundays, Route 2 operates **every 30 minutes** in the middle of the day. All other routes operate **every 60 minutes**.
- Future Stream corridors will aim for service every 10 minute during peak hours, 15 minutes during midday, 30 minutes in the evening, and 20-30 minutes on weekends.
- Based on existing service, Route 2 (Corridor A) is the closest to operating at Stream frequencies and span.



# Transit Performance

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This section provides a summary of transit ridership relative to the amount of service provided, as well as how passengers are using each corridor (in terms of distances they are travelling).

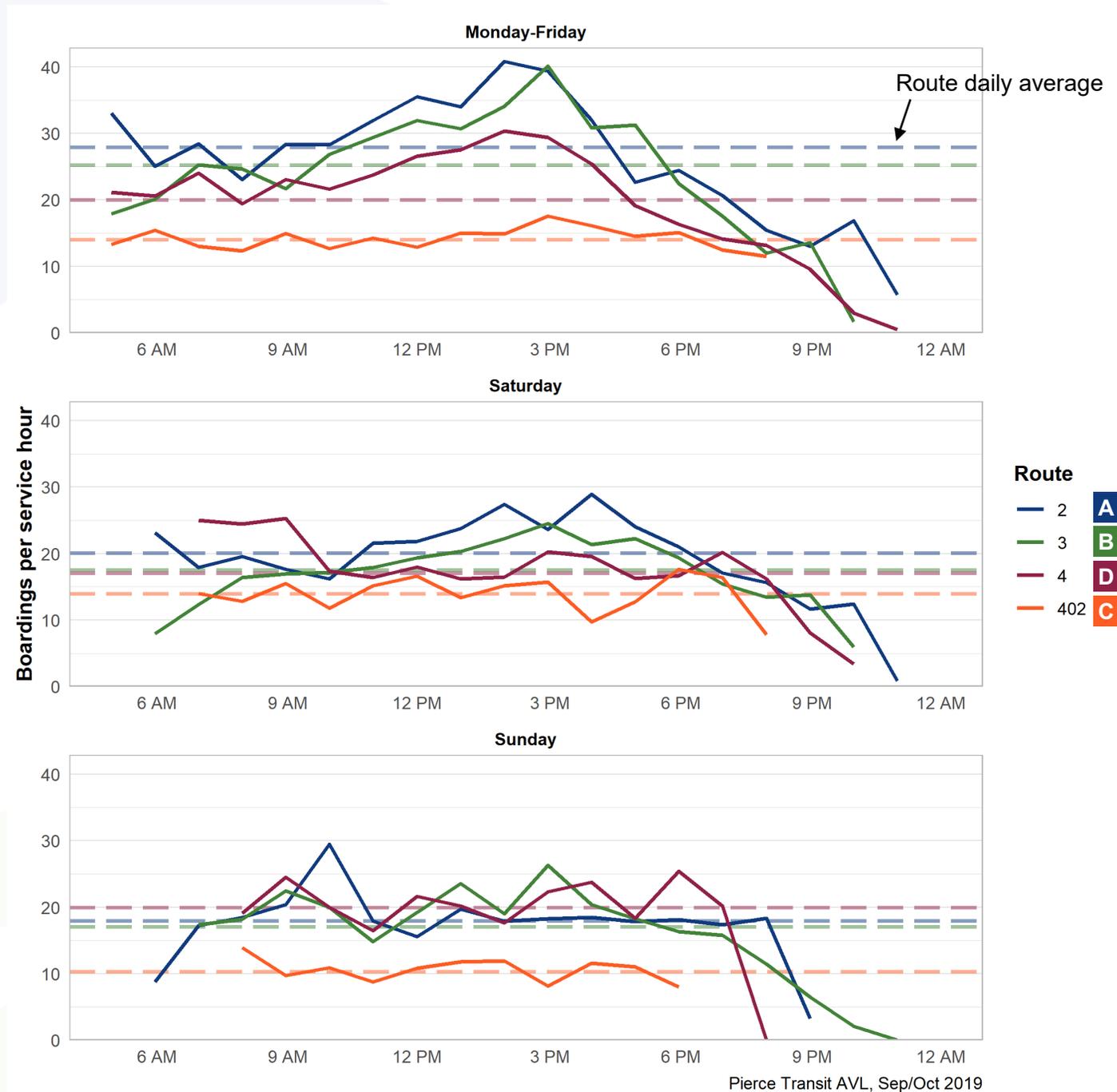
*Passengers per service hour is a measure of transit performance that normalizes the number of boardings relative to the service hours offered.*

*Passengers per service mile is a similar measure, but instead uses service miles.*

*Average passenger distance travelled measures the average length of a journey based on the cumulative distance travelled, and the number of boardings.*

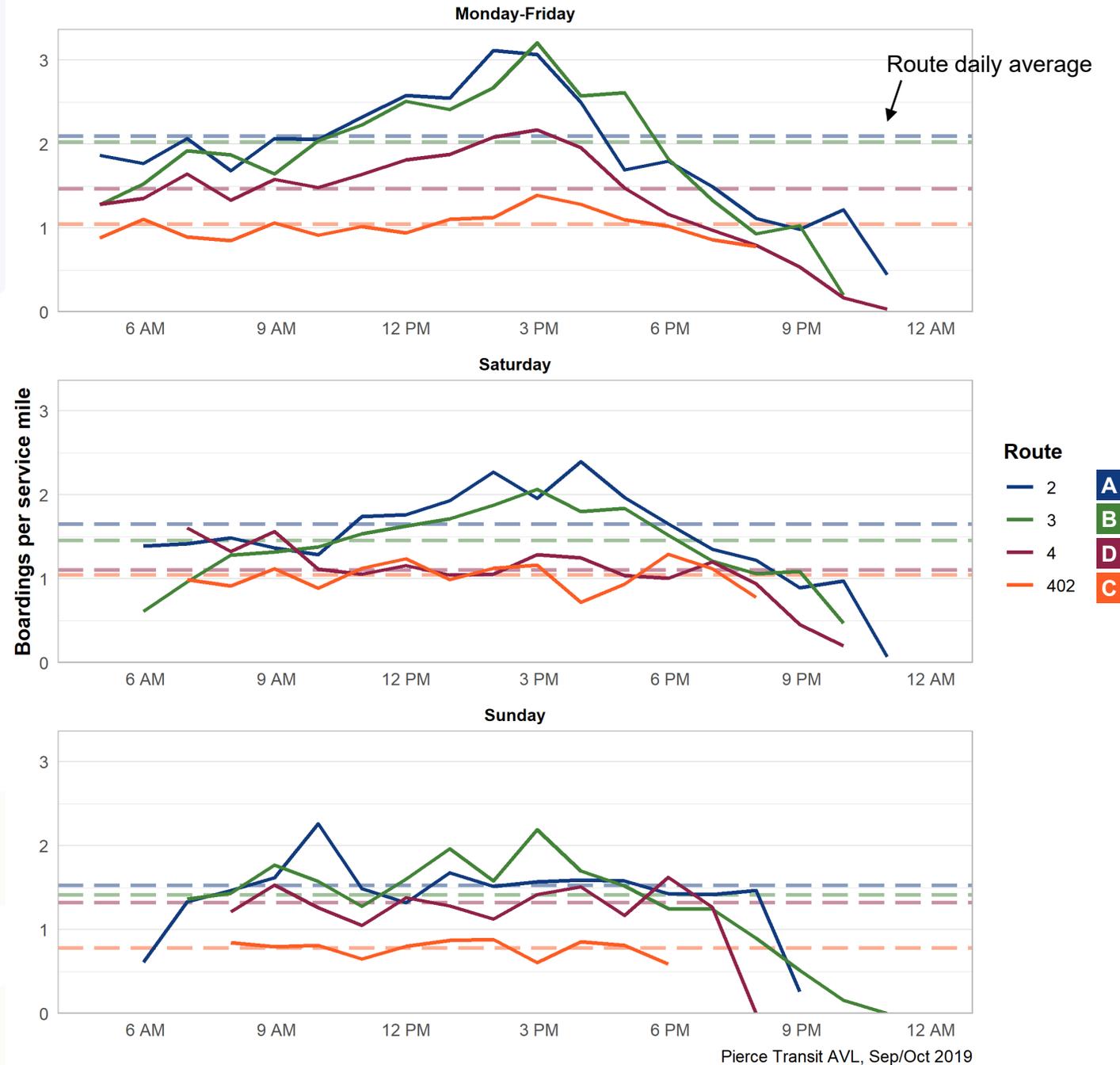
# Passengers per Service Hour

- Routes 2 and 3 have the highest productivity on Monday-Friday and on Saturday.
- Route 4 has the highest productivity on Sunday.
- Route 402 has the lowest productivity of all routes.



# Passengers per Service Mile

- Routes 2 and 3 have the highest productivity relative to service miles on all days of the week.
- Productivity on Route 4 is higher on Sunday than on Saturday.



# Average Passenger Distance Travelled

- On average, passengers travel between 4 and 6 miles per trip.
- Corridor D (Route 4) has the longest average trip distance (6.25 miles).
- Relative to their corridor lengths, Route 402's average passenger distance is one-quarter of the corridor length, whereas Corridor B's average trip distance is more than half the corridor length.

## Corridor Length

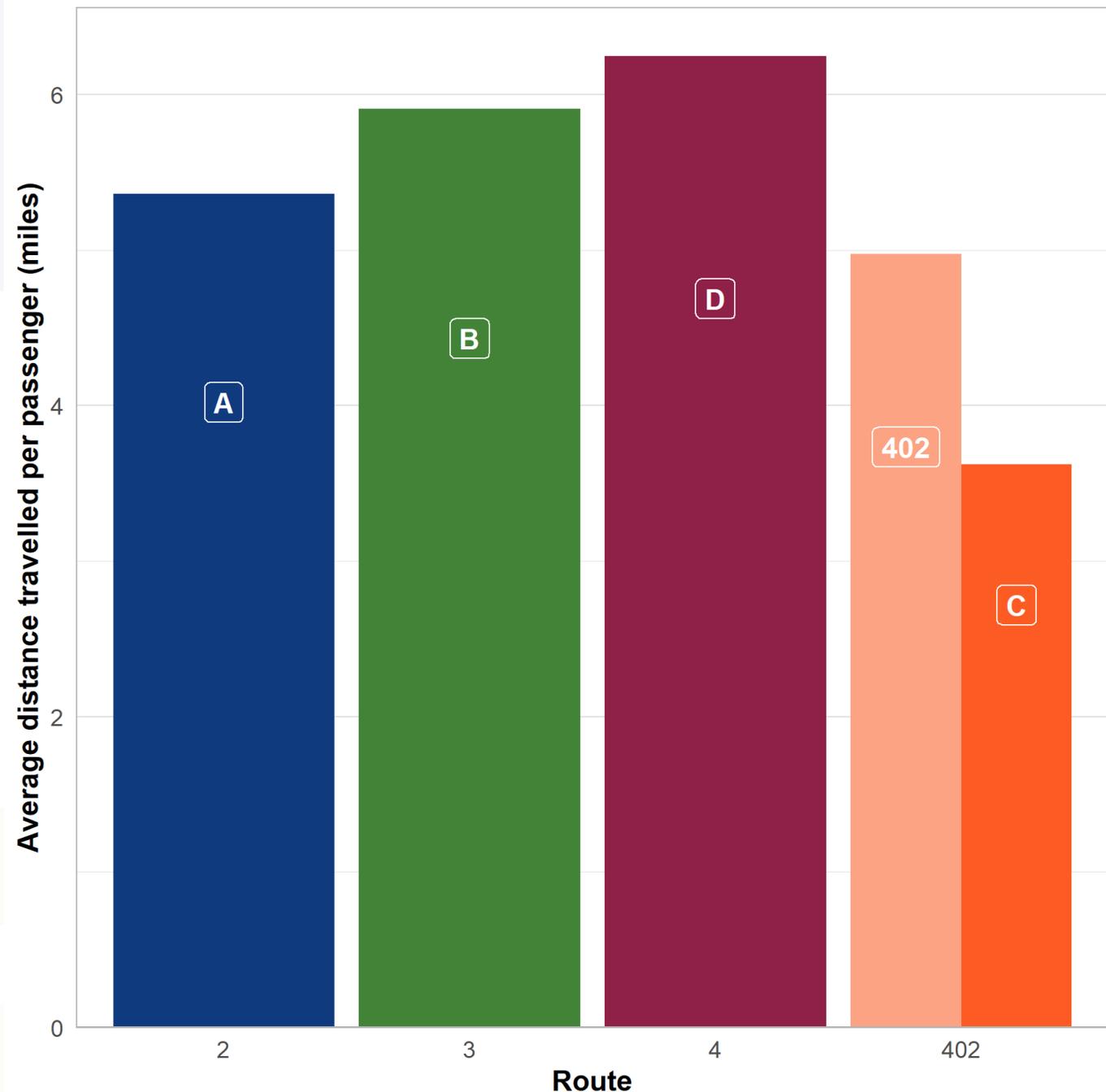
A (Route 2) = 12 miles

B (Routes 3) = 11 miles

C = 8 miles

Route 402 = 19 miles

D (Route 4) = 14 miles



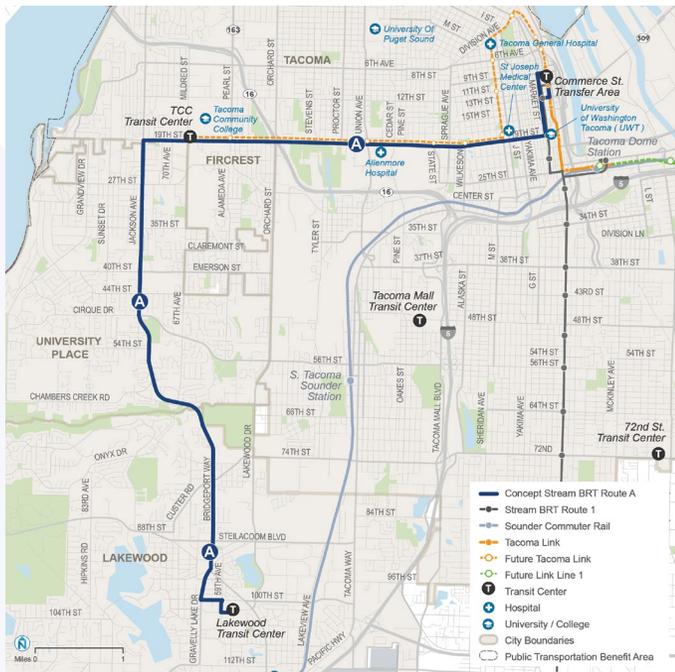
# Key Takeaways



This section summarizes the high-level findings for each candidate corridor, and the system overall.

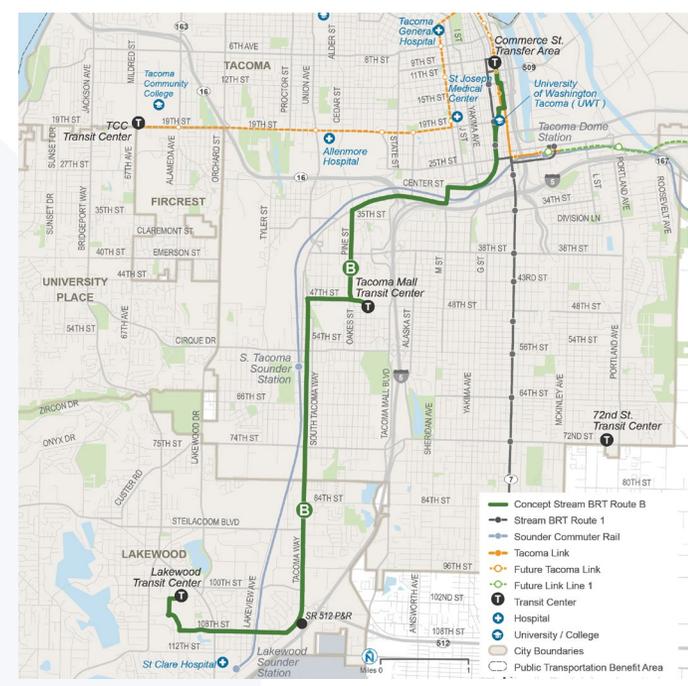
## Corridor A

- Corridor with the highest ridership, highest on-board loads, and highest productivity.
- This corridor has the shortest stop spacing. This could require the greatest level of stop removal and balancing to meet Stream BRT standards.
- There are sections of Bridgeport Way with low levels of ridership. This could support stop spacing longer than ½ mile, with closer spacing through activity centers like University Place Town Center.
- Along 19th Street there is a lot of activity, with a high concentration of stops.
- Span and frequency are closest of the four corridors to Stream BRT standards.



