

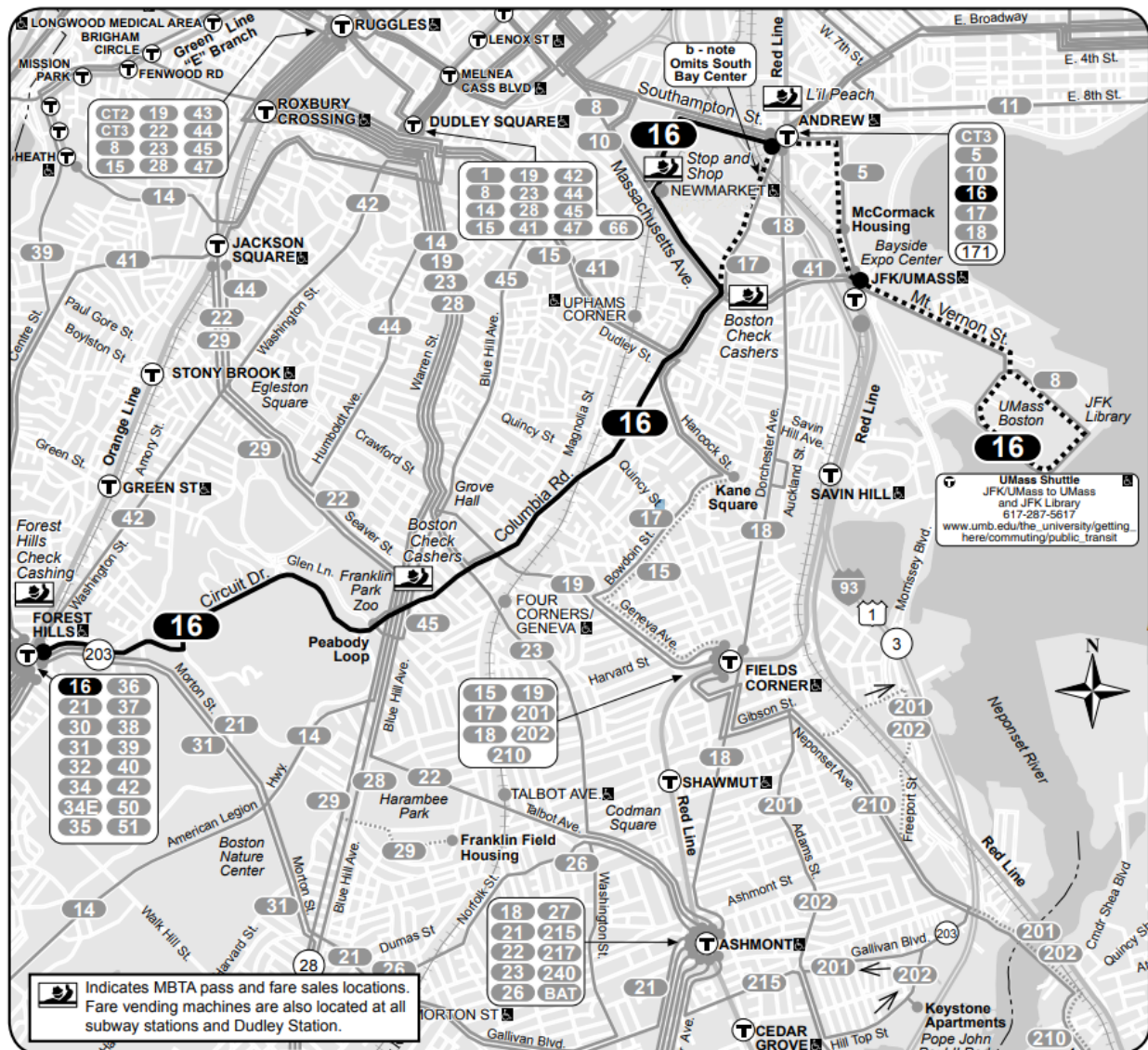
Route 16

Forest Hills Station – Andrew Station or UMass

Route Overview

Route 16 Forest Hills Station – Andrew Station or UMass is a local crosstown route that operates between Forest Hills Station and Andrew Station via Columbia Road and the South Bay Shopping Center. Some service also extends to UMass-Boston.

