



MEMORANDUM

Madison Corridor BRT Study – Existing Conditions Memo #3: Transit Conditions

Prepared For: City of Seattle

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This memo summarizes existing transit conditions in the Madison BRT corridor, including an overview of existing services, stop locations and stop spacing, regional transit connections, and performance of the three routes that most directly serve the corridor: Routes 2, 11, and 12. Transit performance data were provided by King County Metro.

1 EXISTING TRANSIT SERVICE

Service Configuration

The existing transit network - including routes that travel along Madison, on parallel streets and/or via connecting streets - is shown in Figure 1-1. East-west transit service within the corridor is provided primarily by King Country Metro bus routes 2, 12, and 11. Routes operating on Madison include:

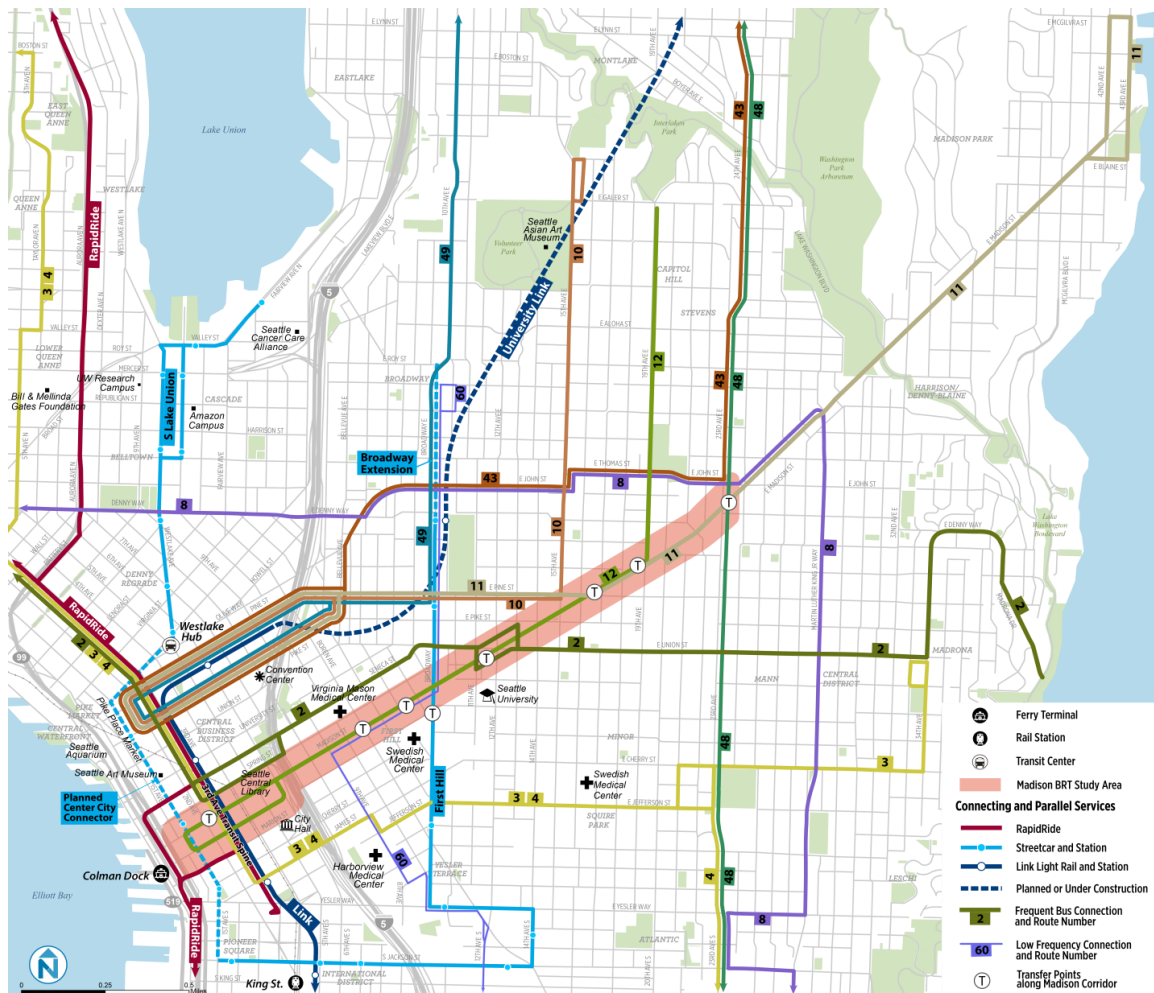
- **Route 12.** The most frequent service operating on Madison, Route 12 makes a counterclockwise loop of Madison, 1st Avenue, Marion and 6th Avenue in Center City and then traveling on Madison from 6th Avenue to 19th Avenue. From 19th Ave the route continues north to Galer Street and Interlaken Park. It operates as often as every five minutes during peak periods, with a mid-day weekday base headway of 15 minutes. It operates seven days a week from approximately 6 a.m. to 11 p.m.
- **Route 11.** While Route 12 operates on western segments of Madison, Route 11 operates on its eastern segments. At its western end, it makes a counterclockwise loop of Pine, 2nd Ave, Pike and Bellevue Ave before proceeding on Pine to Madison and out Madison to the Madison Park neighborhood, where it makes a counterclockwise loop of Blaine Street, 43rd Avenue, McGilvra Street and 42nd Avenue. Routes 11 and 12 overlap and share stops on Madison between 16th and 19th Avenues. Route 11 generally operates every 15 minutes on weekdays, with a period of 30-minute frequencies in the mid-day. It operates seven days a week over a longer span than Route 12, until almost 2 a.m. on weeknights.
- **Route 2.** Route 2 operates on only a short segment of Madison, eastbound between 11th and 12th avenues and westbound between 13th and 12th Avenues, in the “bowtie” area around the intersection of Madison and Union Street. However, it closely parallels western segments of Madison, operating on Seneca Street westbound and Spring Street eastbound between 3rd Avenue and Hubbell Street, just east of Interstate 5, and on Seneca, then Union on First Hill. East of Madison, it continues on Union to 34th Avenue, then on Denny Way and Madrona Drive to Lake Washington Boulevard and Madrona Park. In the west, it continues as Route 13 from Center City to Queen Anne. Route 2’s east-of-Center City segment generally operates every 15 minutes weekdays, and the service runs until well after midnight seven days a week.

Other service on Madison includes Route 60, which serves a portion of the corridor. Route 60 operates north-south from Capitol Hill to Georgetown, and on Madison between 9th Avenue and Broadway. It generally operates every 20 minutes weekdays. It also runs seven days a week, until around midnight on weekdays and 8 p.m. on weekends.