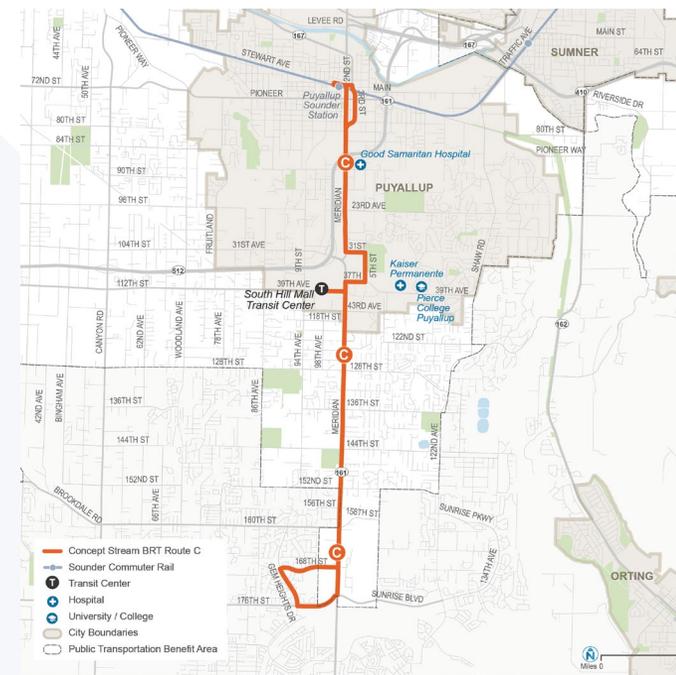
## Corridor B

- Corridor B has relatively high ridership, on-board loads and productivity.
- Low ridership along South Tacoma Way between Pine Street and Yakima Ave provide opportunity to consider routing alternatives that access a different market – like the Lincoln neighborhood.
- Average passenger trip distances are relatively long compared to other corridors. This indicates passengers are traveling farther, and therefore increased speed and fewer stops placed at high ridership locations may be very beneficial for many passengers.
- The highest ridership areas outside major activity centers are primarily located along South Tacoma Way between Tacoma Mall and SR 512 P&R. This is a corridor with moderate densities of both households and employment.



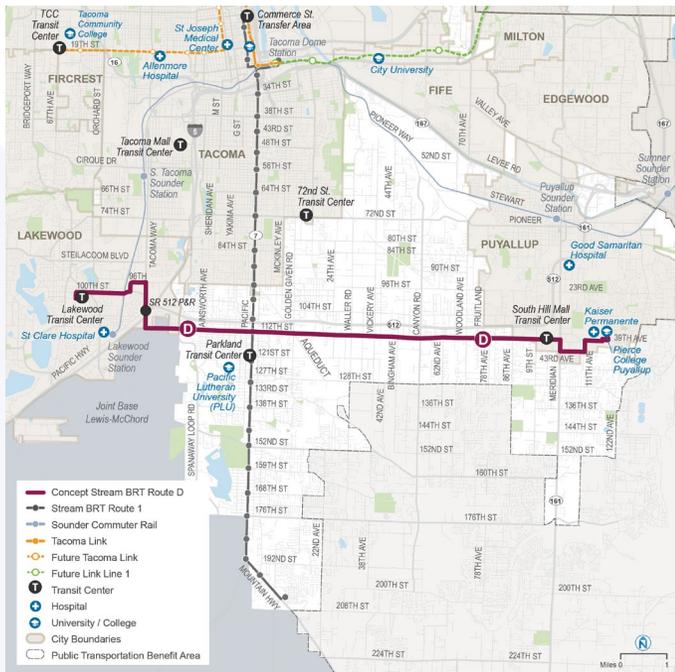
# Corridor C

- Route 402 serves two markets: one between the southern end of the corridor and Puyallup (consistent with Corridor C), and a second market between Puyallup to Federal Way.
- Most of the ridership activity along Route 402 occurs in the area consistent with Corridor C. This suggests the section approximately between 176th Street and Puyallup may have the most supportive current land use and ridership potential for BRT, particularly relative to other locations along Route 402.
- There does not seem to be a strong market from Pierce County to Federal Way, though it is unclear how the future Link extension to Federal Way may change this.
- South Hill Mall is a high ridership location. A renovation of the transit center provides an opportunity to improve amenities for passengers.
- Existing span and frequency of service are the lowest of all the corridors.



## Corridor D

- Relative to other candidate corridor segments, there is low ridership between Canyon Road and South Hill Mall. These areas could be served with spacing of more than 1/2 mile.
- Ridership data suggests many passengers are transferring at Pacific Avenue. Stops at this intersection would need additional amenities and other considerations to improve the quality of the transfer experience.
- Passengers on Corridor D travel long distances – evidenced by average distance traveled and relatively consistent on-board loading along the route. This suggests faster travel times and comfortable vehicles are important for this market.





# Overall

- The average on-board load per trip with existing frequencies is between 12 and 18 passengers. The typical BRT vehicle has a seated capacity of more than 40. This suggests there is a lot of room for seated passengers and ridership growth.
- Significant stop consolidation will be needed to meet Stream 1 station spacing. Nearly every other stop will need to be removed.
- The corridors experience high midday ridership. This suggests speed and reliability treatments will need to examine needs all-day, rather than focusing on peak hours only.



PierceTransit  
***Stream***  
Speed & Reliability  
Opportunity Assessment

November 2021

*The Stream System Expansion Study (SSES) will evaluate four candidate BRT corridors and identify the best candidate for Stream BRT service.*

*This memo analyzes current transit speed and reliability. This is a key input to help understand the issues occurring on each corridor.*

# Overview

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1

Delay

2

Reliability

3

Dwell Time

4

Existing Transit Priority

# SSES CORRIDORS

- 4 candidate BRT corridors generally match existing routes.

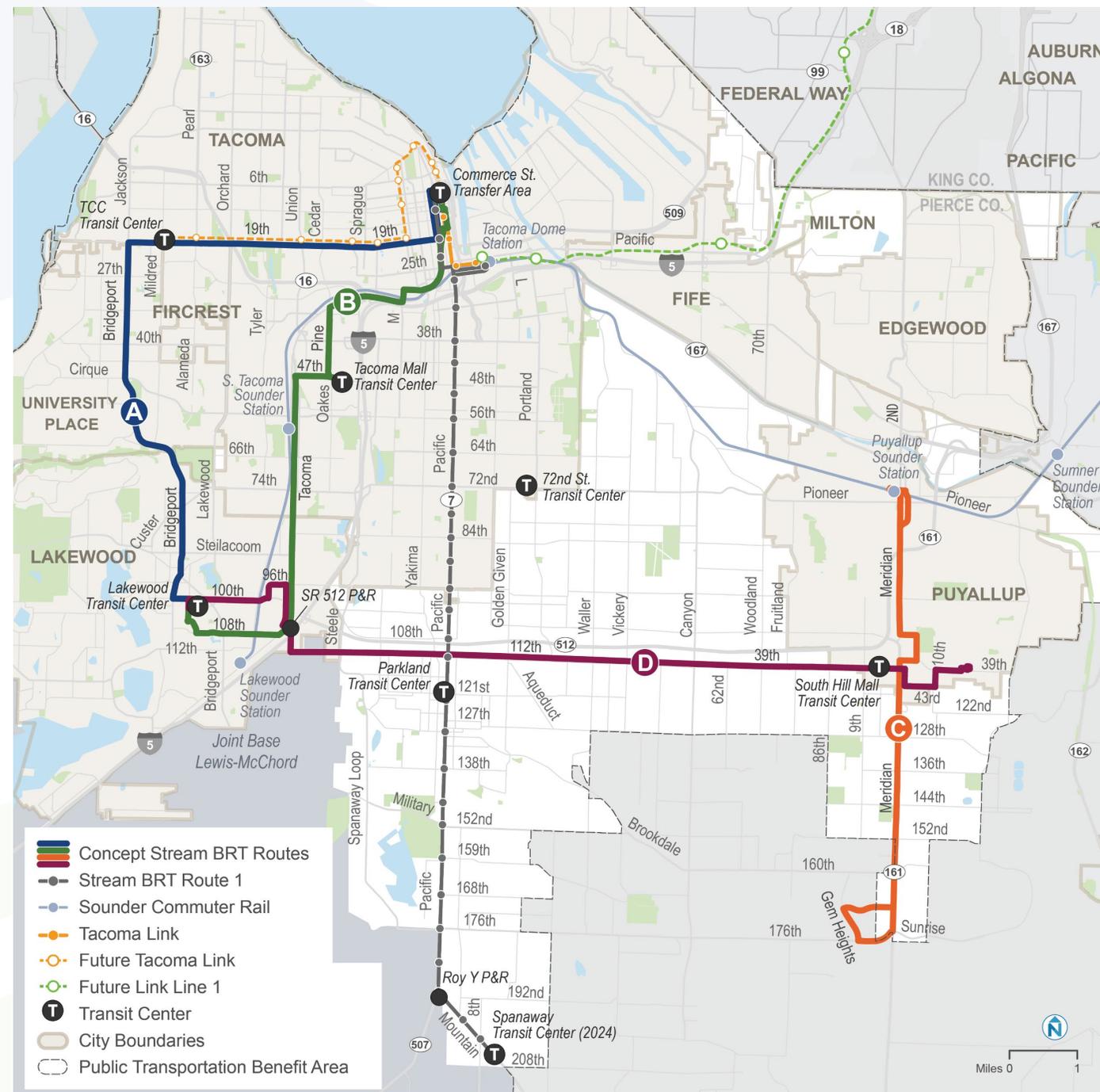
Corridor A = Route 2.

Corridor B = Route 3.

Corridor C = Portion of Route 402.\*

Corridor D = Route 4.

\* Corridor C includes a portion of today's Route 402, which extends to Federal Way. Corridor C's northern terminus would be Puyallup Station.



# Delay Methods

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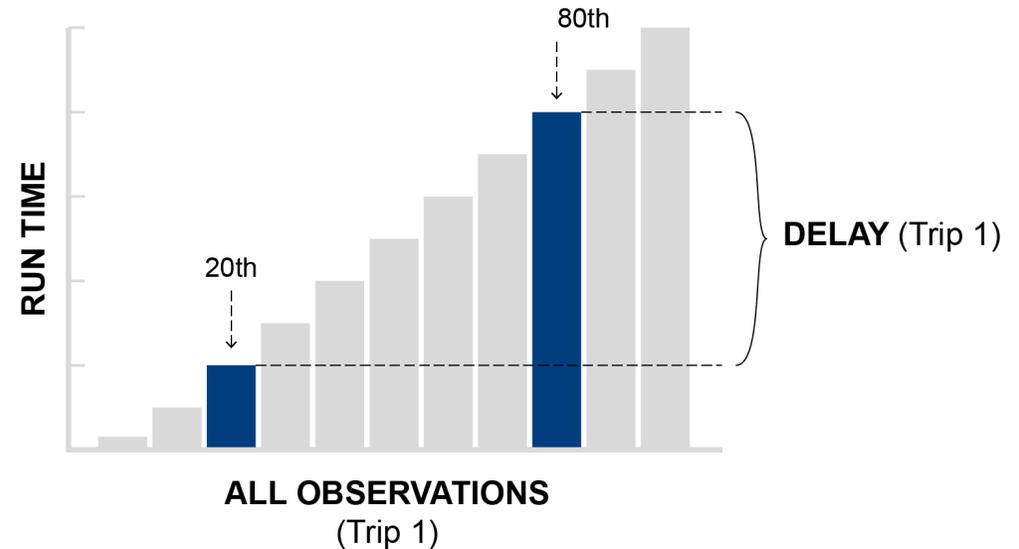
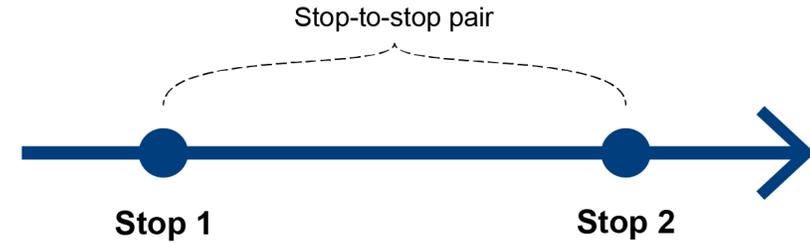
This section provides an explanation of how delay was calculated.

*Delay is a metric that is used to quantify the variation in run time (i.e., travel time, excluding dwell time).*

*Delay by location or time of day indicates where and when future Stream corridors would benefit from transit priority investments.*

# How do we calculate delay?

- Compare run times (excluding dwell) between each consecutive stop on an individual trip over multiple weeks to identify range of travel times.
- **Bus Delay** = 80th percentile travel time minus 20th percentile travel time.
- The individual delay values for each stop pair and trip are added together into a cumulative delay value.
- **Passenger delay** is calculated by multiplying delay at the trip and stop level by the average on-board load for each trip and stop. Passenger delay represents the cumulative delay experienced by all passengers on-board.
- Delay values are normalized by distance and number of trips to account for longer stop pairs and more frequent service.



$$\left. \begin{array}{l} \text{DELAY (Trip 1)} \\ \text{DELAY (Trip 2)} \\ \text{DELAY (Trip 3)} \\ \text{DELAY (Trip 4)} \\ \text{DELAY (Trip 5)} \end{array} \right\} \Sigma = \text{Cumulative delay}$$

# Delay



This section summarizes the **bus delay** and **passenger delay** by stop group, and by time of day along each of the corridors.

Data is from Fall 2019 (pre-pandemic).

The maps show data by stop group, which are groupings of multiple stop pairs.

# Daily Bus Delay (per mile)

- Overall, candidate corridor A has the highest bus delay among candidate corridors.
- High bus delay occurs at segments approaching and headed away from the major transit centers.
- Areas near the South Hill Mall (near 39th Ave and Meridian Ave on Corridors C and D) have high bus delay.
- The longest continuous segments that have the highest bus delay in both directions among all four candidate corridors are along 19th Street between Downtown Tacoma and Stevens Street/Tyler Street.
- Corridor D has relatively low daily bus delay, except near South Hill Mall Transit Center.





# Daily Bus Delay (per mile per trip)

- Bus delay, normalized per trip, shows delay areas where the total number of daily trips is low (e.g., peak-oriented service) or by normalizing for high frequency of service.
- Segments near the South Hill Mall and in Downtown Tacoma have some of the highest bus delay on a per trip basis.

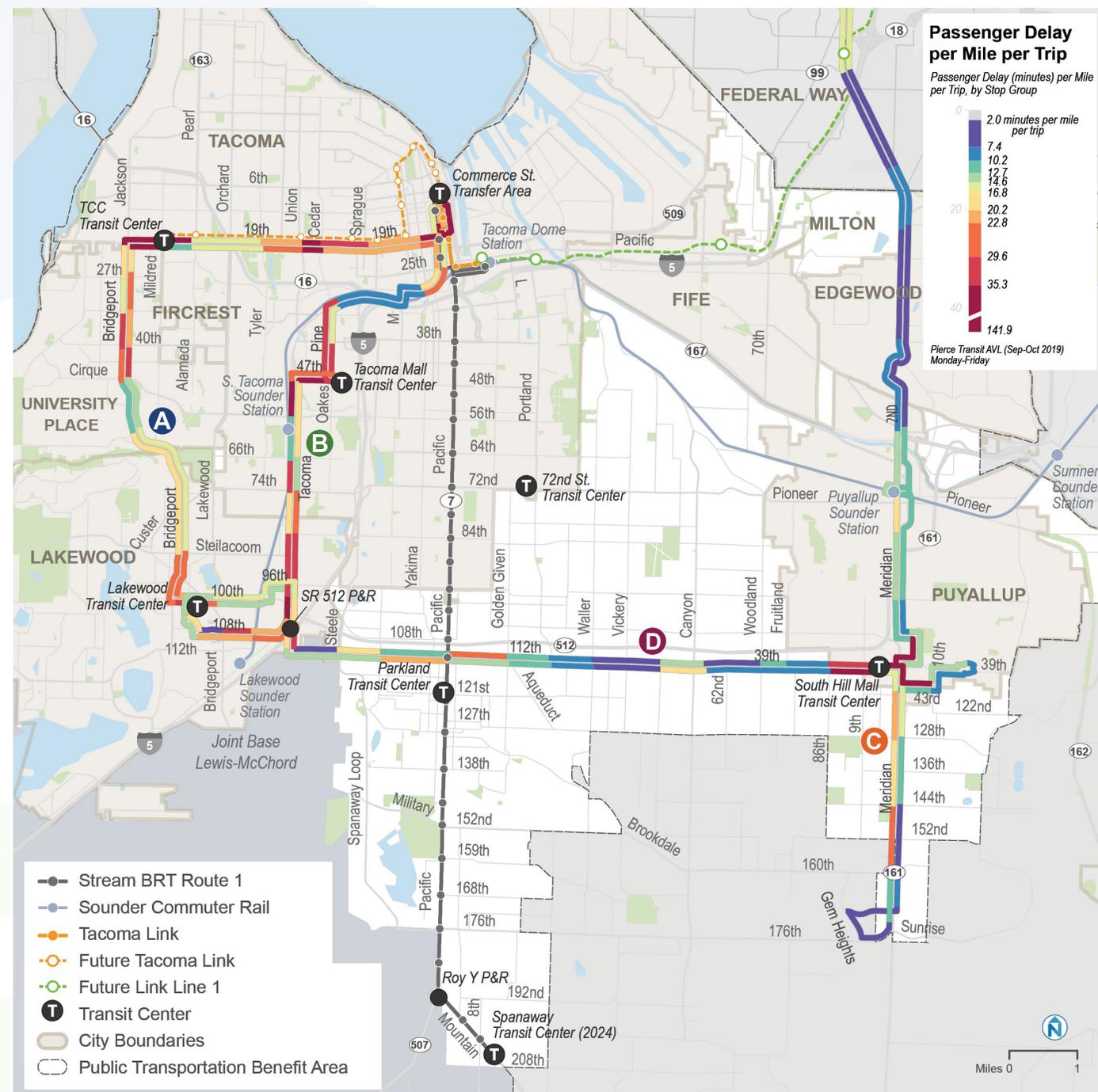
Note: bus delay per trip is also normalized for distance, similar to bus delay and passenger delay metrics



# Daily Passenger Delay (per mile per trip)

- High daily passenger delay per trip occurs mostly at segments approaching and headed away from the major transit centers.
- Some of the highest passenger delay on a per trip basis occurs in Downtown Tacoma, near TCC Transit Center, and near the South Hill Mall Transit Center.