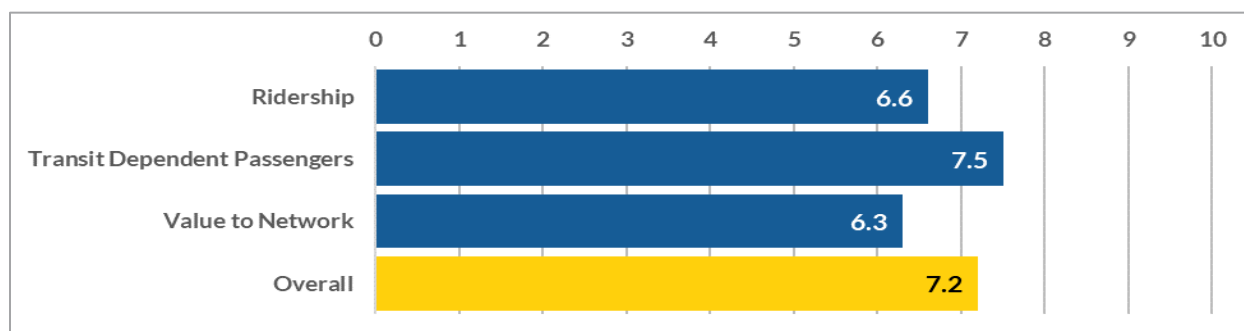
Figure 1 | Service Map



Network Importance

Route 16 is important to the MBTA bus network overall. On a relative scale of 0 to 10, the route rates 6.6 in terms of ridership, 7.5 in terms of transit dependent ridership, and 6.3 in terms of its value to the network (which reflects the number of people who are uniquely served, the number of jobs and other important destinations, and the number of transferring passengers). Its overall score, which gives a 70% weight to overall ridership and a 15% weight to both other measures, is 7.2 (see Figure 2)

Figure 2 | Relative Importance within MBTA Bus Network (on a scale of 0 to 10)



Service Overview

Schedule

On weekdays, Route 16 operates from 5:00 AM to 1:46 AM (see Table 1). From the beginning of service through 10:00 PM, average frequencies range from 15 to 27 minutes. After 10:00 PM, frequencies average 42 minutes.

Note also that Route 16 provides more outbound service than inbound service (64 trips versus 54). Most of these additional outbound trips are provided using 60-foot buses, which are operated in-service on Route 16 and then become Route 39 trips after reaching Forest Hills Station. This arrangement allows additional Route 16 trips at limited additional cost when there is high demand, and results in higher ridership outbound than inbound (as discussed further below.)

On Saturdays, service operates from 4:47 AM to 1:38 AM. Service operates every 30 minutes for most of the day, but with longer frequencies in the early morning and late evening that range from 45 to 70 minutes.

On Sundays, service operates from 6:40 AM to 1:28 AM. Service operates every 35 to 40 minutes for most of the day, but with longer frequencies in the early morning and late evening that range from 45 to 50 minutes.

Route 16 meets the MBTA's span of service standards for local routes on all days. It also meets the service frequency standards most of the time, but not on Saturday evenings when service operates as infrequently as 70 minutes versus the standard of 60 minutes.

Table 1 | Schedule Statistics

SERVICE DAY	SPAN OF SERVICE	FREQUENCY (RANGE)	FREQUENCY (AVERAGE)	DAILY TRIPS (INBOUND/OUTBOUND)
Monday-Friday	5:00 AM to 1:46 AM			56/64
Sunrise	5:00 AM to 5:59 AM	20	20	3/4
Early AM	6:00 AM to 6:59 AM	15-20	15	4/8
AM Peak	7:00 AM to 8:59 AM	1-17	15	8/9
Midday Base	9:00 AM to 1:29 PM	15-30	27	10/10
Midday School	1:30 PM to 3:59 PM	15-30	22	7/12
PM Peak	4:00 PM to 6:29 PM	15-25	21	7/8
Evening	6:30 PM to 9:59 PM	10-30	18	11/8
Late Evening	10:00 PM to 11:59 PM	25-50	42	3/3
Night	12:00 AM to 1:46 AM	35-50	42	3/2
Saturday	4:47 AM to 1:38 AM	30-70	36	34/34
Sunday	6:40 AM to 1:28 AM	35-50	45	27/27

Note: Span of service reflects the time the first bus begins service until the time the last bus finishes service.

Service Patterns

Route 16 has five inbound service patterns and four outbound patterns (see Table 2).

- Pattern 16.9 is the primary service pattern, and operates between Forest Hills Station and Andrew Station via Circuit Drive, Columbia Road, Massachusetts Avenue, through South Bay Center, and to Andrew Station via Southampton Street. The pattern is shown with the solid black line above in Figure 1.

In addition, on weekdays:

- Pattern 16.0 makes one inbound school trip that originates at Franklin Park Zoo at 7:18 AM, rather than Forest Hills Station, skipping the beginning of the route on Circuit Drive. The route continues to Andrew Station via Columbia Road and Boston Street without serving South Bay Center.
- Pattern 16.3 runs inbound until 6:15 AM and from 10:25 PM on, and outbound until 6:50 AM and from 10:50 PM on. All trips except one operate between Forest Hills Station and Andrew Station skip service into South Bay Center. Between those times, three inbound and four outbound trips also skip South Bay Center, but there is no pattern to the times of these trips. These trips are operated with 60-foot buses, providing additional Route 16 service as buses are moved between the Southampton Yard and Forest Hills Station – where they are used for Route 39 service.
- Pattern 16.2 runs between approximately 6:30 AM and 10:00 AM. Nearly all service operates between Forest Hills Station and UMass-Boston without serving South Bay Center.

- Pattern 16.8 runs between approximately 2:00 PM and 5:45 PM inbound, and 3:45 PM and 6:15 PM outbound. Nearly all service operates between Forest Hills Station and UMass-Boston via South Bay Center.