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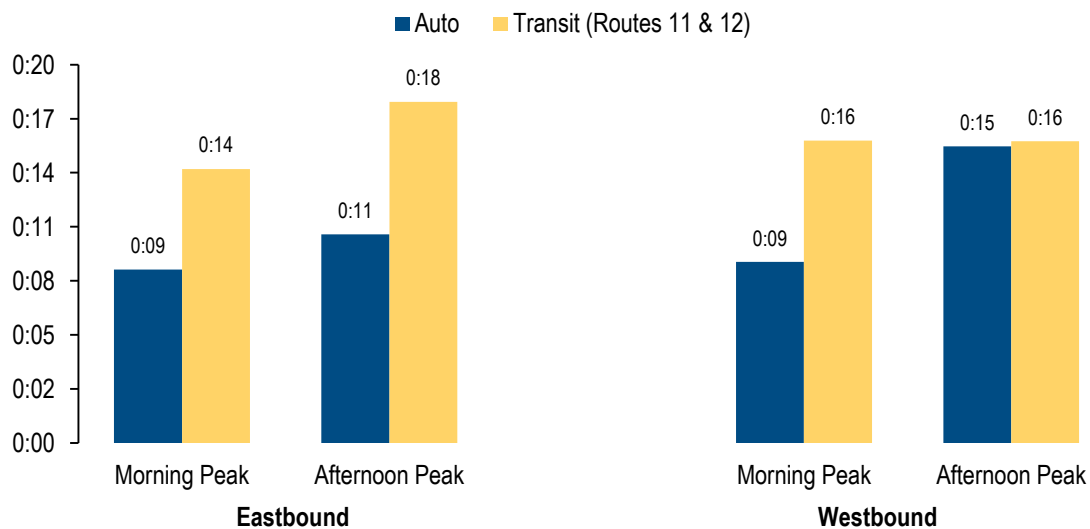
Downtown, important north-south connections can be made to regional bus service on Second, Fourth and Fifth Avenues, bus and Sound Transit Link light rail service in the Downtown Seattle Transit Tunnel (DSTT) below Third Avenue, and local routes on the Third Avenue transit spine. King County Metro Rapid Ride routes operate on Third Avenue and Alaskan Way, and the planned Seattle Center City Connector streetcar would operate on First Avenue, offering the potential for a shared BRT/streetcar stop on First. Outside of Downtown, north-south connections can be made to Route 60 (which shares a segment of Madison Street from Broadway to Ninth Avenue), the First Hill Streetcar (Broadway), Route 9 (Broadway), Routes 2/12 (Union), Routes 12/11 (19th), Route 48 (23rd), and Route 8 (MLK Jr. Way).

Figure 1-1 Existing Transit Network



The 2013 study of Madison BRT conducted by DKS included preliminary analysis of travel times, transit reliability, and turning movements in the corridor. Figure 1-2 shows travel times by auto and bus on Madison Street and Marion Street, where used by transit, between 2nd Avenue and 23rd Avenue. According to the analysis, travel time by bus is significantly slower than by auto in both directions in the AM peak period, and in the eastbound direction in the PM peak period.

Figure 1-2 Travel Times on Madison



Stop Locations and Spacing

Figure 1-3 shows distances between stops on Madison on Routes 11 and 12. On average, stops are every 650 feet apart eastbound and every 741 feet apart westbound. However, the distance between adjacent stops ranges from as little as 330 feet on Route 12 eastbound on Marion between First and Second avenues to as much as 1125 feet on Route 12 westbound between Ninth and Fifth avenues.

Figure 1-3 Bus Stop Spacing

Eastbound			Westbound		
Route	Cross Section	Distance to next stop (ft)	Route	Cross Section	Distance to next stop (ft)
11	17th Ave	480	11	23rd Ave E	605
11	18th Ave	835	11	22nd Ave E	550
11	20th Ave	530	11	20th Ave	522
11	22nd Ave	546	11	19th Ave	790
11	23rd Ave E	934	11	17th Ave	722
Route Average		665	Route Average		638
12	1st Ave	330	12	19th Ave	789
12	2nd Ave	637	12	17th Ave	850
12	4th Ave	646	12	15th Ave	873
12	6th Ave	972	12	13th Ave	1000
12	8th Ave	694	12	Broadway Ct	862
12	Boren Ave	615	12	Summit Ave	750
12	Summit Ave	604	12	Boren Ave	675
12	Broadway	903	12	9th Ave	1125
12	12th Ave	922	12	5th Ave	463
12	14th Ave	495	12	4th Ave	471
12	15th Ave	675	12	2nd Ave	813
12	17th Ave	462			
12	18th Ave	475			
Route Average		648	Route Average		788
Overall Average		653	Overall Average		741

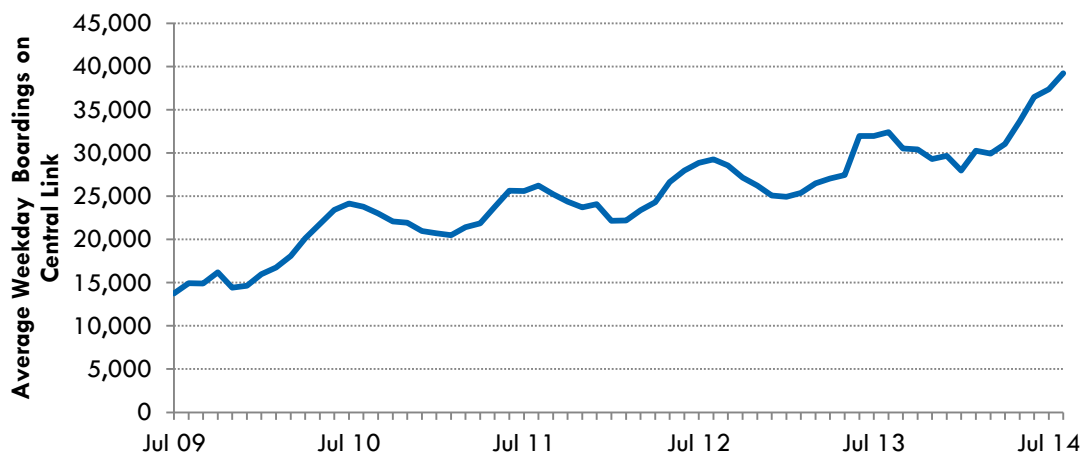
Regional Transit Connections

The Madison corridor provides important connections to transit services in Downtown Seattle, including a connection to ferry service at Colman Dock (within walking distance of the Route 12 terminus at First Avenue) and connections to Link light rail at Third Street (the nearest DSTT entrances for Link access are three blocks to the south of Madison at James Street, for Pioneer Square Station, and three blocks to the north at Seneca for University Station).

Upon completion of the University Link light rail extension in 2016, regional bus volumes in the DSTT will likely need to be reduced in order to maintain reliability for light rail service. However, overall ridership within the DSTT is likely to increase significantly with the opening of the extension, which will provide service between the existing line in Downtown Seattle, Capitol Hill and the University of Washington in addition to allowing three- and four- car trains to run on the entire system. The Northgate Link and East Link extensions are expected to open by 2023.