Note: bus delay per trip is also normalized for distance, similar to bus delay and passenger delay metrics

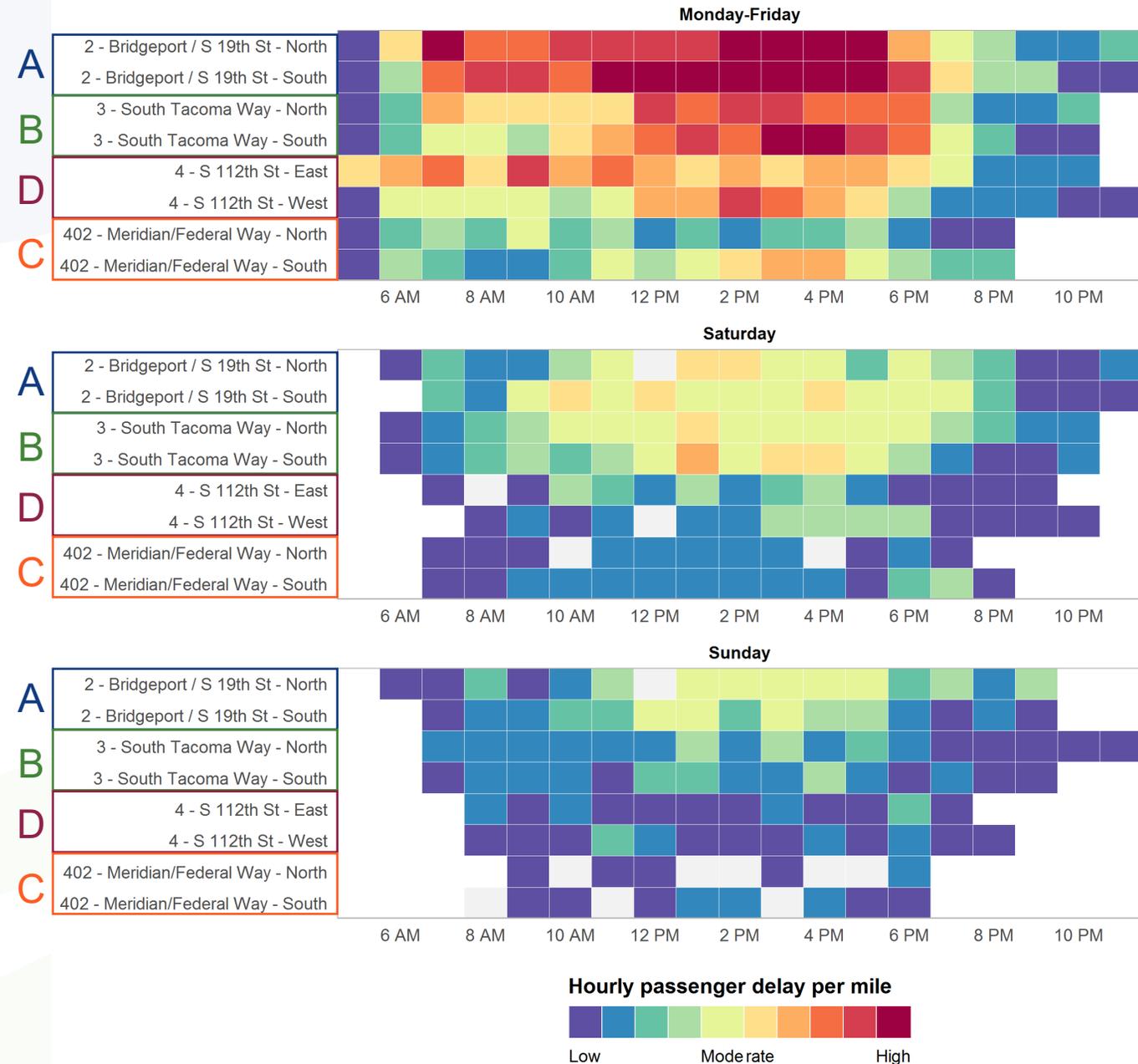




# Daily Passenger Delay (per mile by time of day)

- On weekdays, each route experiences the following amounts of passenger delay:
  - Route 2: 400 hr (17 hr / mile)
  - Route 3: 262 hr (12 hr / mile)
  - Route 4: 272 hr (10 hr / mile)
  - Route 402: 193 hr ( 5 hr / mile).
- Total passenger delay is greatest on Routes 2 and 4. But on a per mile basis, passenger delay is greatest on Routes 2 and 3.
- Delay peaks between noon and 6 pm.
- Routes 4 primarily experiences delay on weekdays.
- Relatively little passenger delay occurs on Route 402, except in the southbound direction on weekdays between 2 and 5 pm.

Each row represents one direction of travel for each route



# Travel Time and Reliability



This section summarizes the travel times for sections along each of the corridors by time of day.

These sections are longer than the stop groups shown in the previous pages and divide the corridors into between 5 and 9 sections each.

# Run Time by Section

- The charts on the following pages provide an overview of the consistency of bus run time (excluding dwell) within each time of day (shown through height) and allows for run times to be compared across the day (how far left or right the curve is).
- Time periods
  - Morning: 4-7 am
  - AM Peak: 7-10 am
  - Midday: 10 am-3 pm
  - PM Peak: 3-7 pm
  - Evening: 7 pm – 12 am.

Each chart shows a single section of the corridor

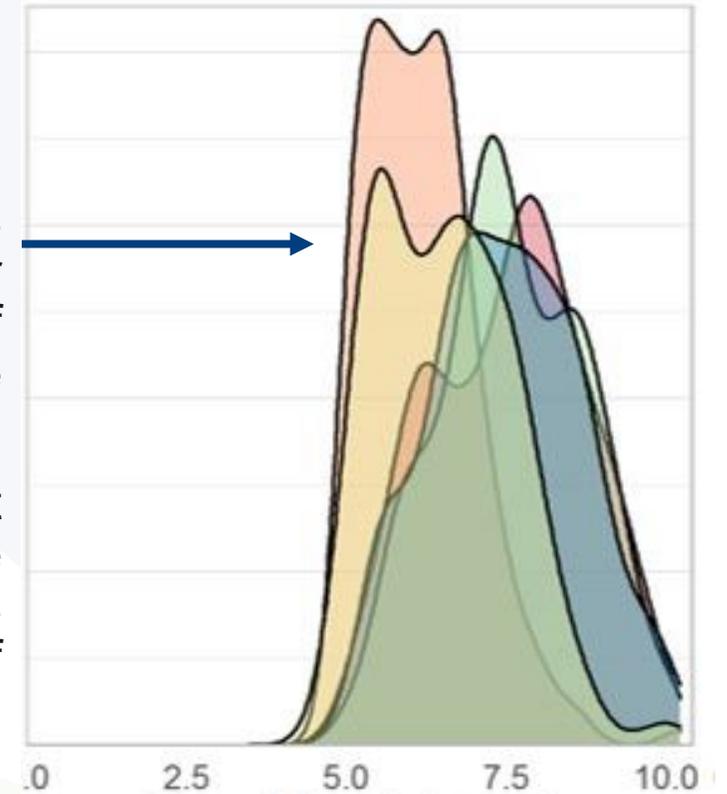
Mullen St to Hosmer St

Taller, narrower curves indicate a greater concentration of observations (i.e., more consistent travel times).

Flatter, spread-out curves indicate a wide variety of travel times (indicating lack of reliability).

High values indicate slower speeds.  
Excludes dwell time.

Each curve identifies the travel times for a particular time of day



Travel time (minutes)

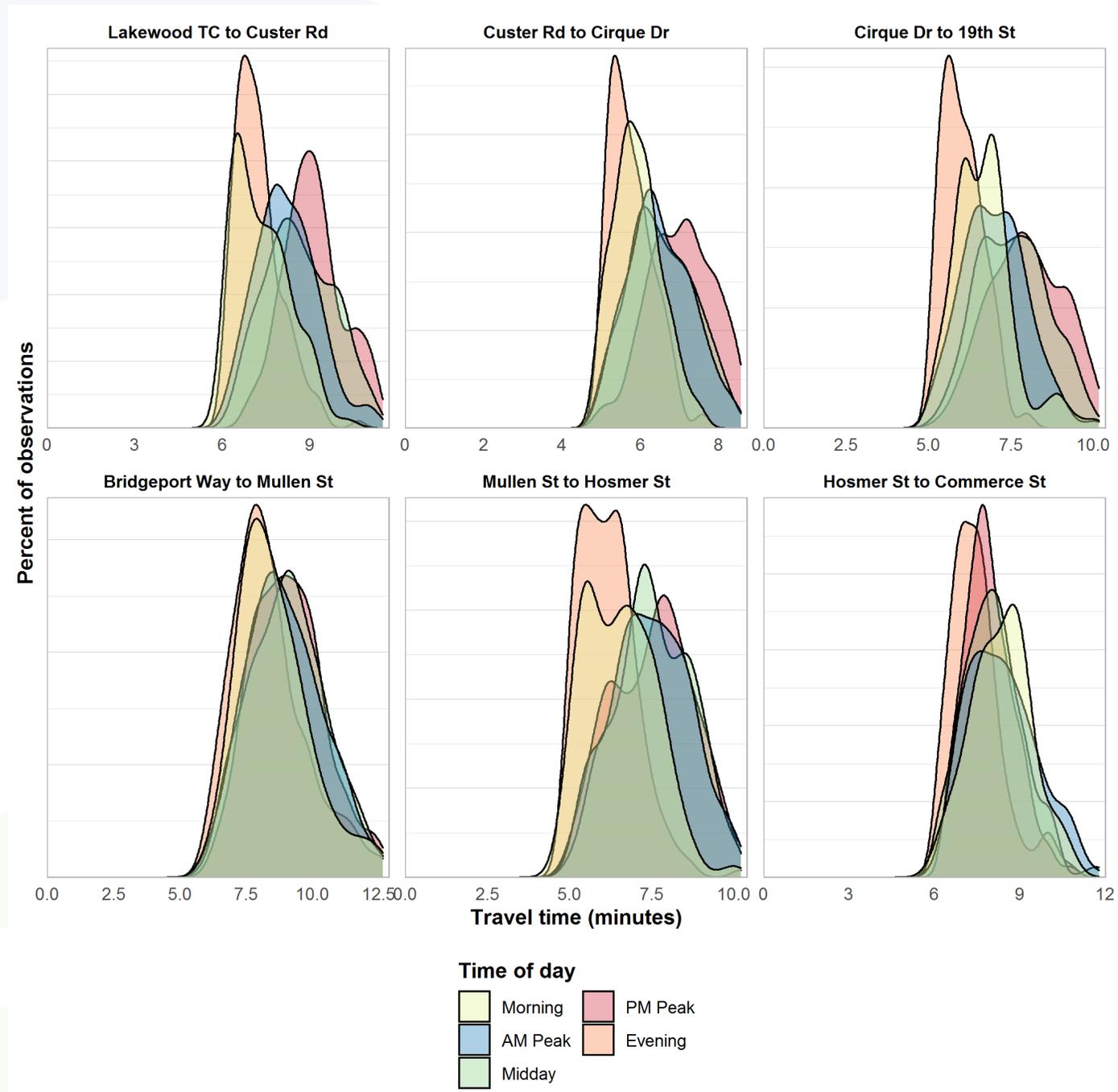
Time of day



# Run Time

## Route 2 – Northbound (Corridor A)

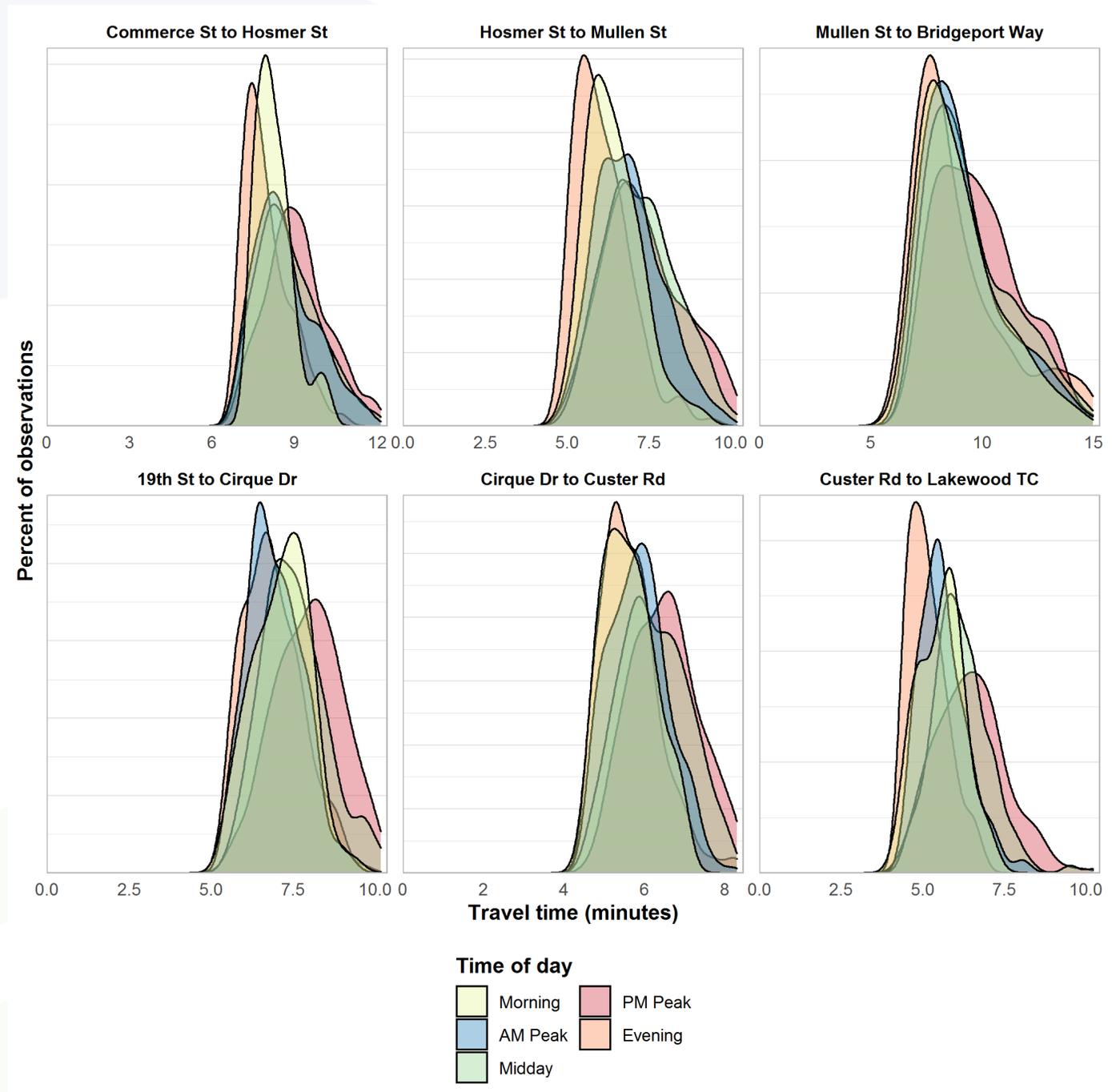
- Most sections have consistent travel times, but a few are slower in AM and PM peak hours such as:
  - Lakewood TC to 19th St (top 3 charts)
  - Bridgeport Way to Mullen St
  - Hosmer St to Commerce St.