On weekends, all service operates between Forest Hills Station and Andrew Station. Saturday service before approximately 9:30 AM and after 10:45 PM does not serve the South Bay Center, while all service in between does. Sunday service patterns are similar except that service to South Bay Center starts about an hour earlier and ends with the 6:40 PM outbound and 7:25 inbound trips.

The MBTA added additional early-morning service to Route 16 in spring 2018 and made minor modifications to Route 16 school-trip service patterns in Fall 2018, after the completion of this document.

Table 2 | Service Patterns

PATTERN	ORIGIN	DESTINATION	UNIQUE FEATURE	TRIPS PER WKD	TRIPS PER SAT	TRIPS PER SUN
INBOUND				56	34	27
16.0	Franklin Park Loop at Zoo Entrance	Andrew Station	AM short-turn school trip	1	-	-
16.2	Forest Hills Station	UMass Boston	Skips South Bay Center	10	-	-
16.3	Forest Hills Station	Andrew Station	Skips South Bay Center	13	10	10
16.8	Forest Hills Station	UMass Boston	Serves UMass Boston and South Bay Center	11	-	-
16.9	Forest Hills Station	Andrew Station	Serves South Bay Center	21	24	17
OUTBOUND				64	34	27
16.2	UMass Boston	Forest Hills Station	Skips South Bay Center	11	-	-
16.3	Andrew Station	Forest Hills Station	Skips South Bay Center	20	11	11
16.8	UMass Boston	Forest Hills Station	Serves UMass-Boston and South Bay Center	9	-	-
16.9	Andrew Station	Forest Hills Station	Serves South Bay Center	24	23	16

Ridership

Route 16 is a high ridership route that carries approximately 5,540 passengers per weekday, 2,550 passengers per Saturday, and 1,700 passengers per Sunday. It is the MBTA's 23rd highest ridership route on weekdays, with higher ridership than two Key Bus routes.

As mentioned above, on weekdays, Route 16 provides more outbound trips than inbound trips (64 versus 56, or 14% more). Weekday outbound ridership, at 3,020 passengers, is 20% higher than inbound ridership, at 2,520 passengers.