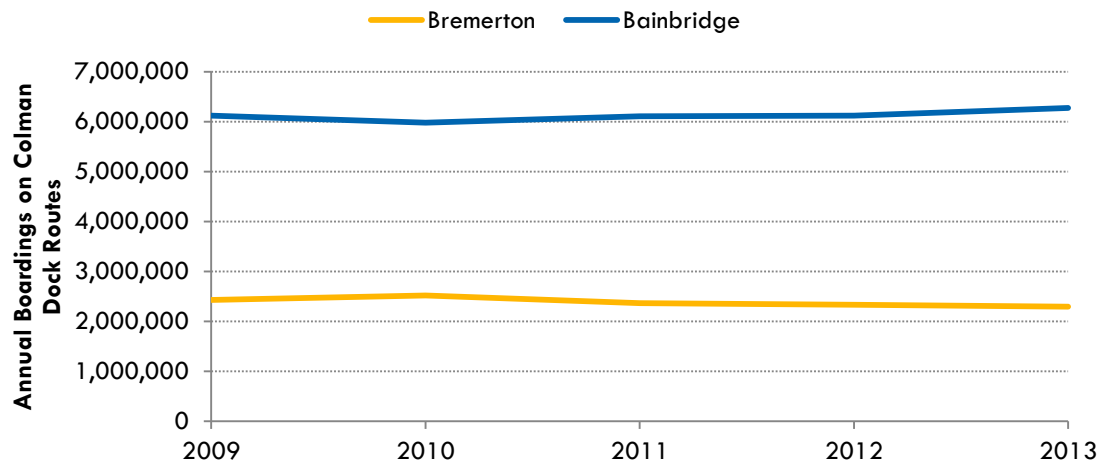
Ridership has continued to increase year-over-year on the existing Central Link segment since it opened in 2009. Figure 1-4 shows that average weekday boardings have risen from around 15,000 when the line opened to nearly 40,000 in July 2014. Central Link had almost 10 million boardings in 2013, with 2014 on track to surpass that number.

Figure 1-4 Monthly Boardings on Central Link, 2009-2014



Colman Dock, also referred to as the Seattle Multimodal Terminal at Colman Dock, is also an important connection for Madison Street, with Seattle-Bremerton and Seattle-Bainbridge ferry service, as well as King County water taxi service to Vashon Island and West Seattle. A pedestrian bridge connects passengers from the ferry terminal to First Avenue alongside Marion. In 2013, Colman Dock served more than 8.5 million passengers, of which 4.4 million were foot passengers. However, due to constrained capacity, the ferry and water taxi markets are unlikely to grow significantly in the future. Figure 1-5 shows that annual ridership on the Bremerton and Bainbridge ferries has remained nearly constant since 2009. Colman Dock is scheduled for extensive reconstruction between now and 2021, with improved pedestrian and bicycle connections including partial reconstruction of the Marion Street pedestrian bridge.

Figure 1-5 Annual Ferry Boardings on Bremerton and Bainbridge Routes, 2009-2013



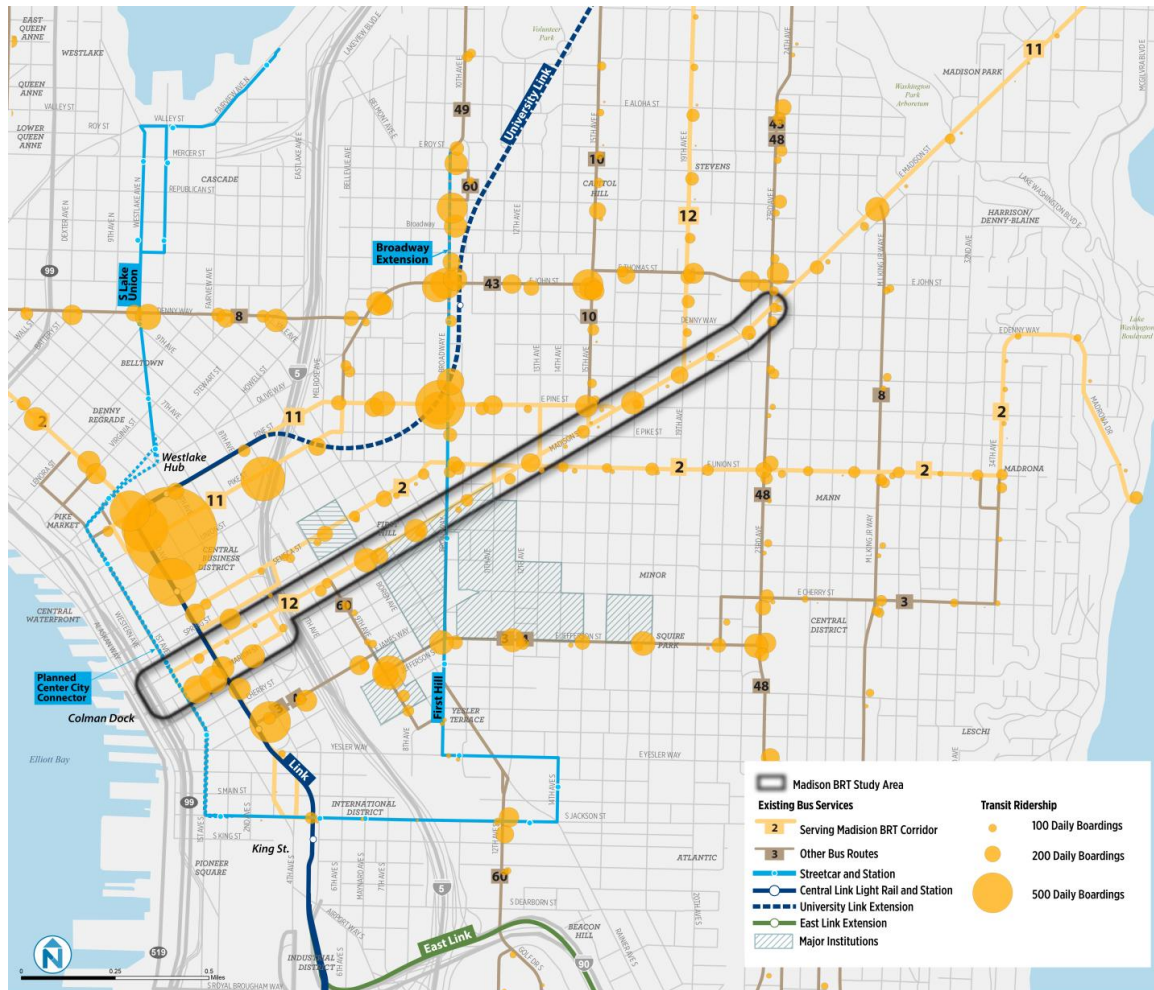
2 TRANSIT PERFORMANCE

Overview

Analysis of ridership and reliability was conducted for Routes 2, 11, and 12, which provide the bulk of east-west service in the Madison corridor. Additional ridership analysis was conducted for several routes that intersect the corridor, including Routes 2, 3, 8, 10, 11, 12, 43, 48, 49, and 60. Route 9X was not included in this analysis as it does not stop at Madison, but stops instead at E Union and E Marion. Ridership on Route 9X is approximately 40 people per day at the Marion stops and 80 people per day at the Union Stops. Route 84, which provides night owl service between Downtown Seattle and Madison Park using the Route 11 alignment, was also not included in ridership numbers. All data in this memo uses data from King County Metro's Fall service period unless otherwise noted.