## Run Time

### Route 2 – Southbound (Corridor A)

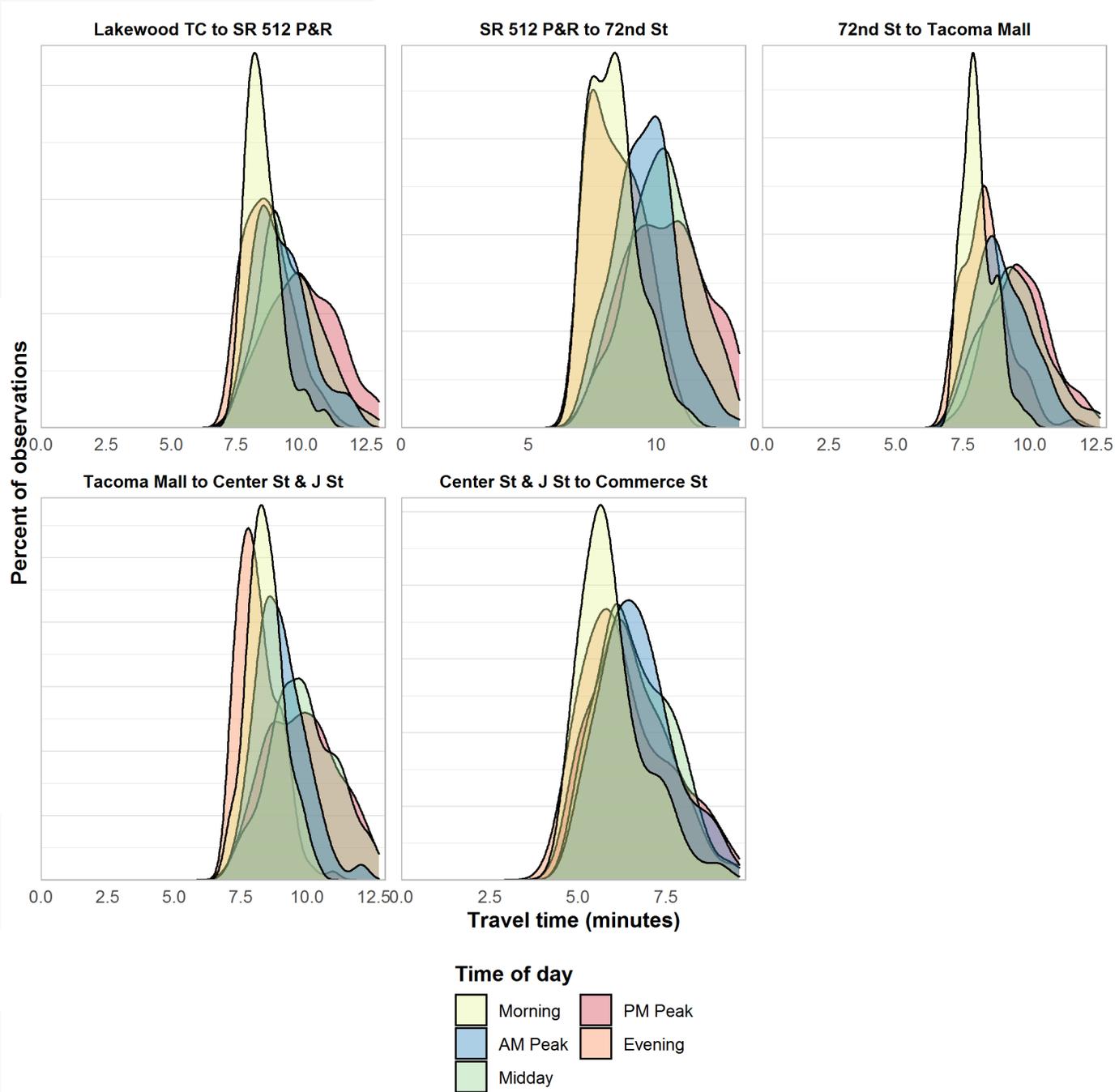
- Bus takes longer in the PM peak hour than other times of the day.
- AM and PM peak hour, and evening travel time is slower than other times of day between Mullen St and Bridgeport Way, and with wide variety of time from 5 minutes to 15 minutes or even more.



# Run Time

## Route 3 – Northbound (Corridor B)

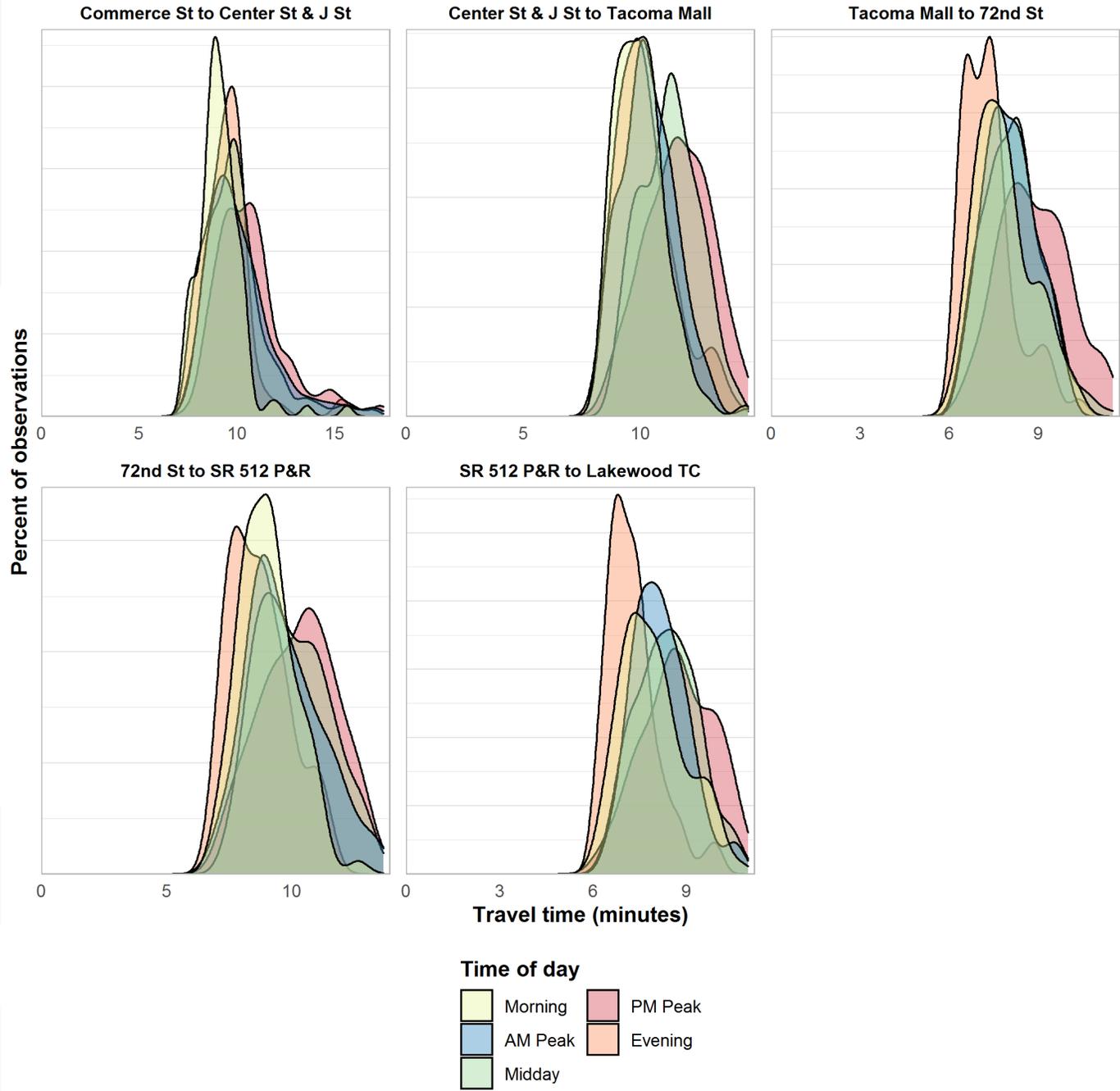
- In general, buses are slower in the PM peak hour than other times of the day.
- In the morning, travel time are faster in most sections.



# Run Time

## Route 3 – Southbound (Corridor B)

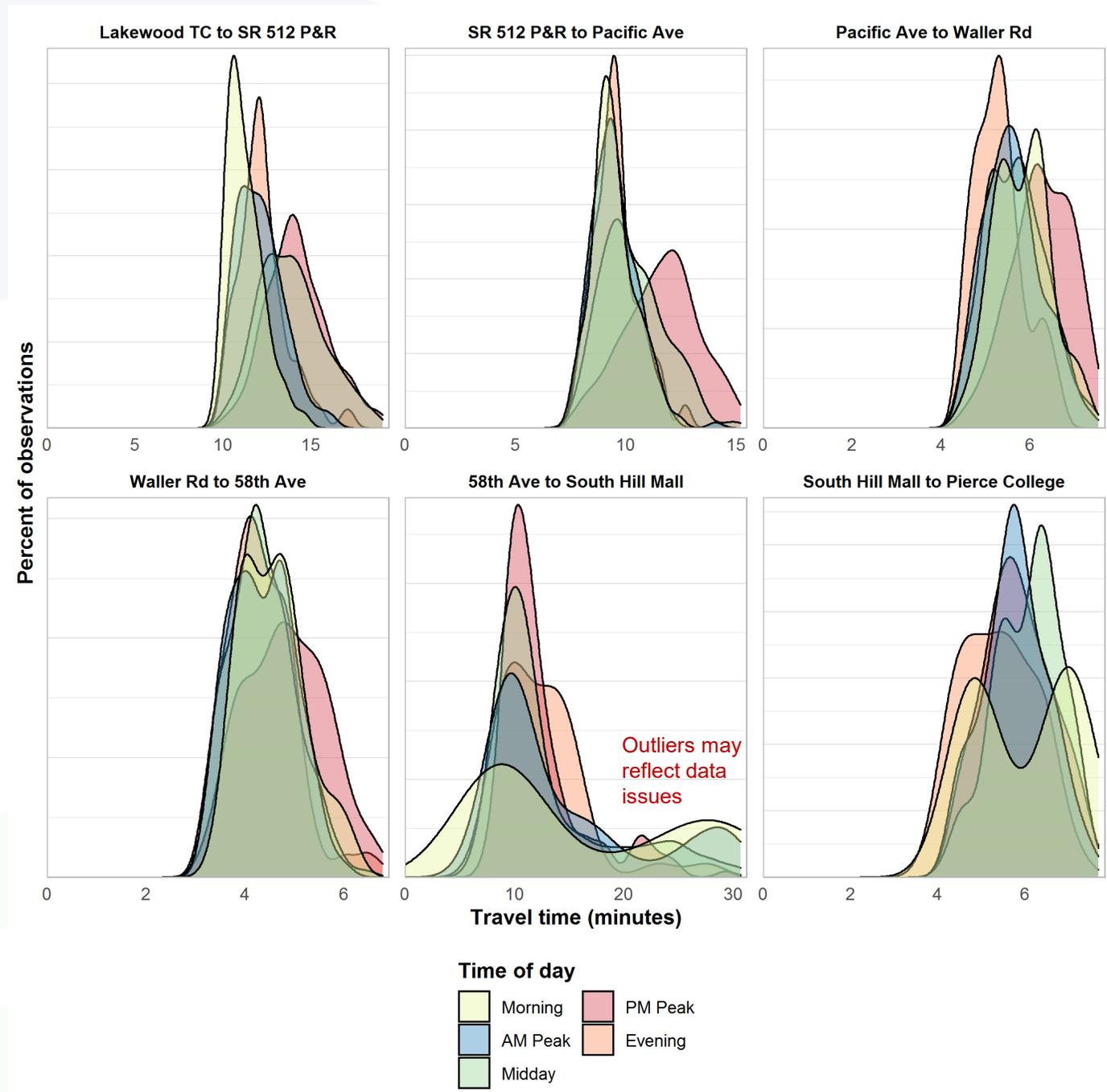
- Most sections have consistent travel times, except Commerce St to Center St & J St with slower travel time in the AM and PM peaks.



# Run Time

## Route 4 – Eastbound (Corridor D)

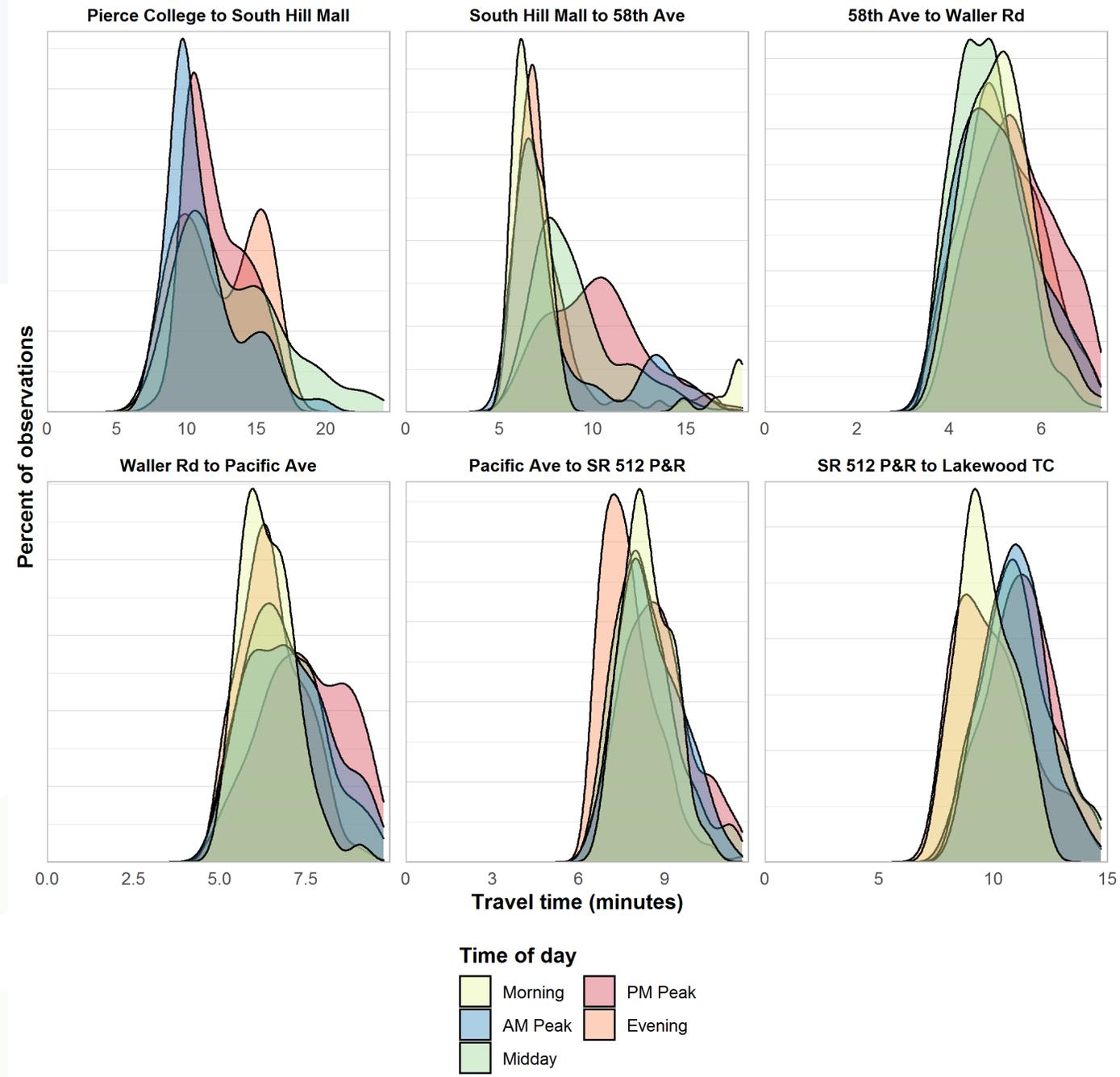
- Travel times from 58th Ave to South Hill Mall and from South Hill Mall to Pierce College have a wider variety of travel times, reflecting variable conditions all times of day.