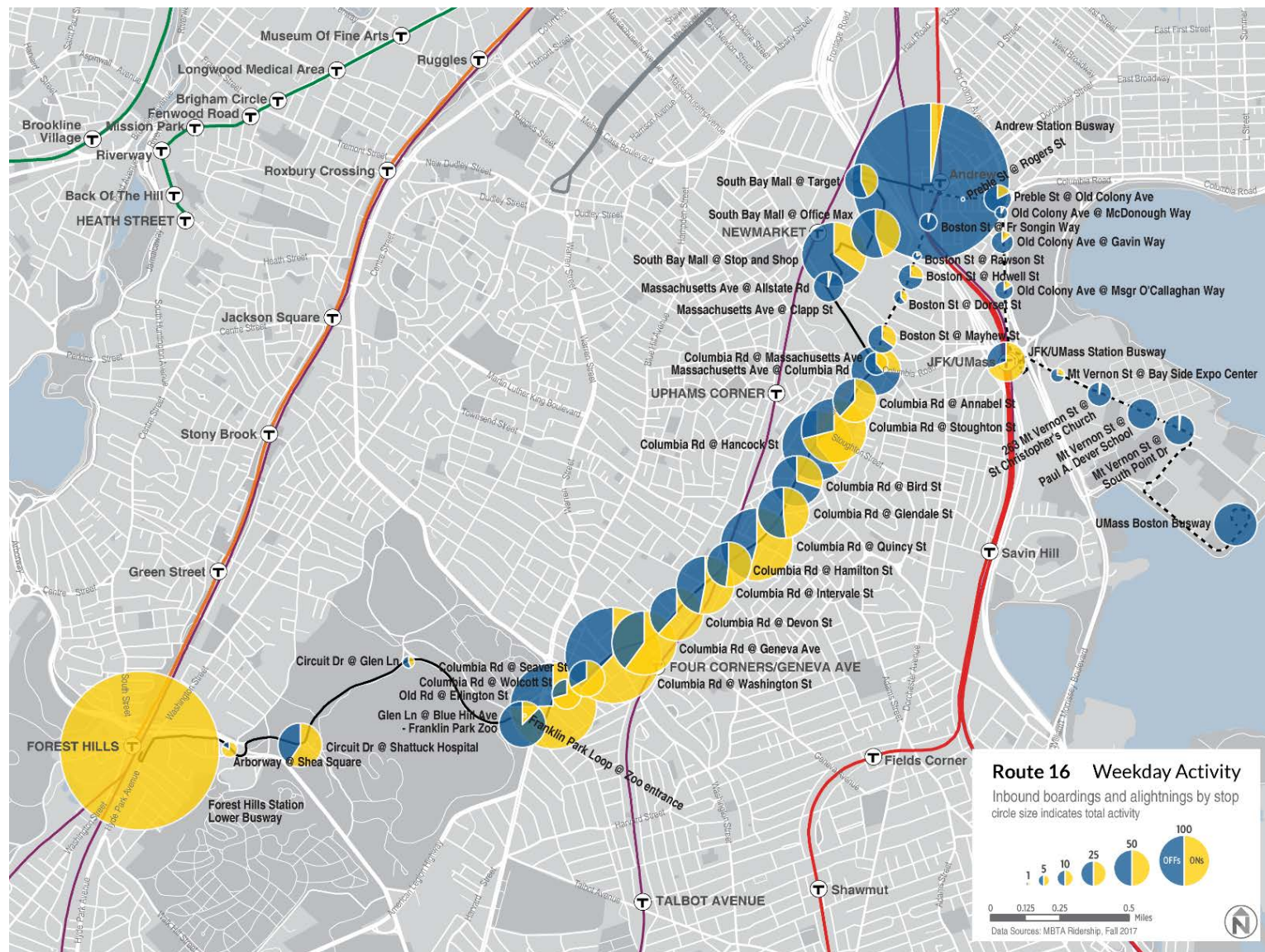
Ridership by Stop

Route 16's highest ridership stops – by far – are Forest Hills Station and Andrew Station. Stops in between generally have moderate ridership. Stops between Andrew Station and UMass-Boston have the lowest ridership, in part due to the part-time service. On weekday inbound trips (see also Figure 3):

- 990 passengers board at Forest Hills Station.
- The first major stop after Forest Hills Station is Old Road at Ellington Street with 220 boardings and 70 alightings. This is a transfer point with Blue Hill Avenue routes.
- Nearly all stops between there and Andrew Station serve fewer than 100 total boardings and alightings. Exceptions are:
 - Columbia Road at Washington Street, with 220 boardings and 140 alightings. This is a transfer point with Route 23 Ashmont Station-Ruggles Station.
 - Columbia Road at Quincy Street, with 110 boardings and 100 alightings.
 - The two stops that serve Uphams Corner, with a total of 200 boardings and 170 alightings.
 - The three stops that serve South Bay Center, with a total of 120 boardings and 180 alightings.
- 30 passengers board and 960 alight at Andrew Station
- Ridership is relatively low on the extended trips beyond Andrew Station to UMass-Boston., with total ridership of 80 boardings and 250 alightings. The highest ridership stops are:
 - JFK/UMass Station, with 40 boardings and 20 alightings
 - The final stop at the UMass-Boston busway with 70 alightings.

Outbound ridership follows the same patterns, but in reverse and with 20% higher ridership. Weekend service also follows similar patterns but with South Bay Center having a higher proportion of overall ridership.

Figure 3 | Weekday Inbound Ridership by Stop Map



Ridership by Trip

On weekdays, Route 16 has high ridership throughout the day, but especially in the peaks (see Figure 4 and Figure 5). PM peak ridership is significantly higher than AM peak ridership, when some trips carry over 100 passengers, versus a maximum of less than 75 passengers in the AM peak. Route 16 has very high ridership turnover levels along the route, which means that maximum loads are much lower than total ridership. Still, loads on a number of trips between 6:00 AM and 7:00 AM and between 3:00 PM and 4:00 PM are close to or exceed the MBTA's maximum loading standards. Please note that some trips with higher loads are operated using 60-foot buses, and thus may not exceed the MBTA's higher load standards for those vehicles.

During the midday, ridership generally ranges from 40 to 60 passengers per trips and all trips except those on the shoulders of the peaks operate at well less than maximum capacity. In the evening, inbound ridership tails off steadily from about 35 passengers at 7:00 PM to less than five on the last inbound trip at 1:30 AM. Outbound ridership is higher and stays at or above 30 passengers per trip until 11:00 PM. It then tails off steadily to less than five on the last trip at 1:15 AM.

On Saturdays, inbound ridership is highest between 10:00 AM and 6:00 PM, when most trips carry around 50 passengers (see Figure 6 and Figure 7). Outbound ridership is highest between 11:00 AM and 7:00 PM, and most trips during this period carry around 50 passengers. Ridership before and after those times is lower, building in the morning and then declining in the evening. All trips operate at well below maximum loads.

Sunday patterns are similar but lower ridership (see Figure 8 and Figure 9). Inbound ridership is highest between 11:00 AM and 7:00 PM, when most trips carry around 40 passengers. Outbound ridership is highest between 11:30 AM and 6:30 PM, when most trips carry between 40 and 50 passengers. As on Saturdays, ridership before and after those times is lower, building in the morning and then declining in the evening. Also, as on Saturdays, all trips operate at well below maximum loads.