The total ridership on Madison Street between the waterfront and 23rd Avenue is 2,566 boardings per day. Figure 2-1 shows total daily boardings for the routes significant to the Madison Corridor listed above. Ridership east-west through the corridor is relatively evenly split between Route 2 and Route 12, which run parallel through most of Downtown and First Hill, although ridership is slightly higher on this portion of Route 12. The most boarding activity on Madison Street occurs in Downtown Seattle, in First Hill at Boren and Summit, at 17th Avenue, and at 23rd Avenue. When the First Hill Streetcar begins operation, the nearest stop will be just off Madison Street at Marion and Broadway.

Figure 2-1 Ridership on Madison-Area Bus Routes



As shown in Figure 2-2, performance on Routes 2, 11, and 12 is mixed. While all three routes perform in the top 25 percent of King County Metro routes in terms of boardings per platform hour during peak period, Routes 11 and 12 perform in the bottom 25 percent of routes for passenger miles per platform mile during some or all time periods. This is to be expected given the short length of the corridor, and resulting relatively short trips taken by most passengers.

Figure 2-2 2013 Performance Metrics for Routes 2, 11, and 12

Route	Peak		Off Peak		Night	
	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile
Route 2	49.1*	11.4	45.7	9.8	29.8	6.8
Route 11	52.7*	10.2^	48.7	9.4^	38.4*	6.5
Route 12	50.6*	9.5^	38.0	6.3^	16.4^	2.7^

*Denotes performance in the top 25% of all King County Metro Routes.

^Denotes performance in the bottom 25% of all King County Metro Routes.

Figure 2-3, Figure 2-4 and Figure 2-5 show average on-time performance by route from June 2013 through May 2014. A bus is considered on-time if it is between 1 minute early and 5 minutes late. A trip is considered early if it is more than one minute early, and late if it is more than 5 minutes behind schedule at the route's final timepoint. With the exception of Route 12 on Saturdays and Sundays and Route 2 on Sundays, all routes are below the King County Metro target of 80 percent schedule adherence (based on a standard of no more than one minute early or five minutes late at schedule timepoints). On-time performance is lowest on Route 11, ranging from 67 to 69 percent on-time. Approximately one-quarter of all weekday arrivals and departures on Routes 2 and 11 are five or more minutes behind schedule.

Figure 2-3 Weekday On-Time Performance by Route

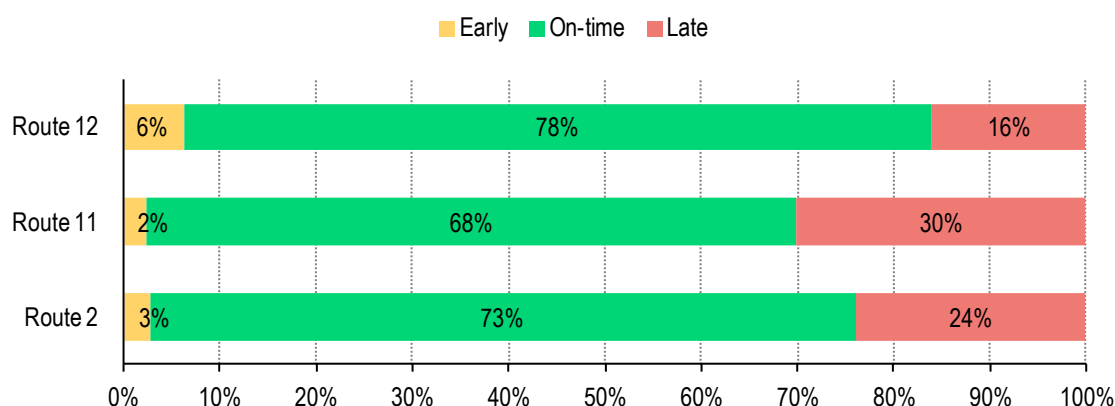


Figure 2-4 Saturday On-Time Performance by Route

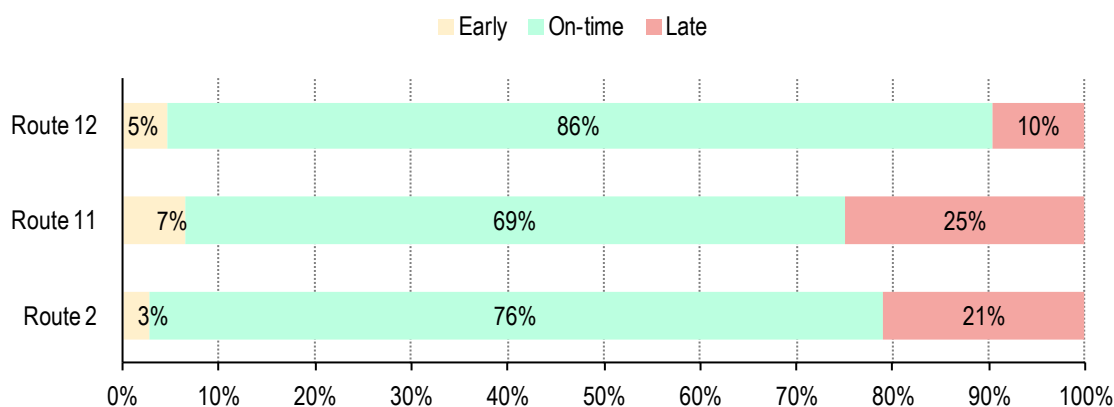
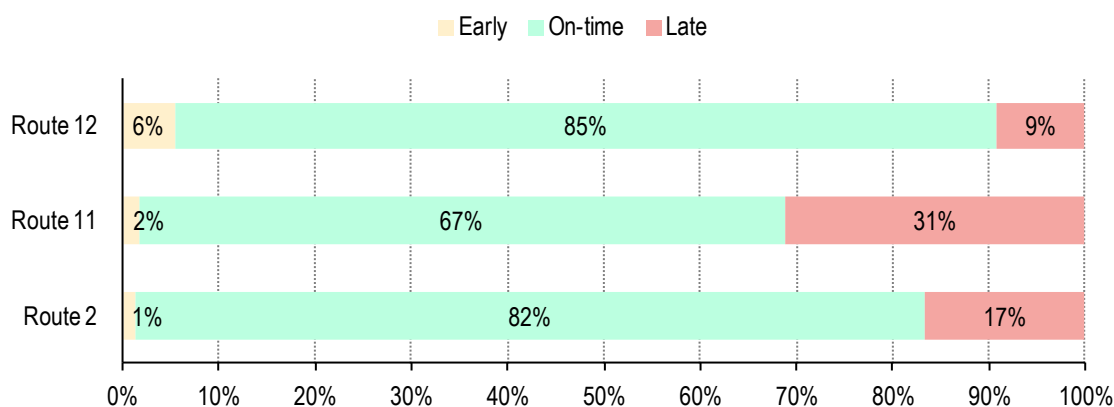


Figure 2-5 Sunday On-Time Performance by Route



Based on the 2013 performance evaluation of overcrowding and on-time performance, the King County Metro 2013 Service Guidelines report offered several recommendations for Routes 2 and 11:

- Route 11: Overcrowding on two weekday trips. Recommended action: add one trip in AM peak.
- Route 11: Low on-time performance all day (23 percent of trips late), on Saturdays (22 percent of trips late), and Sundays (22 percent of trips late). Recommended action: invest 350 service hours.
- Route 2: Low on-time performance on Saturdays (24 percent of trips late). Recommended action: no immediate action but future investment.