# Run Time

## Route 4 – Westbound (Corridor D)

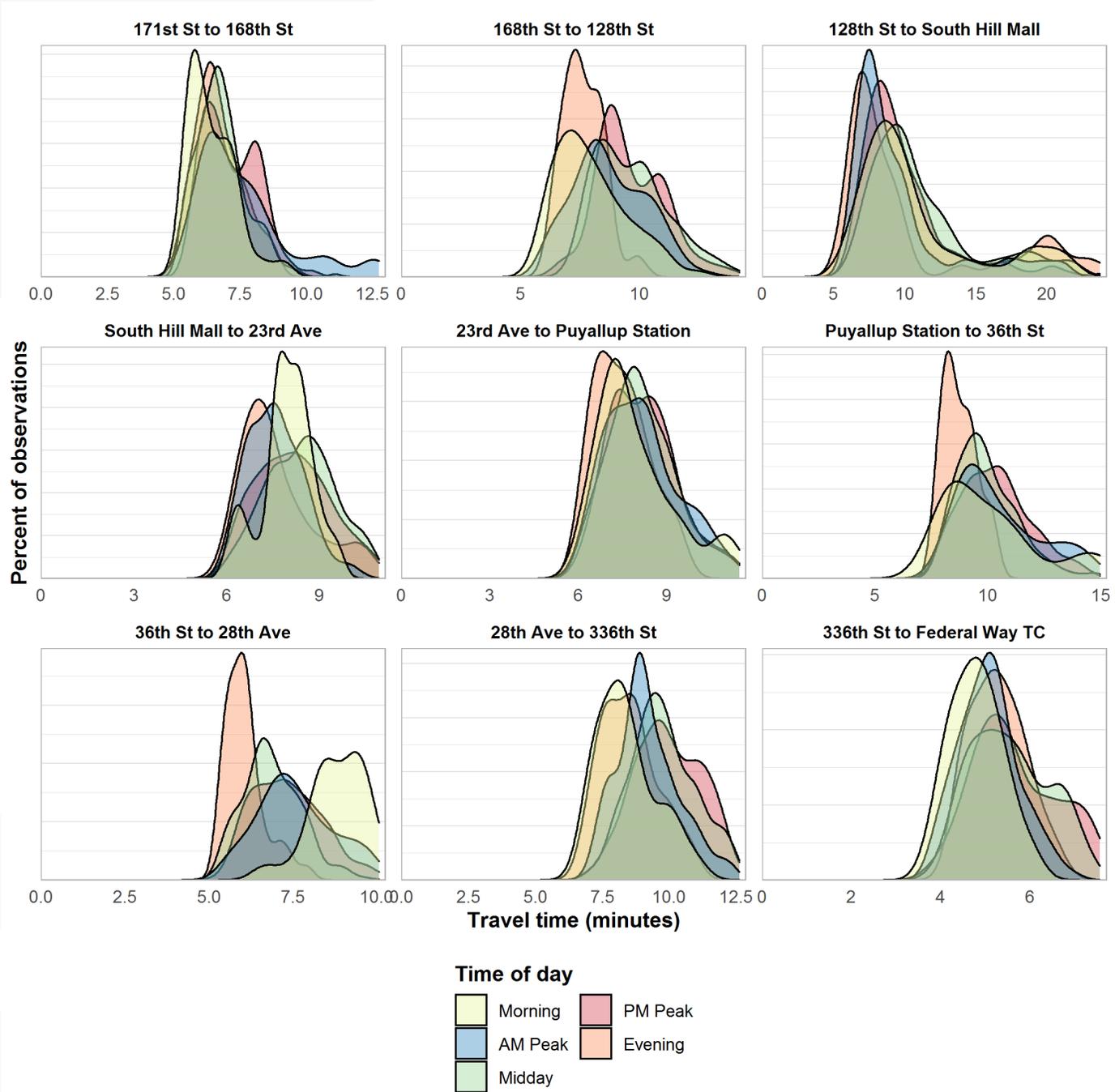
- In general, the travel time is relatively consistent for all sections between 58th Ave and Lakewood TC
- However, the travel time is slower during the morning, AM Peak, PM Peak and evening between Pierce College and 58th Ave than at other times of day.



# Run Time

## Route 402 – Northbound (Corridor C)

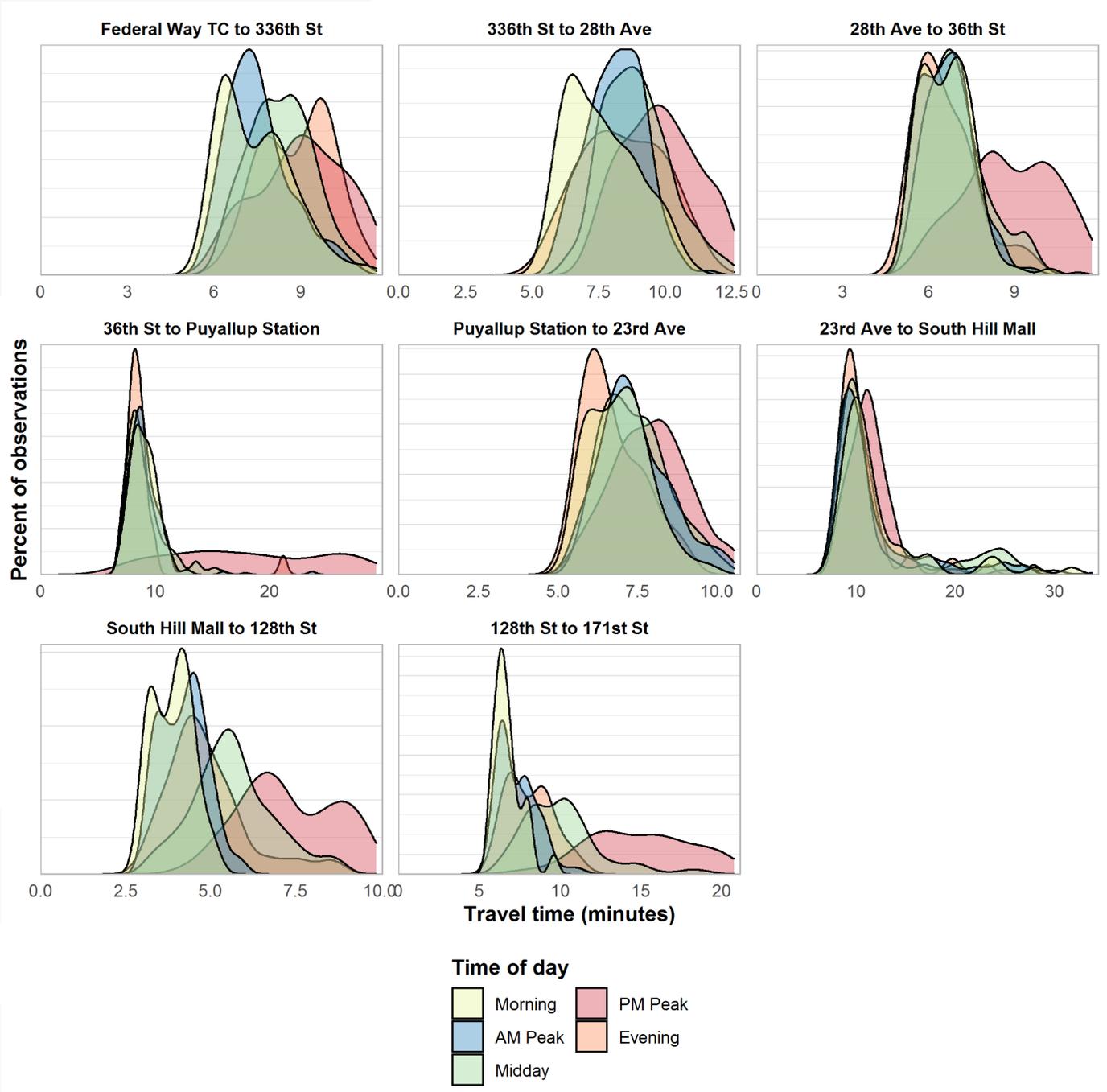
- In general, bus takes longer in both AM and PM peak hour and in some places most of the day.
  - **171st to 168th St:** The AM peak hour travel time varies from 5 minutes to more than 12 minutes.
  - **128th St to South Hill Mall:** The peak hour travel times significantly change from less than 5 minutes to more than 20 minutes for most of the day.
  - **36th St to 28th Ave:** Has the highest travel time in the Morning but better in the Evening.



# Run Time

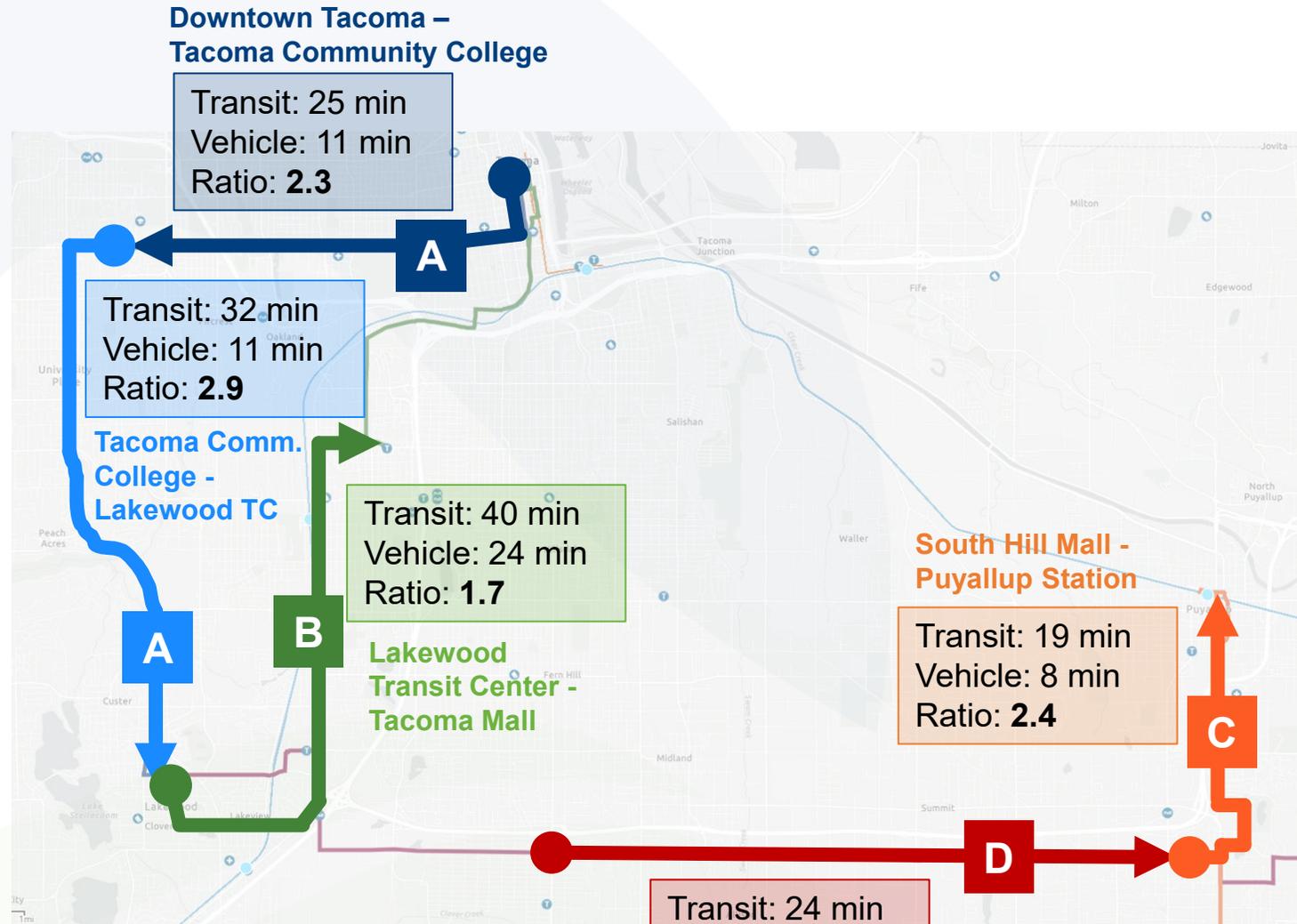
## Route 402 - Southbound (Corridor C)

- Overall, buses are slower, and the travel time is more variable during the day than other corridors.
- The travel time is significantly slow in the following locations:
  - 36th St to Puyallup Station
  - 23rd Ave to South Hill Mall
  - 128th to 171st St



# Compared to Auto Travel Time (PM Peak)

- Travel times on transit are approximately 1.5 and 2.9 times the travel time by car.
  - Transit travel times are scheduled and auto travel times are based on Google Maps (both 5 pm)
- Transit travel times between Downtown Tacoma and TCC, between TCC and Lakewood TC, and between South Hill Mall and Puyallup Station have the highest disparities compared to auto travel times.
- Corridor A (Route 2) has the highest ridership and load in places where the transit travel time has the greatest disadvantage over driving, suggesting significant passenger savings could be achieved with travel time improvements.
- There is less disparity in travel time along the other corridors; however, they are still relatively long compared to vehicle travel times.



## Notes:

- All travel times are based on trips at 5 pm on a weekday.
- Transit travel times based on Pierce Transit schedules.
- Vehicle travel times based on Google Maps travel time estimates (using same routing as buses).

# Compared to Auto Travel Time (PM Peak)

- Travel times on transit are approximately 1.5 and 2.9 times the travel time by car.
  - Transit travel times are scheduled and auto travel times are based on Google Maps (both 5 pm)
- The times between Downtown Tacoma and TCC, between TCC and Lakewood TC, and between South Hill Mall and Puyallup Station have the highest disparities.
- Corridor A (Route 2) has the highest ridership and load and high travel time ratio, suggesting significant passenger savings could be achieved with travel time improvements.
- There is less disparity in travel time along the other corridors; however, they are still relatively long compared to vehicle travel times.

**A**

**B**

**D**

**C**

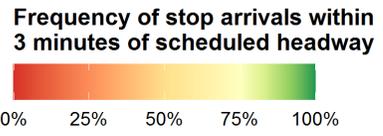
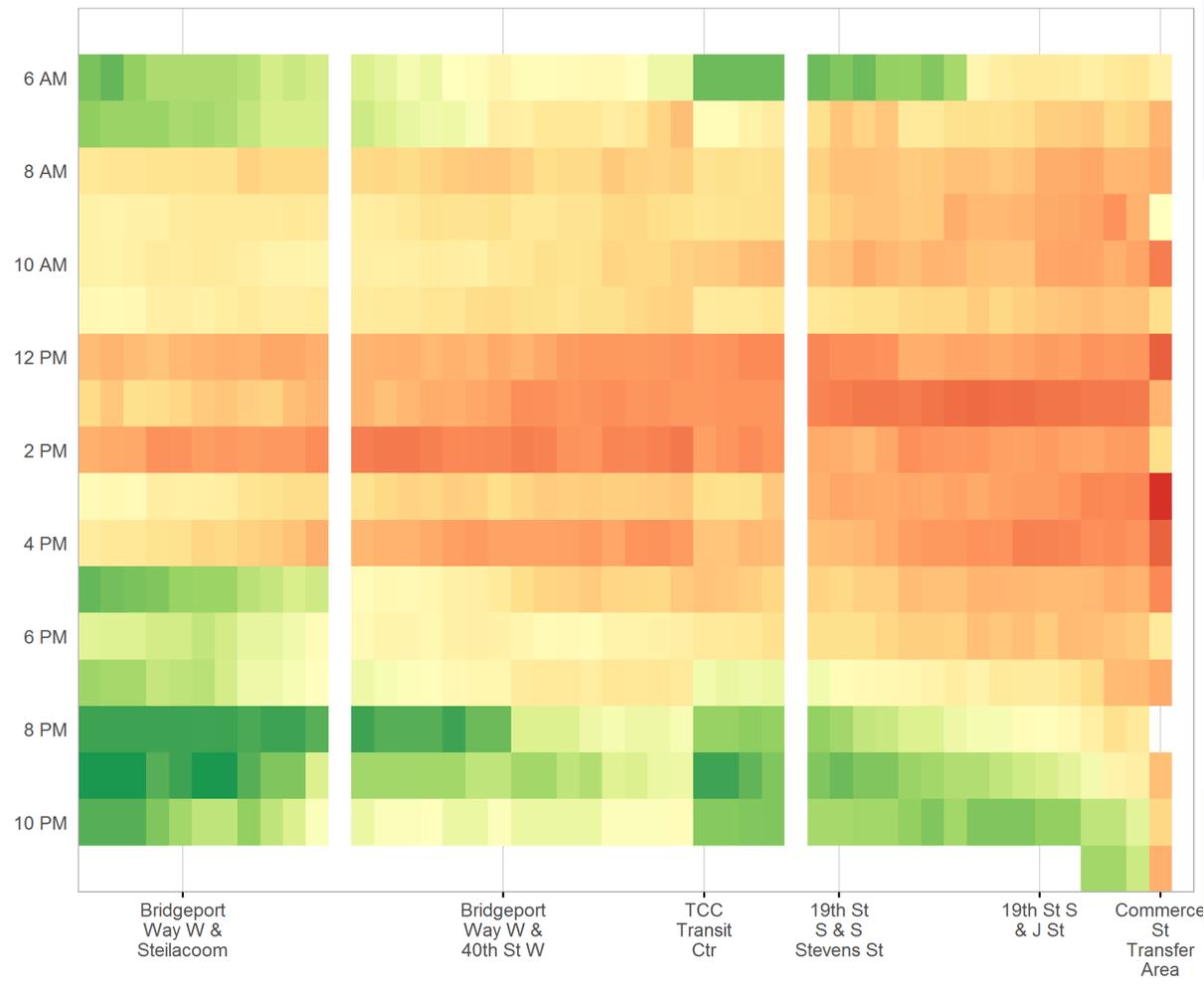
Destination Pair	Transit Travel Time (min)	Vehicle Travel Time (min)	Travel Time Ratio (Transit:Vehicle)
<b>Corridor A:</b> Downtown Tacoma <> Tacoma Community College	25	11	2.3
<b>Corridor A:</b> Tacoma Community College - Lakewood Transit Center	32	11	2.9
<b>Corridor B:</b> Lakewood Transit Center <> Tacoma Mall	40	24	1.7
<b>Corridor D:</b> 112th & Pacific <> South Hill Mall	24	16	1.5
<b>Corridor C:</b> South Hill Mall <> Puyallup Station	19	8	2.4
Source	Pierce Transit schedules	Google Maps travel time estimates. Based on same routing as buses.	