Figure 4 | Weekday Ridership by Trip: Inbound

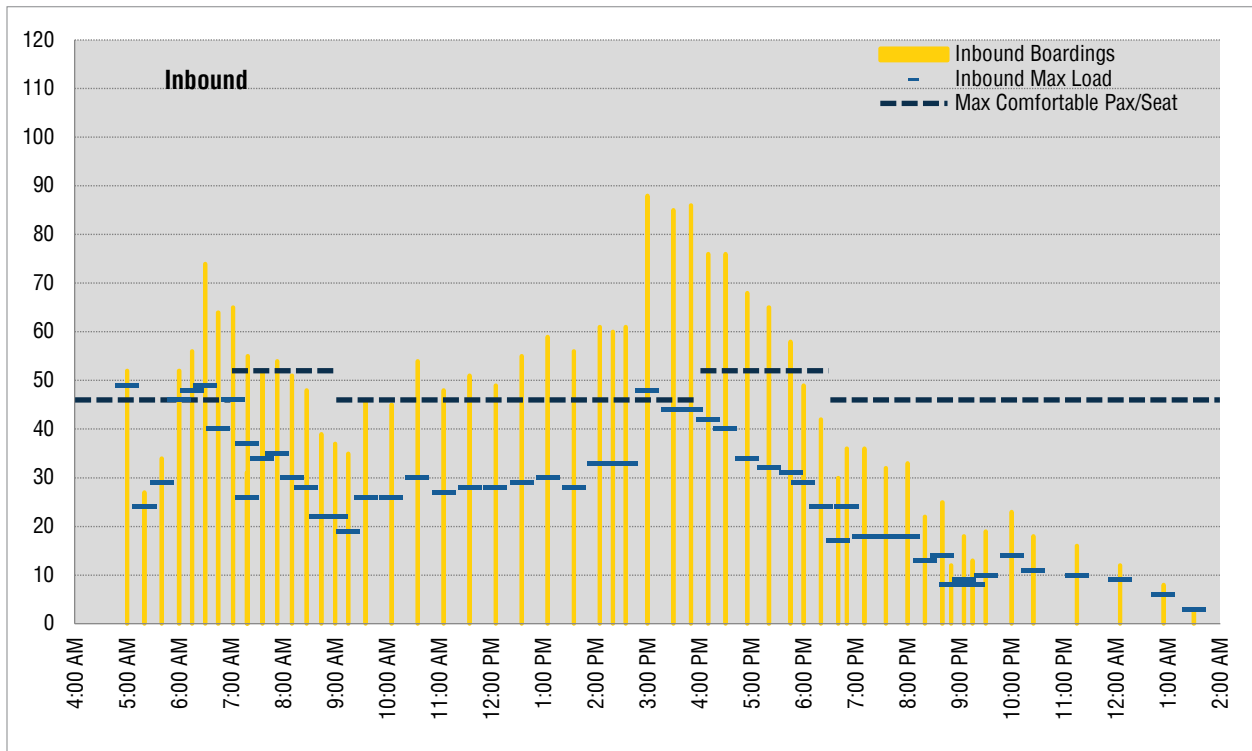


Figure 5 | Weekday Ridership by Trip: Outbound

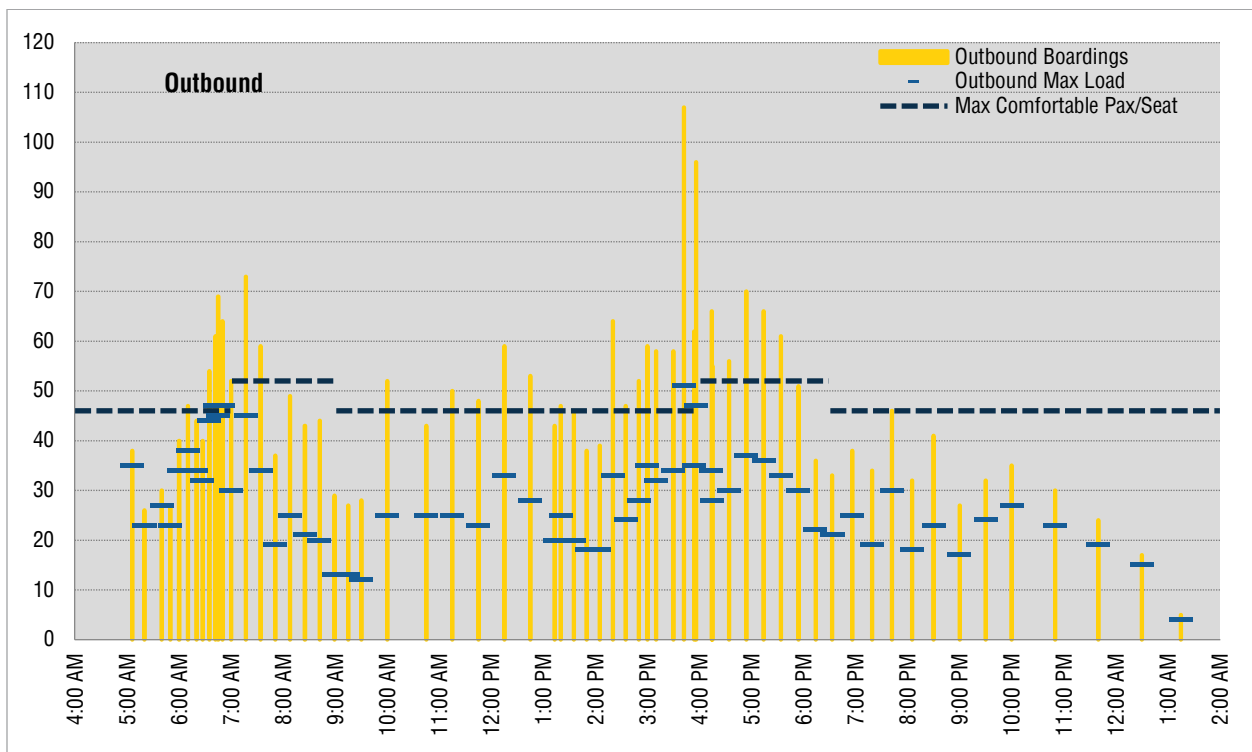