The following sections provide additional detail on ridership and reliability for Routes 2, 11, and 12. Individual route performance is based on data provided by King County Metro for the Spring 2014 service period.

Route 2 Evaluation

Ridership

Figure 2-6 and Figure 2-7 show total boardings and maximum load by trip for the portion of Route 2 that operates between 3rd Avenue and Spring/Seneca and Madrona, since this portion of the route is more relevant to service planning for the Madison corridor.

Outbound (eastbound in this segment), the maximum load on nearly all trips exceeds the number of boardings on the eastern segment of the route, meaning that a high number of passengers are already on board by the time buses reach Spring. These data also reveal that a significant number of passengers who board westbound on the Madrona-Downtown segment ride through beyond Seneca to Downtown Seattle, Belltown, Uptown, or Queen Anne. There appear to be relatively few passengers boarding along Spring/Seneca to reach destinations to the east, although boardings along this segment increase in the afternoon peak period.

Both directions experience peaks in the morning and afternoon peak, although outbound boardings are highest in the afternoon and inbound boardings are highest in the morning, reflecting a downtown orientation. Relatively few trips exhibit maximum loads above the seated capacity of 42 passengers, although several inbound morning trips have maximum loads of 40 to 50 passengers. Ridership declines in both directions after 7 p.m., when service is reduced to every 30 minutes.

Figure 2-6 Route 2 (East Segment) Outbound Boardings and Loads

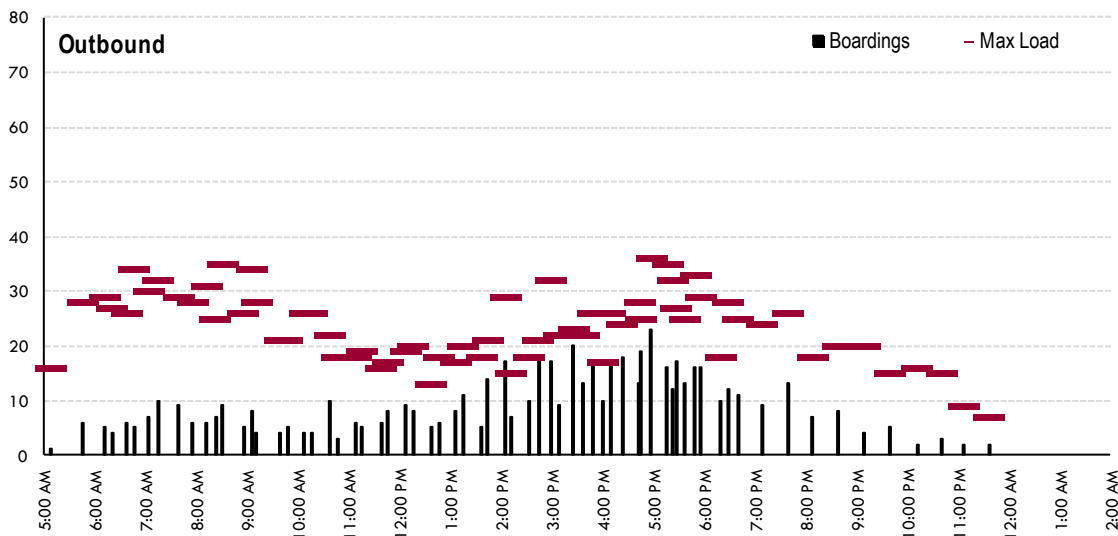
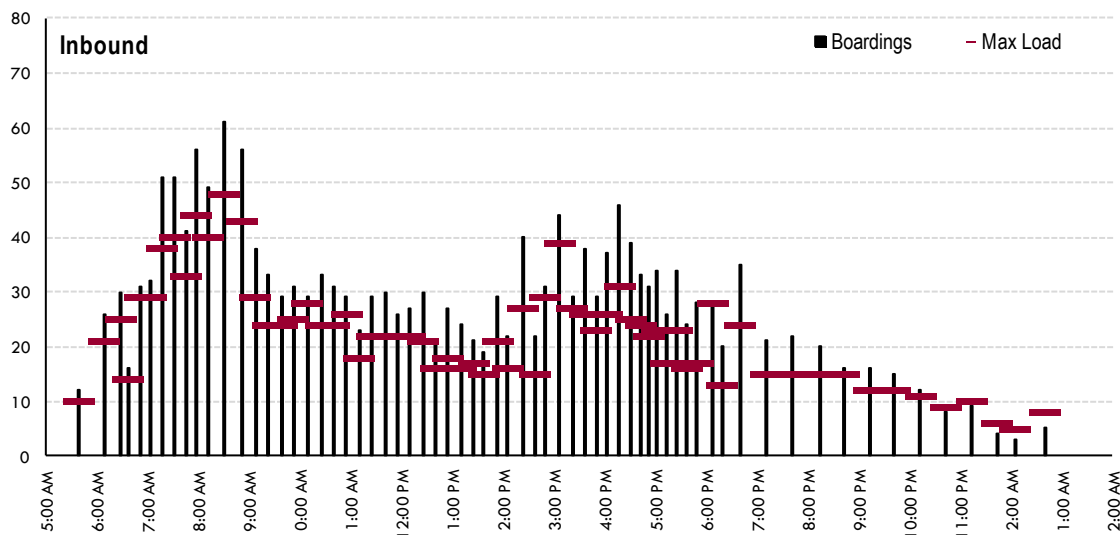


Figure 2-7 Route 2 (East Segment) Inbound Boardings and Loads



Route 11 Evaluation

Ridership

Route 11 has strong all-day ridership in both directions, with relatively small declines in ridership mid-day. This may reflect strong two-way, all-day demand for service to Seattle Central Community College as well as to the Downtown retail core. Although maximum loads are higher than on Route 2, Route 11 operates many trips with longer articulated vehicles, so there is additional capacity. Although ridership does not appear to be highly downtown/peak-oriented, boardings are highest inbound in the morning peak and outbound in the afternoon peak. Outbound in the afternoon peak, loads on at least one trip approach 60 passengers. Ridership remains high midday despite a decrease in service frequency to every 30 minutes, declining most significantly after 10 p.m., when service operates only every hour.