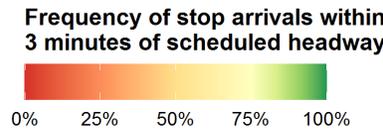
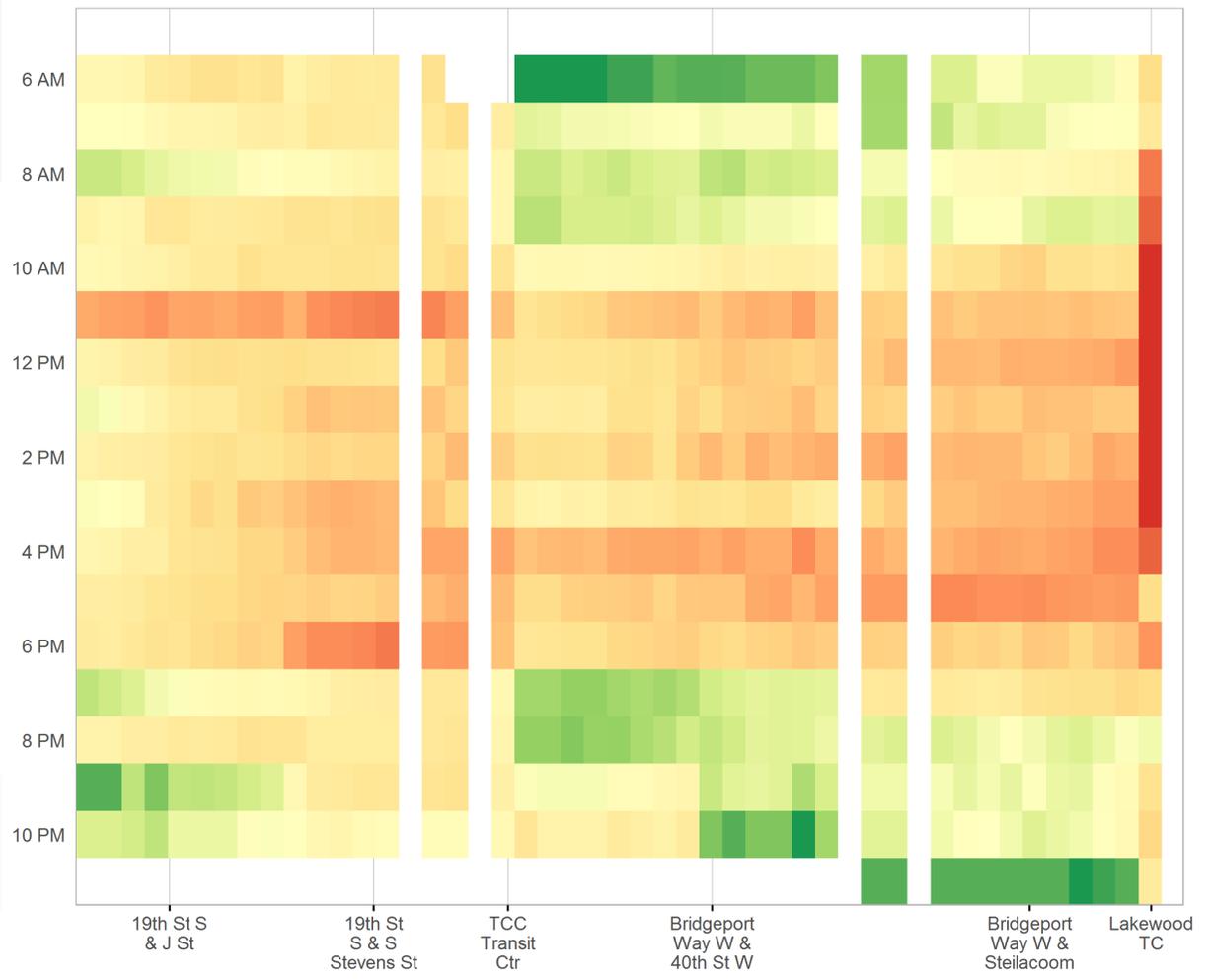
# Corridor A

## Route 2 – Bridgeport / S 19th St (Corridor A)

North to Commerce Street



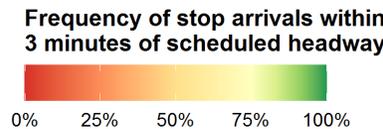
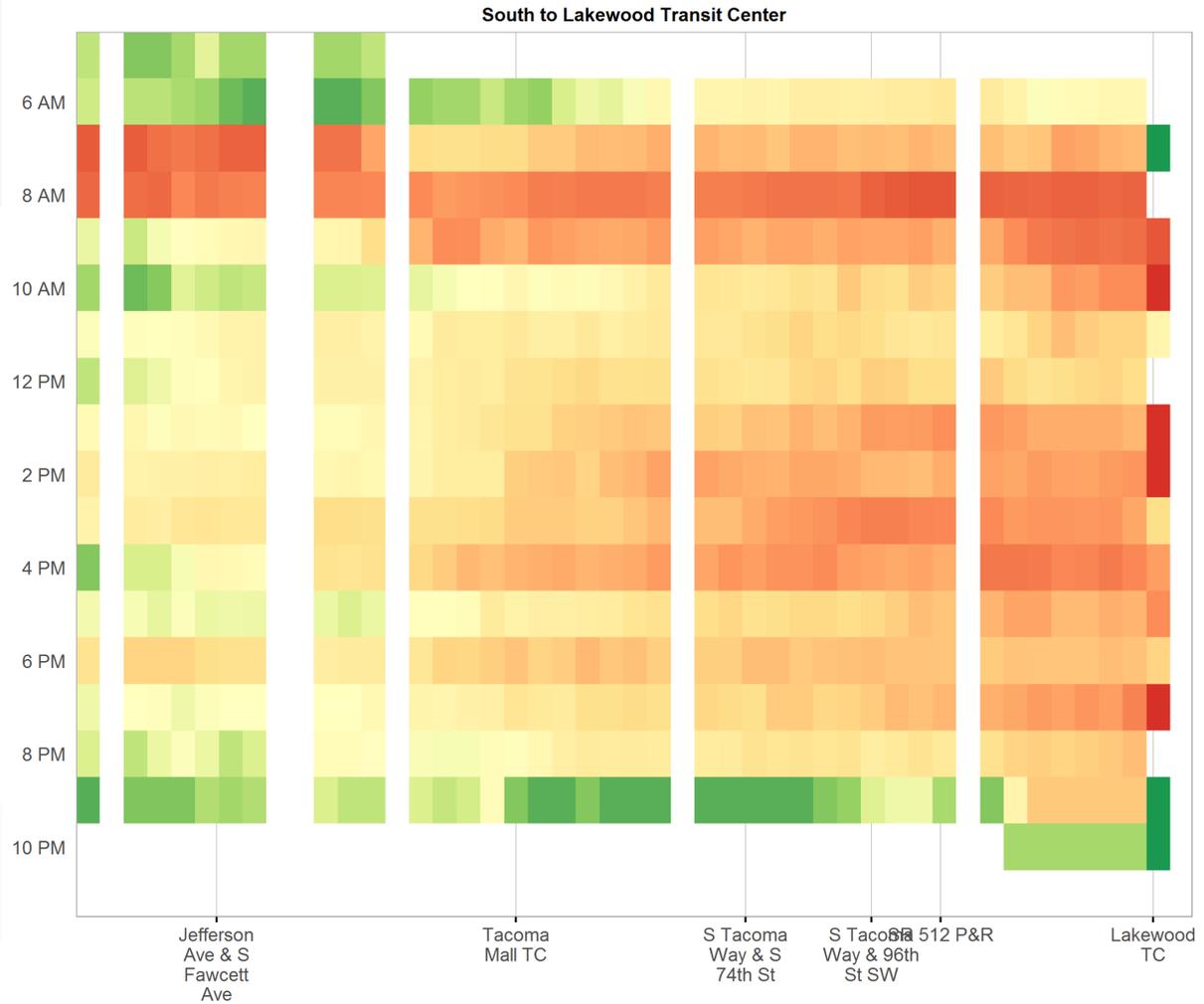
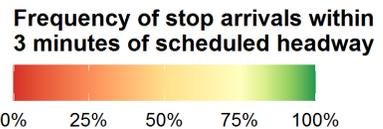
South to Lakewood Transit Center



Note: Horizontal axis is the full route, divided into 1/4 mile segments. White gaps are where there are no bus stops within each 1/4 segment.

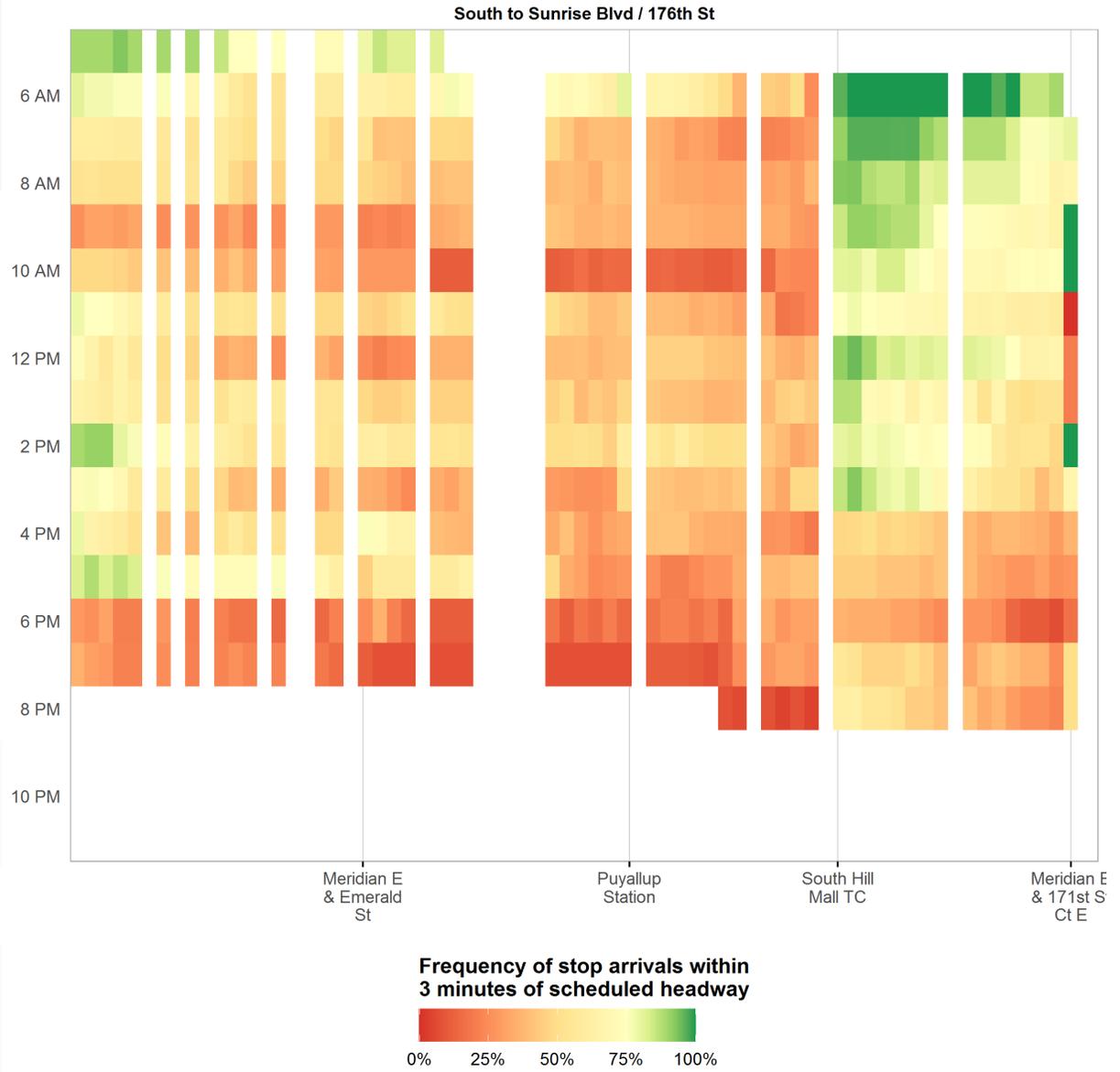
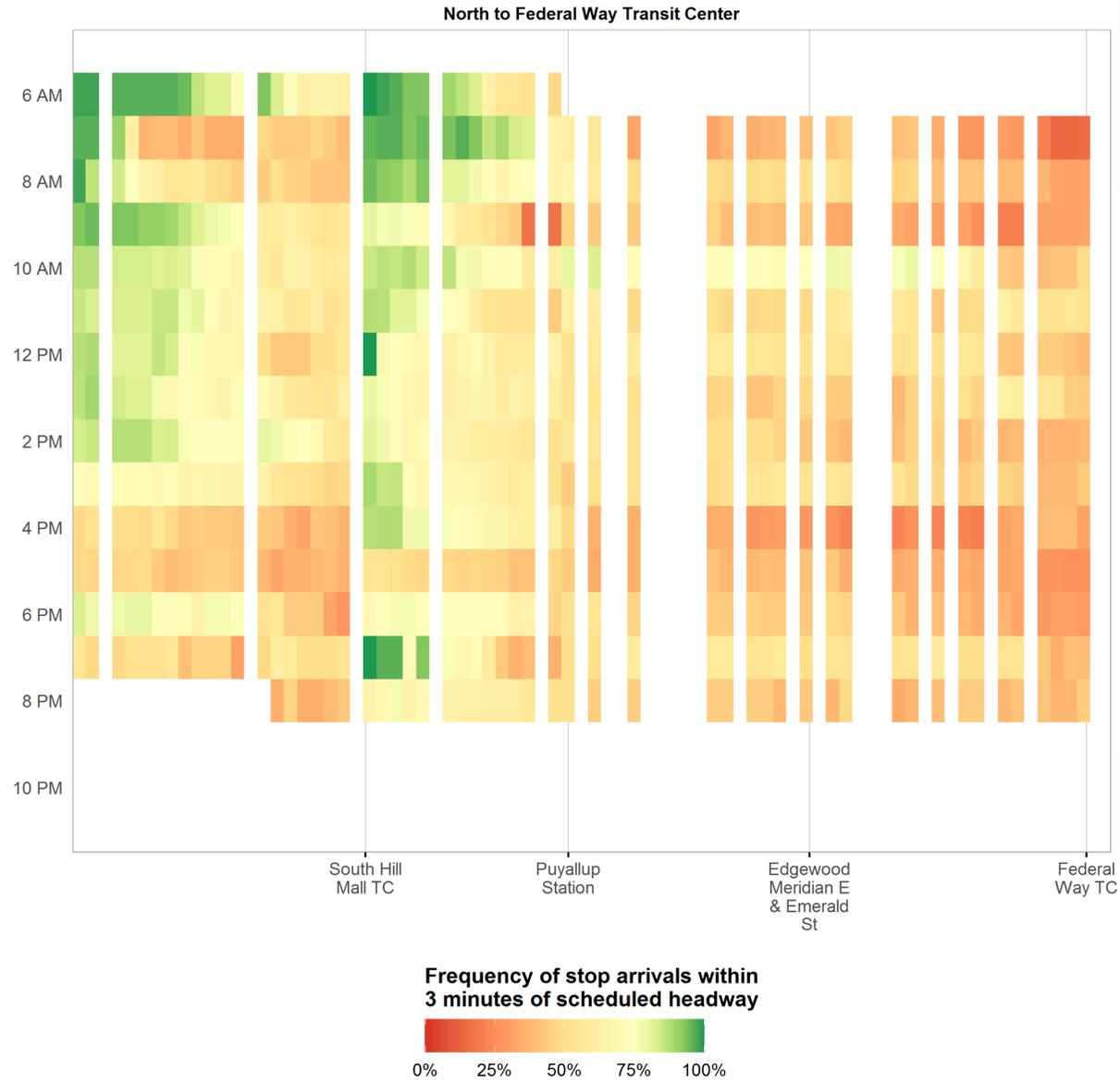
# Corridor B

## Route 3 – South Tacoma Way (Corridor B)



Note: Horizontal axis is the full route, divided into 1/4 mile segments. White gaps are where there are no bus stops within each 1/4 segment.