Figure 6 | Saturday Ridership by Trip: Inbound

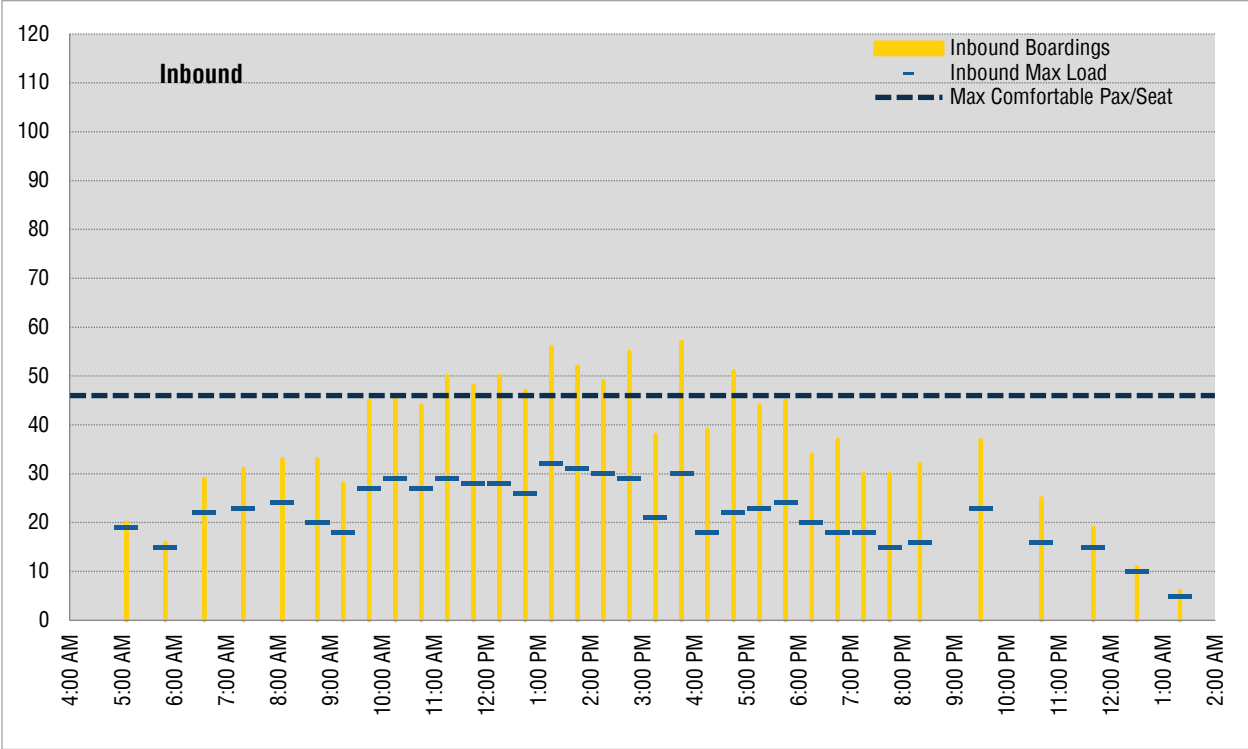


Figure 7 | Saturday Ridership by Trip: Outbound