Figure 2-8 Route 11 Inbound Boardings and Loads

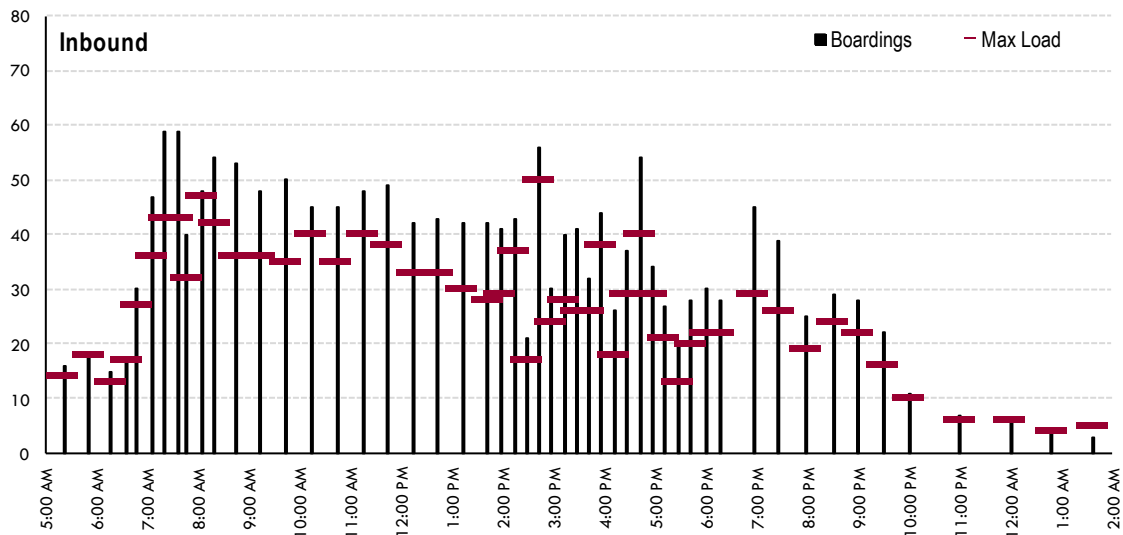
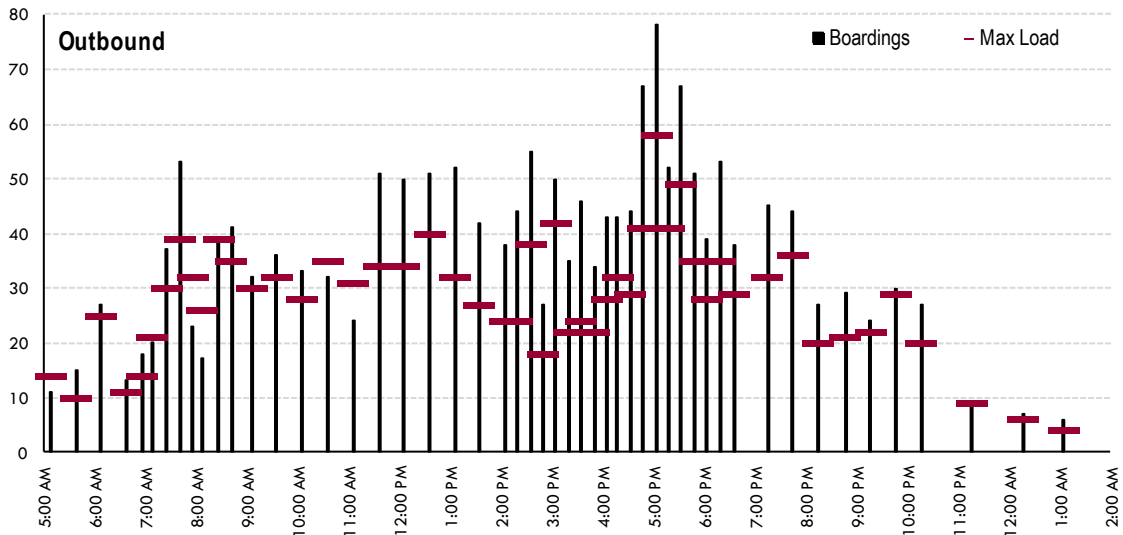


Figure 2-9 Route 11 Outbound Boardings and Loads



Travel Time

A travel time evaluation was conducted on the portion of Route 11 that operates on Madison Street. Figure 2-10 and Figure 2-11 show average travel time as well as the 25th-percentile travel time and 75th-percentile travel time using averaged King County Metro Automatic Vehicle Location (AVL) data from the spring service period. The data show variation in travel time by time of day for Route 11 between 17th and MLK Jr. Way, which includes the highest-ridership portion of Madison Street.

The outbound direction has the largest variation in travel time, from as little as three minutes in the early morning and late at night to up to eight minutes in the evening peak

period. Travel time gradually increases throughout the morning and afternoon until peaking around 6 p.m., at which point travel time declines. Inbound, there is a smaller range of travel times, ranging from four to six minutes for most of the day. The longest travel times and greatest variability between average and 75th-percentile travel times both occur in the morning peak period. The afternoon peak also exhibits greater variability in travel time between average and 75th-percentile times.