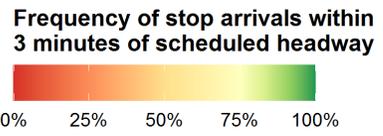
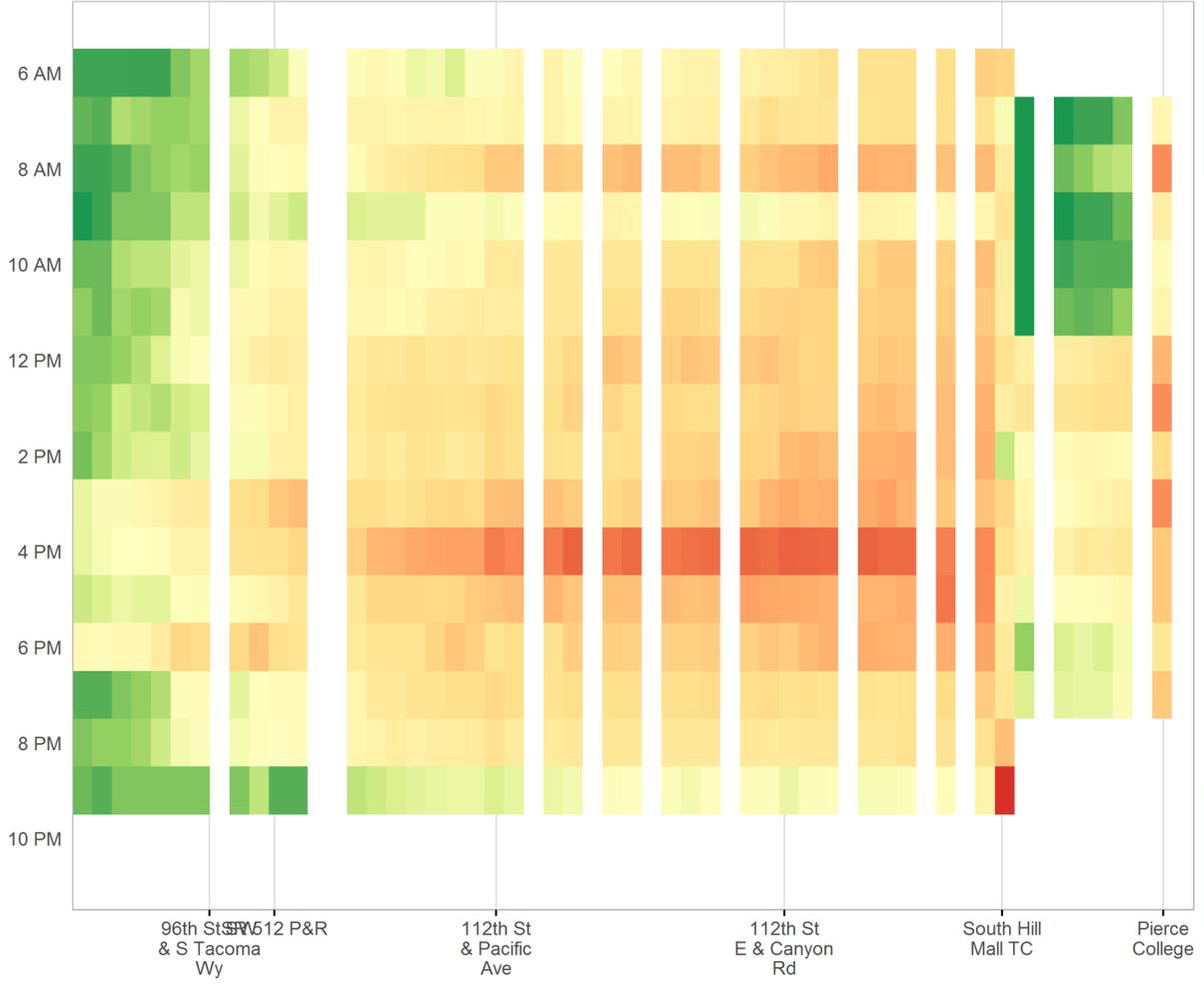
## Route 402 – Meridian/Federal Way (Corridor C)



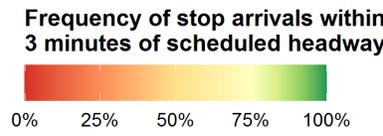
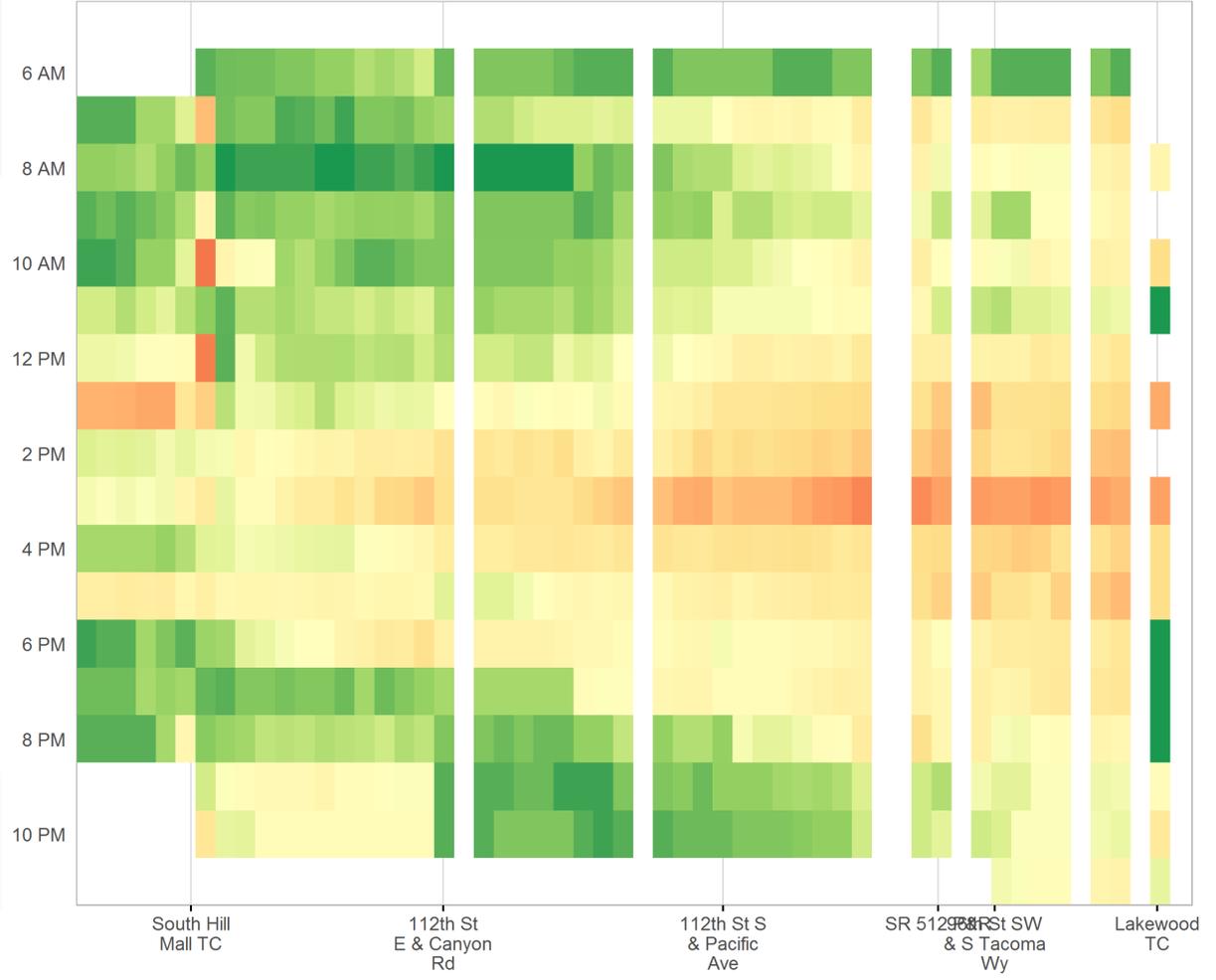
Note: Horizontal axis is the full route, divided into 1/4 mile segments. White gaps are where there are no bus stops within each 1/4 segment.

## Route 4 – S 112th St (Corridor D)

East to Pierce College



West to Lakewood Transit Center



Note: Horizontal axis is the full route, divided into 1/4 mile segments. White gaps are where there are no bus stops within each 1/4 segment.

# Dwell Time

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This section summarizes the dwell times along each of the corridors, and the relationship between passenger volumes and dwell.

*Dwell is the time when a bus is stopped at a bus stop to load or unload passengers.*

# Average Dwell Time per Trip

- Dwell time typically ranges from 10-15% of the total trip travel time along a route.
- Route 4 experiences relatively little dwell time on weekends, whereas Route 2 and 402 experience greater dwell time on Saturdays and Sundays.
- On weekdays, Route 3 experiences the least amount of dwell, whereas Routes 2 and 402 experience the highest.

**A**

2 - Bridgeport / S 19th St - North

12.3%

13.9%

16.1%

2 - Bridgeport / S 19th St - South

14.6%

18.8%

20.4%

**B**

3 - South Tacoma Way - North

10.7%

14.7%

14.3%

3 - South Tacoma Way - South

10.7%

12.6%

13.7%

**D**

4 - S 112th St - East

14.0%

7.7%

7.2%

4 - S 112th St - West

10.6%

8.9%

8.4%

**C**

402 - Meridian/Federal Way - North

12.7%

13.5%

16.9%

402 - Meridian/Federal Way - South

14.1%

13.3%

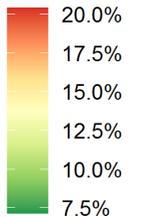
18.1%

Monday-Friday

Saturday

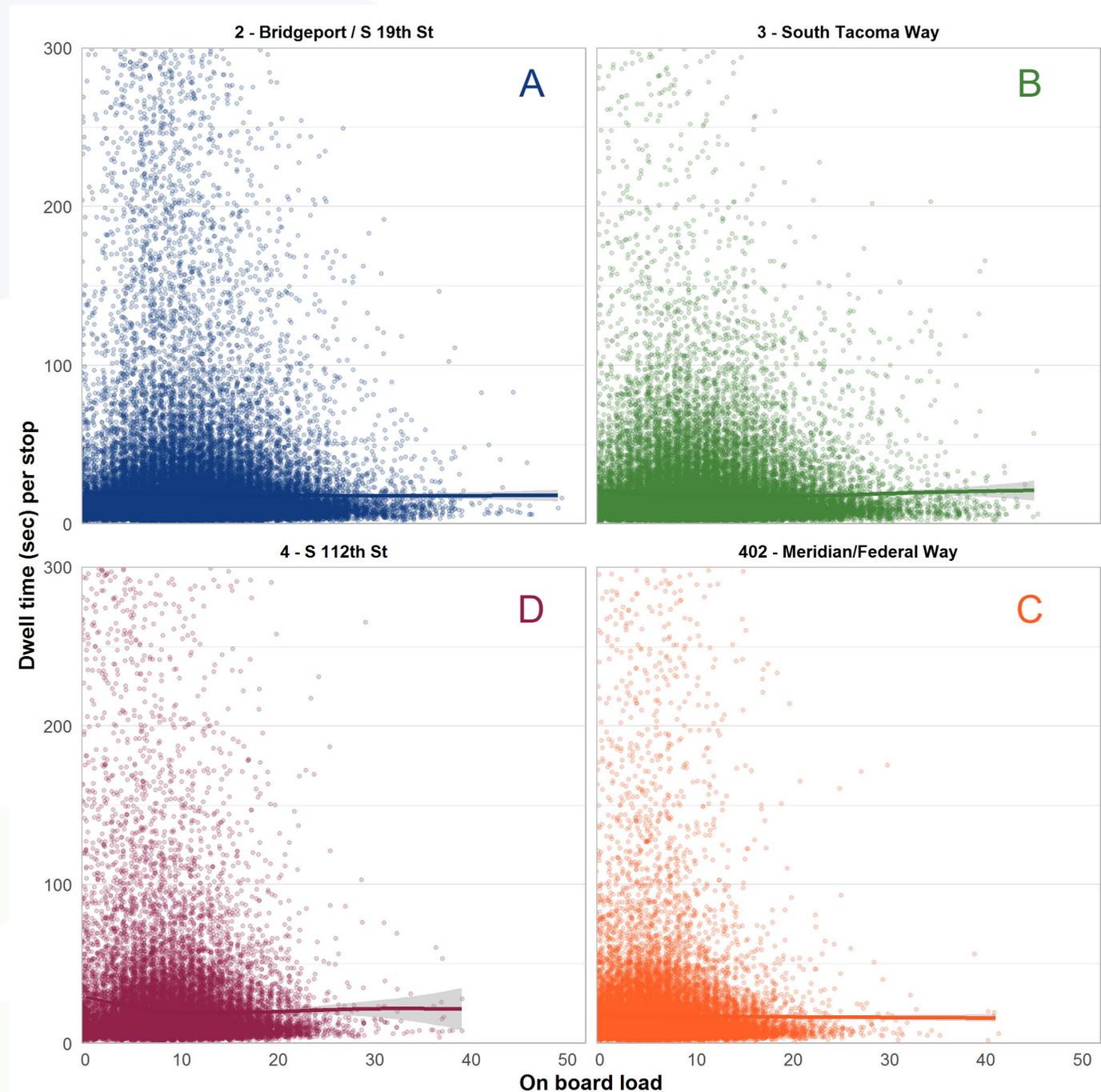
Sunday

Average dwell time as percent of trip time



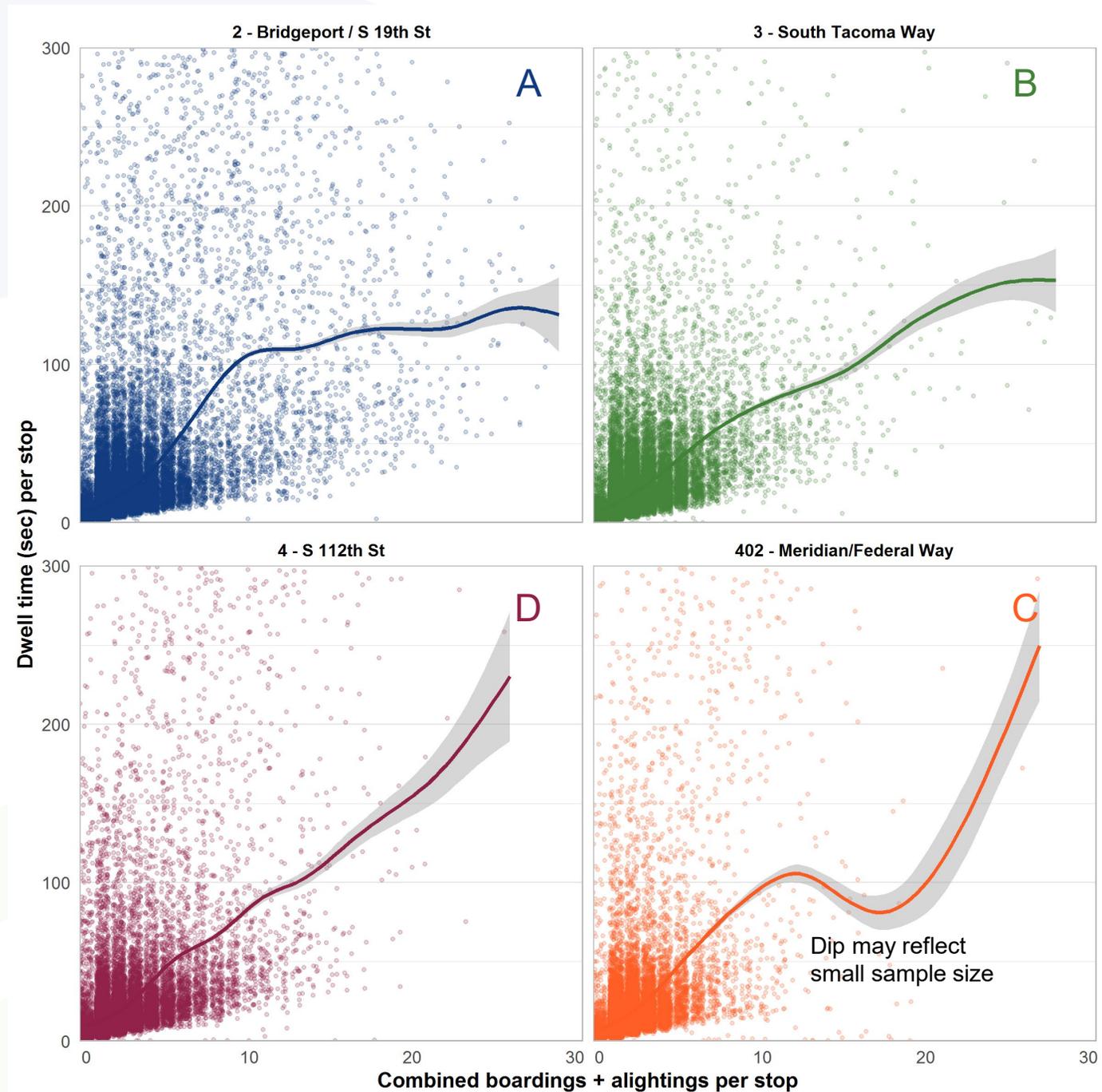
# Impact of On-Board Load on Dwell Time

- On trips with very high on-board loads, dwell times may be high because it takes passengers longer to get off or on a bus when there is limited space.
- However, data from observations on all routes indicate dwell time per stop does not increase noticeably with increased loads.
- However, loads on these corridors are not high enough for there to be a significant or noticeable effect on dwell.