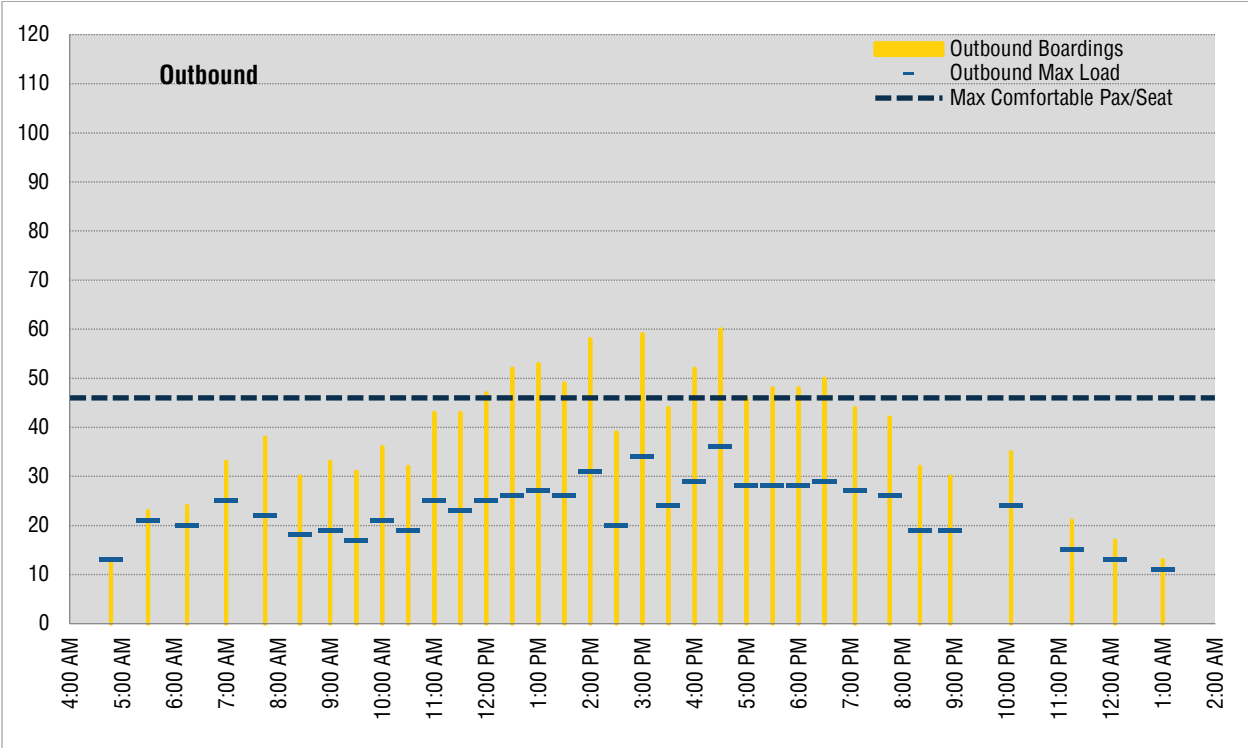


Figure 8 | Sunday Ridership by Trip: Inbound

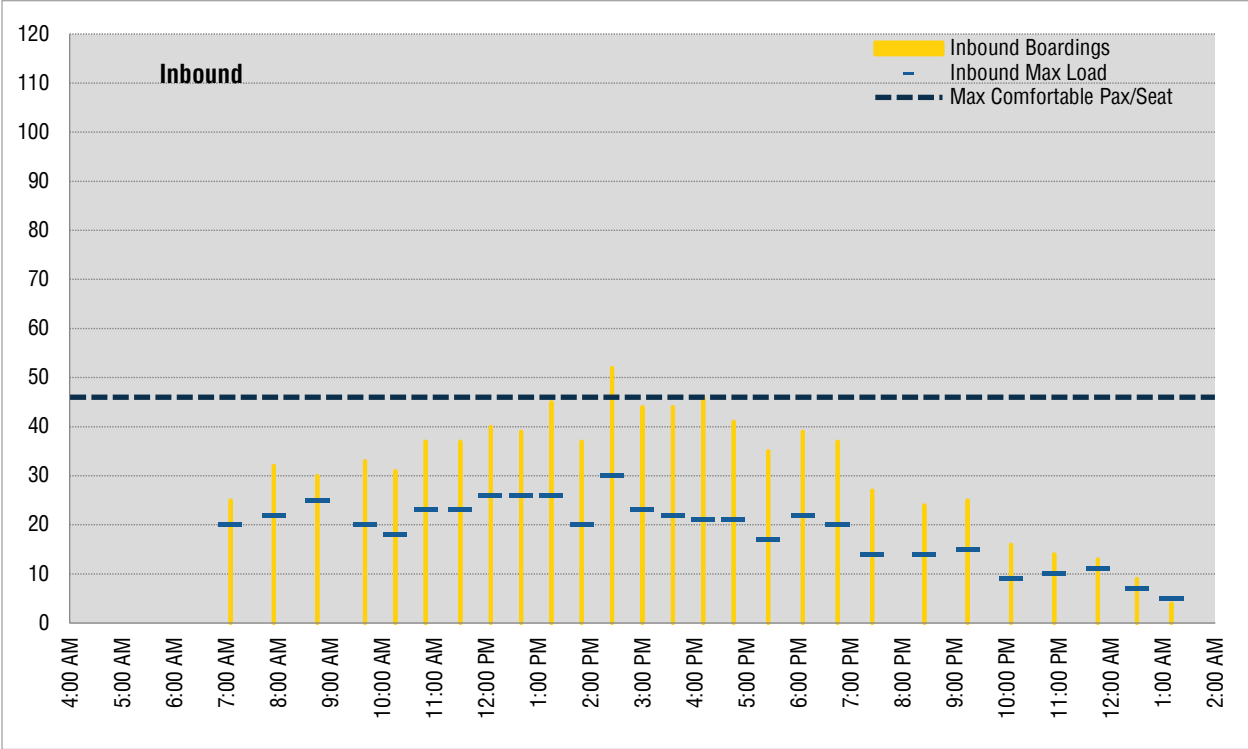
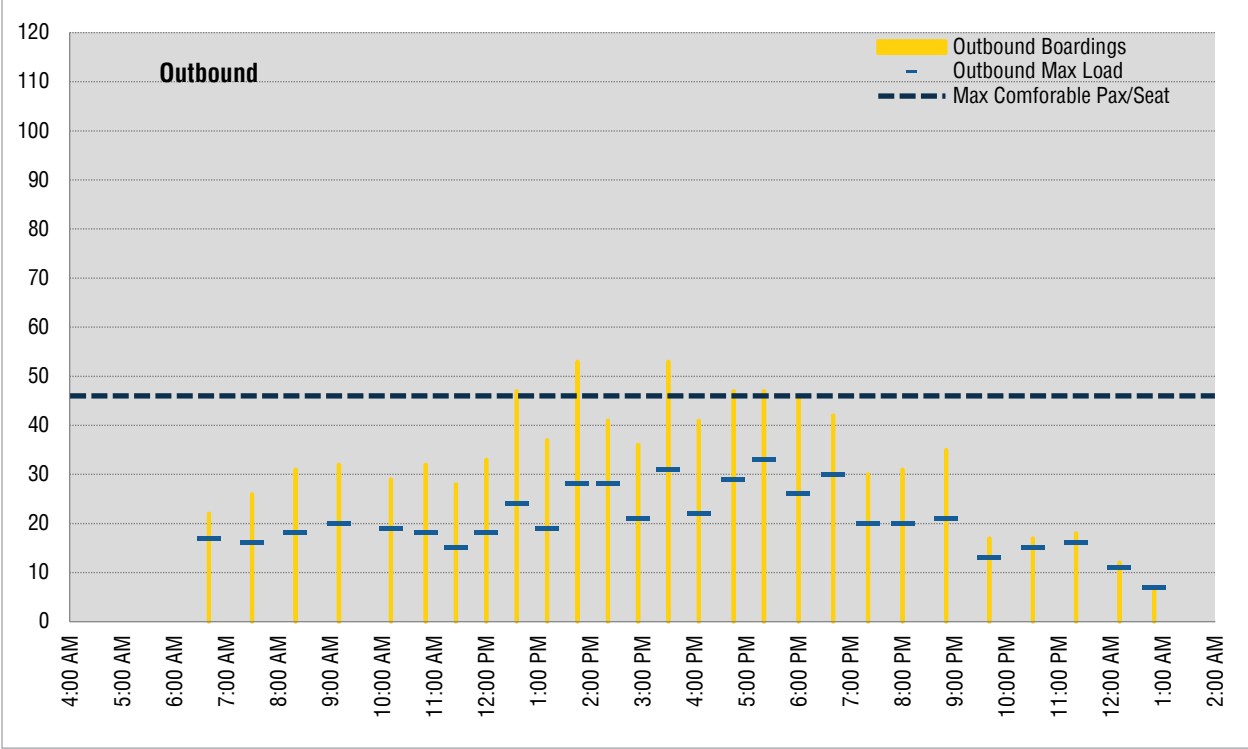