Figure 2-10 Route 11 Inbound (Madison Segment) Travel Time by Time of Day

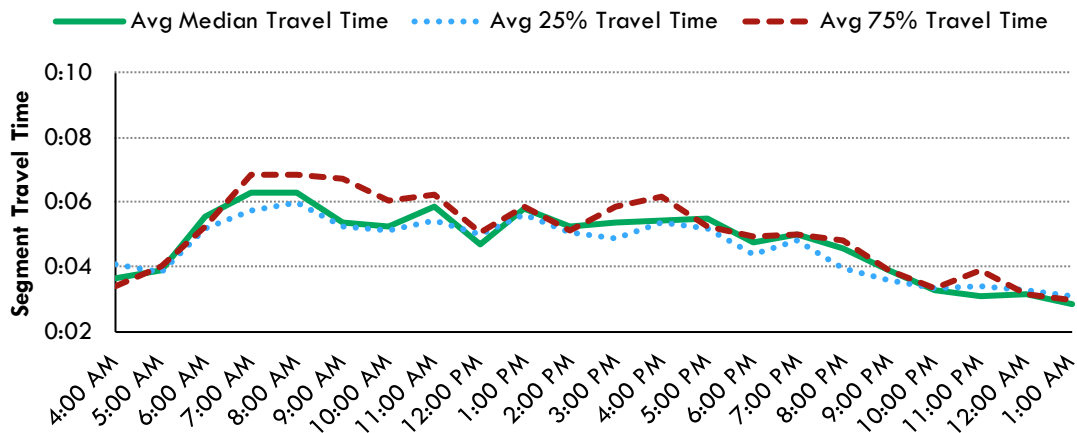
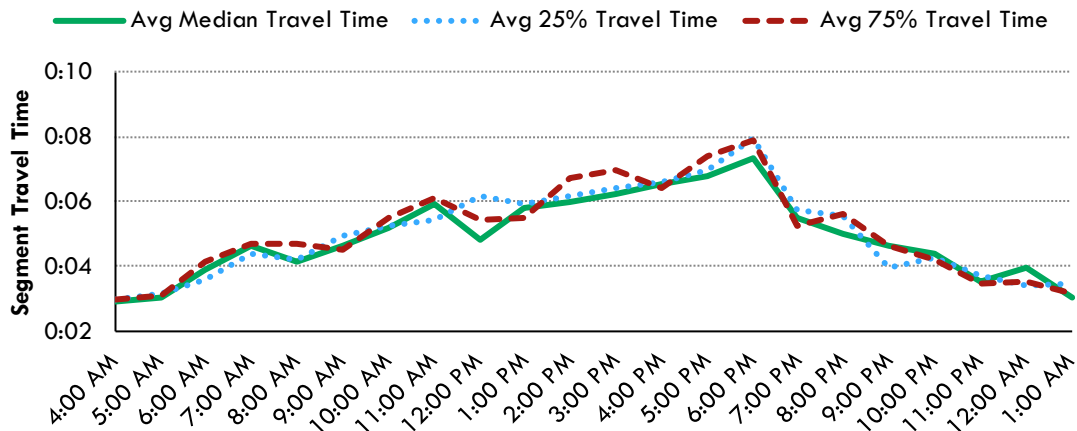


Figure 2-11 Route 11 Outbound (Madison Segment) Travel Time by Time of Day



Route 12 Evaluation

Ridership

Route 12 has strong bi-directional ridership during peak hours, with lower ridership midday and in the evening. Outbound, maximum loads are fairly similar in the morning and afternoon peak, while inbound peak loads are higher in the morning peak. Ridership is much lower midday, and not surprisingly tails off in the evenings as service ends at 11 p.m.

Figure 2-12 Route 12 Inbound Boardings and Loads

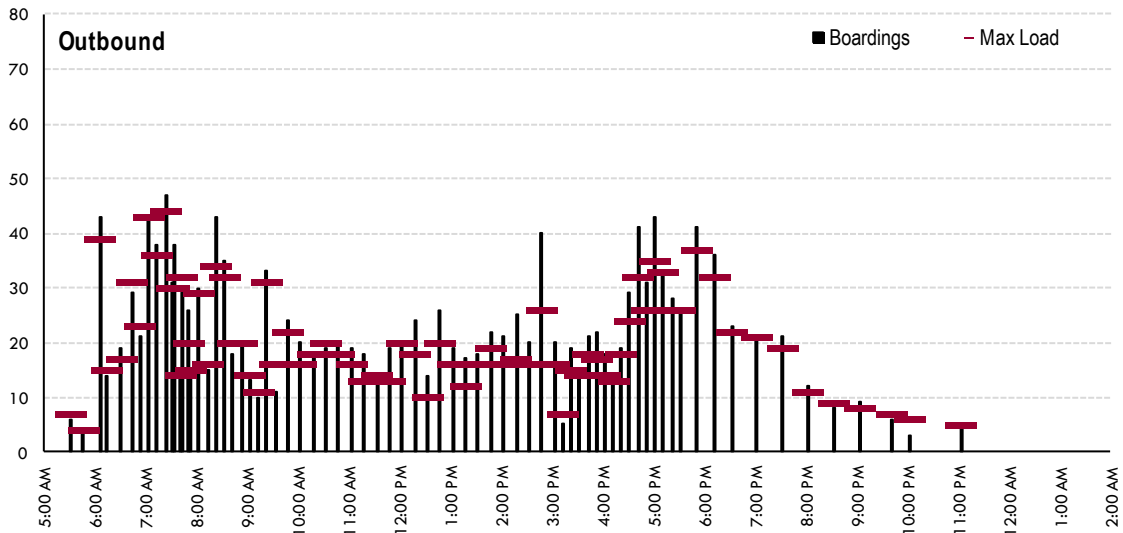
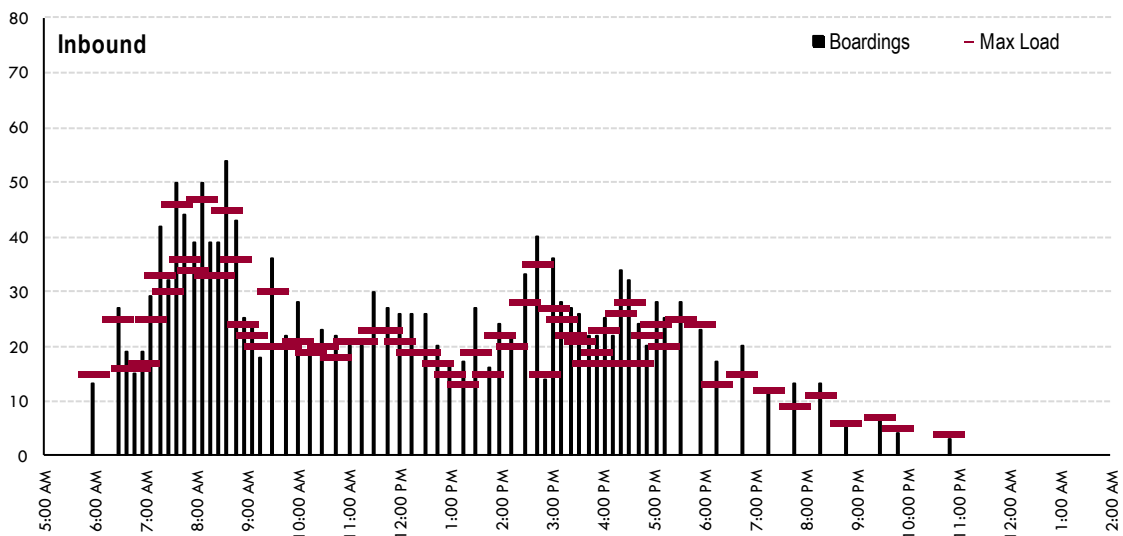


Figure 2-13 Route 12 Outbound Boardings and Load



Travel Time

Figure 2-14 through Figure 2-17 show travel time and travel time variance between the median travel time and 25th-percentile and 75th-percentile travel times. Inbound, travel time is twice as long in the afternoon as it is in the early morning and evening, with 75th-percentile travel times as great as 12 minutes from Downtown to Broadway.