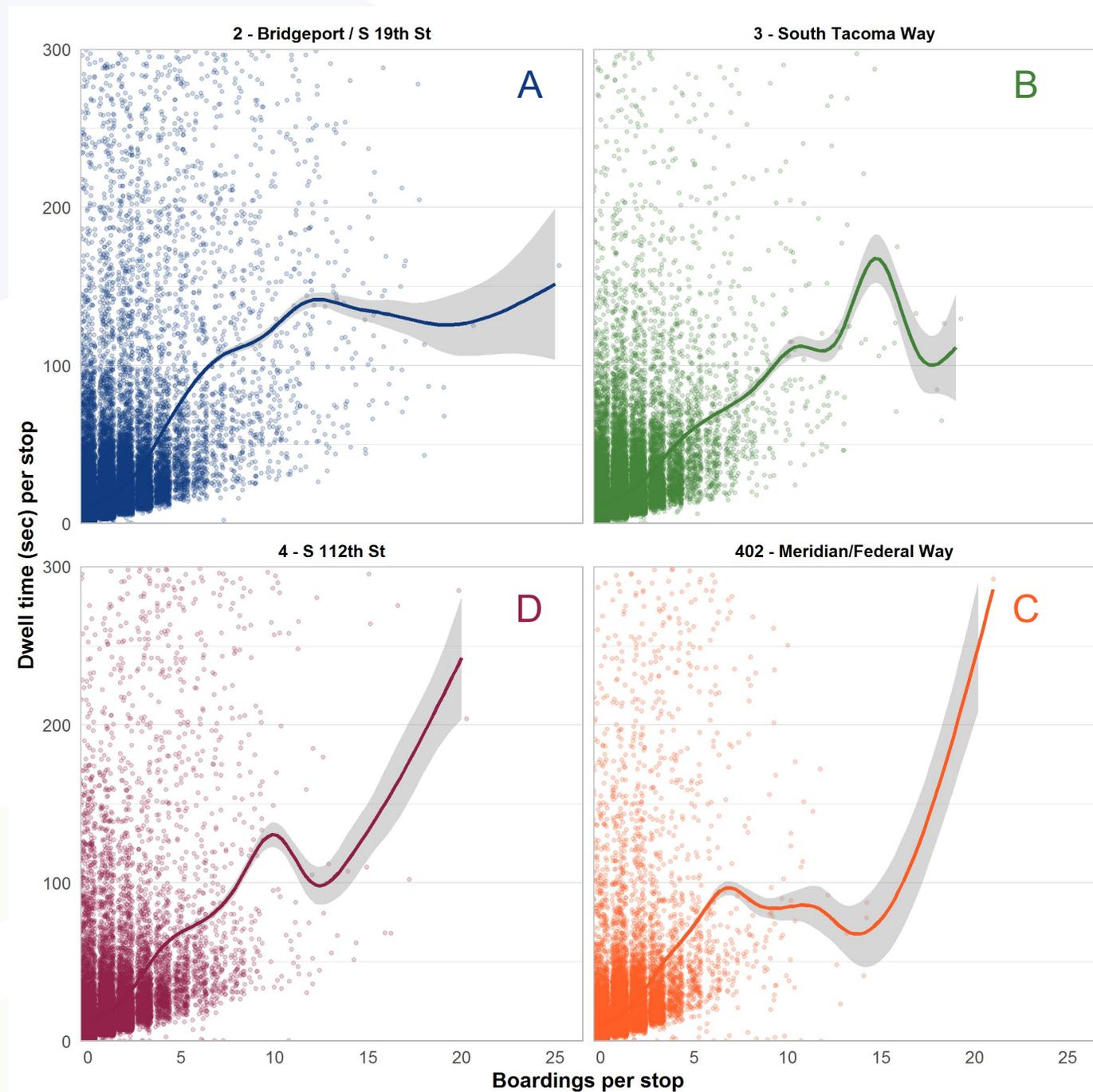
# Impact of Stop Activity on Dwell Time

- Dwell time is directly influenced by how long it takes passengers to get on or off the bus. Higher passenger volumes at a stop suggest dwell times will increase.
- The charts on the right show that dwell times increase as the combined stop activity (i.e., boardings plus alightings) increases.
- This suggests the busiest stops contribute most to dwell times.



# Impact of Boardings on Dwell Time

- Boardings usually take longer than alightings because of the need to pay a fare and find a seat. People getting off the bus may already be waiting at the door when the doors opening, reducing the dwell time needed for those passengers.
- The charts on the right show the amount of dwell time observed relative to the amount of people who board the bus. Dwell times tend to increase as boarding volumes also go up.



# Dwell Time Reduction Potential

- The table below shows the potential reduction in dwell time that passengers would experience on an average trip if stop spacing were reduced to every ¼ mile or every ½ mile.
- Routes 2, 3, and 4 would see a small reduction of up to a minute with ¼-mile spacing.
- All routes would see a reduction of more than 1 minute with ½-mile spacing.

Route	Avg stop spacing (A)	Average passenger trip distance (B)	Average stops per passenger trip (C = B / A)	Average dwell time per stop (D)	Average percent of stops that are served by a trip (E)	Average dwell time per passenger trip (F = C * D * E)	Dwell time reduction (1/4 mile)	Dwell time reduction (1/2 mile)
<b>A</b> Route 2	988 ft	5.36 miles	29	22.3 sec	31.6%	3.4 min	0.9 min	2.1 min
<b>B</b> Route 3	1,067 ft	5.91 miles	29	18.0 sec	33.7%	2.9 min	0.5 min	1.7 min
<b>D</b> Route 4	1,285 ft	6.25 miles	26	34.2 sec	23.8%	3.5 min	0.1 min	1.8 min
<b>C</b> Route 402	1,515 ft	4.98 miles	17	41.0 sec	26.4%	3.1 min	NA	1.3 min

Methodology Note: The reduction in dwell time was calculated by finding the difference in dwell time for different stop spacing (existing vs ¼ or existing vs ½ mile). The ¼ and ½ mile dwell times were calculated by multiplying the average dwell time per stop with the number of stops that would be placed along each route assuming the ¼ or ½ mile stop spacing) and then multiplying the result by the percent of stops that are served on a trip. The difference between these results and the existing dwell time are shown in the tables. These reductions do not include reduction of acceleration/deceleration time and do not factor in the increase in dwell time that would be experienced at stops due to more passengers boarding in fewer locations.

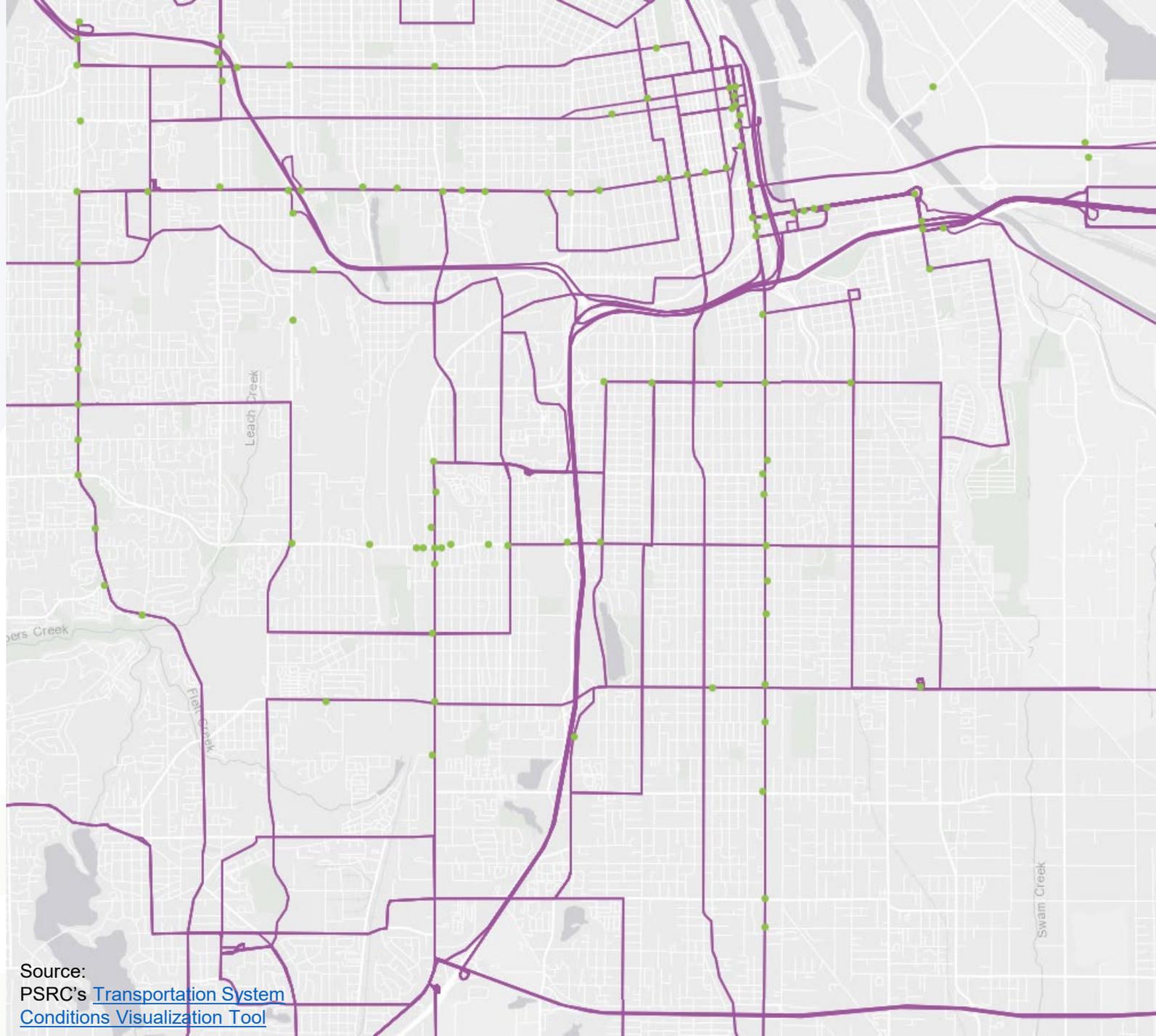
# Existing Transit Priority



This section shows the transit priority that exists today along the corridors. It also shows where TSP may not be feasible.

# Transit Signal Priority (TSP)

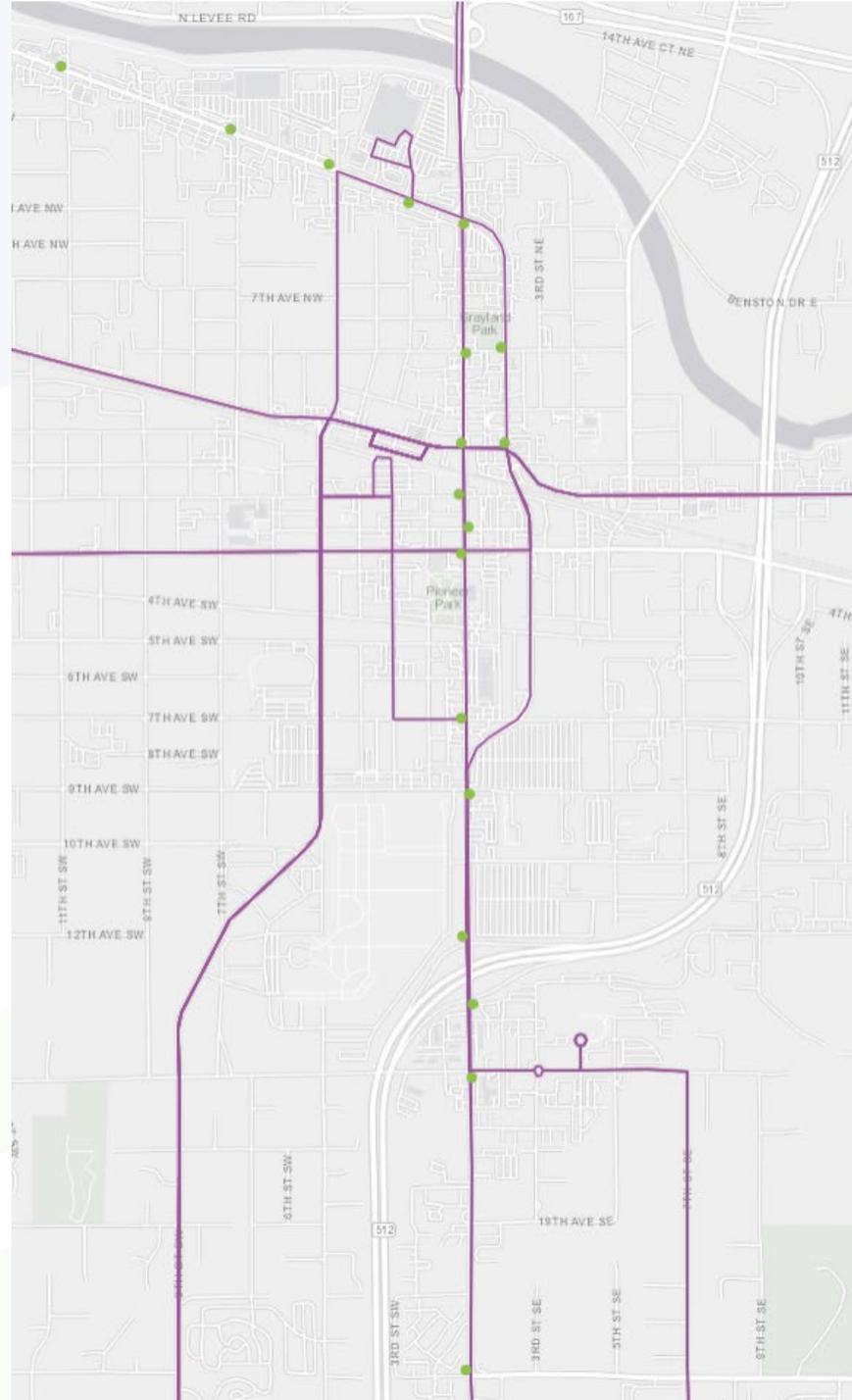
- Many signals throughout Pierce Transit's service area are enabled with TSP equipment.
- It is unclear if TSP is operating at these signals, and if so, how effective they are in ensuring transit reliability.



Source:  
PSRC's [Transportation System  
Conditions Visualization Tool](#)

# Transit Signal Priority (TSP) in Puyallup

- The City of Puyallup uses **adaptive signals** for a few limited corridors, including Meridian Road.
- Adaptive signals adjust their cycle timing based on roadway volumes, to keep most of the traffic moving as much as possible.
- Pierce Transit has been advised that the adaptive signals in Puyallup are **not compatible with TSP**.



Adaptive signals in Puyallup

Source:  
PSRC's [Transportation System Conditions Visualization Tool](#)

# Key Takeaways



This section summarizes the high-level findings.

# Takeaways

- Delay occurs throughout all corridors; however, it tends to be concentrated on Corridors A and B, and near South Hill Mall Transit Center.
- Delay tends to be highest in the afternoon and early evening. This is consistent with the time of day with the highest ridership.
- Most sections of the corridors have relatively consistent run times, but there are select locations and time periods when there is greater variability in travel times.
- Compared to vehicle travel times, transit travel times are 1.5-3 times longer.
- There are significant headway consistency issues on all routes, particularly on weekdays. The midday and early afternoon on all days of the week tend to experience the worst consistency.
- Dwell time typically ranges from 10-15% of the total trip travel time along a route.
- The busiest stops contribute most to dwell time because of the increased passenger activity.