Figure 2-14 Route 12 Inbound Downtown and First Hill Segment Travel Time by Time of Day

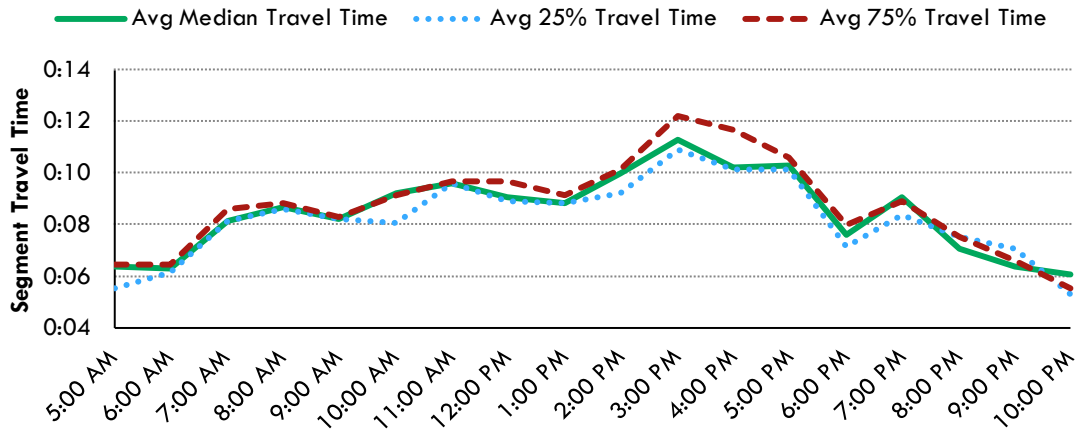


Figure 2-15 Route 12 Inbound East Segment Travel Time by Time of Day

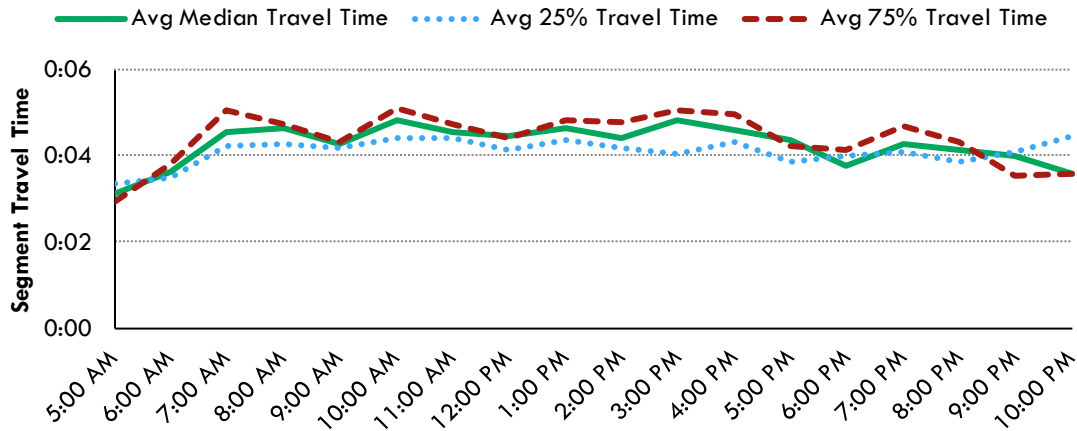


Figure 2-16 Route 12 Outbound Downtown and First Hill Segment Travel Time by Time of Day

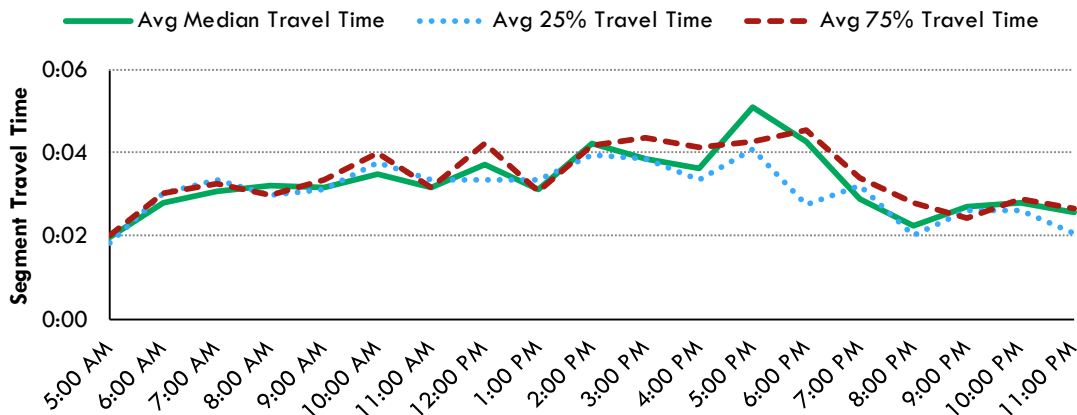
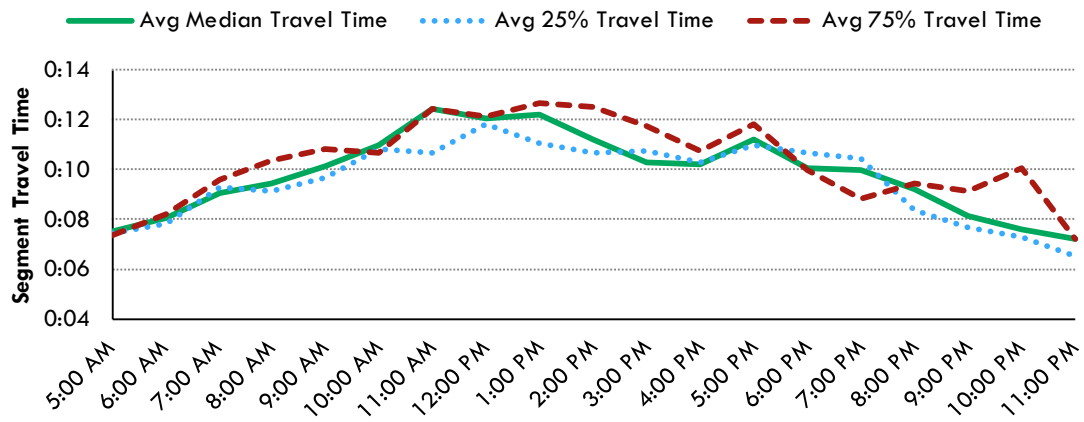


Figure 2-17 Route 12 Outbound East Segment Travel Time by Time of Day



3 TRANSIT INFRASTRUCTURE

Existing Trolley Wire

Figure 3-1 shows existing overhead wire or Overhead Contact System (OCS) infrastructure for electrically powered trolleybuses. Routes 2 and 12 both currently operate as trolleybuses. There are several trolleybus turnarounds in Downtown Seattle, including the Madison/Marion/First Avenue turnaround currently used by Route 12. Additional turnarounds are located in Pioneer Square and in the Downtown core. There is no existing overhead wire on Pine Street between Madison and 15th Avenue, and no wire east of 19th Avenue on Madison, which has potential implications for service planning in the corridor. While trolleybuses are best suited to the steep grades on Madison through Downtown and First Hill, continuing trolley service all the way through Madison to Madison Park would require a significant amount of new wire.

Figure 3-1 Existing Trolley Wire