Figure 9 | Sunday Ridership by Trip: Outbound



Passenger Comfort

The MBTA desires that passengers travel in relatively comfortable conditions. At the same time, the MBTA's definition of comfort reflects the very high volume environment in which the MBTA operates, and that some passengers may have to stand for a portion of their trip. More specifically, at least 92% of passengers' travel times should be in comfortable conditions, and ideally, at least 96% of travel times should be in comfortable conditions. Comfortable conditions are considered to be 140% or less of seated capacity during high volume periods and 125% or less during other periods.

On Route 16, 94.4% of passenger minutes are in comfortable conditions, which is above the minimum standard of 92%, but below the target of 96% (see Table 3). The below target comfort levels are primarily due to the overcrowding on selected trips that operate in the shoulders of the peaks.

Table 3 | Passenger Time Spent Traveling in Comfortable Conditions

	WEEKDAYS	SATURDAYS	SUNDAYS
Minimum Standard	92%	92%	92%
Target	96%	96%	96%
Actual	94.4%	-	-

Reliability and Speed

Reliability

Route 16's overall on-time performance is poor, at 54% on weekdays, 60% on Saturdays, and 57% on Sundays (see Table 4). All of these figures are well below the MBTA's minimum standard of 70% and the target of 75% for local routes. Dropped trips are also an issue, with 1.2% of trips dropped in the fall of 2017.

Table 4 | Reliability

SERVICE DAY	ORIGIN/MID-ROUTE ON-TIME PERFORMANCE	DESTINATION ON-TIME PERFORMANCE	OVERALL RELIABILITY	DROPPED TRIPS
Monday-Friday	53%	60%	54%	1.2%
Saturday	59%	66%	60%	-
Sunday	56%	61%	57%	-

Running Times

A primary cause of poor reliability is that actual running times are significantly longer than scheduled times. The differences are greatest between 6:50 AM and 7:20 PM, when actual times exceed schedule times by up to eight minutes (see Figure 10 and Figure 11).

Figure 10 | Scheduled & Median Travel Time by Trip: Route 16.3 Inbound

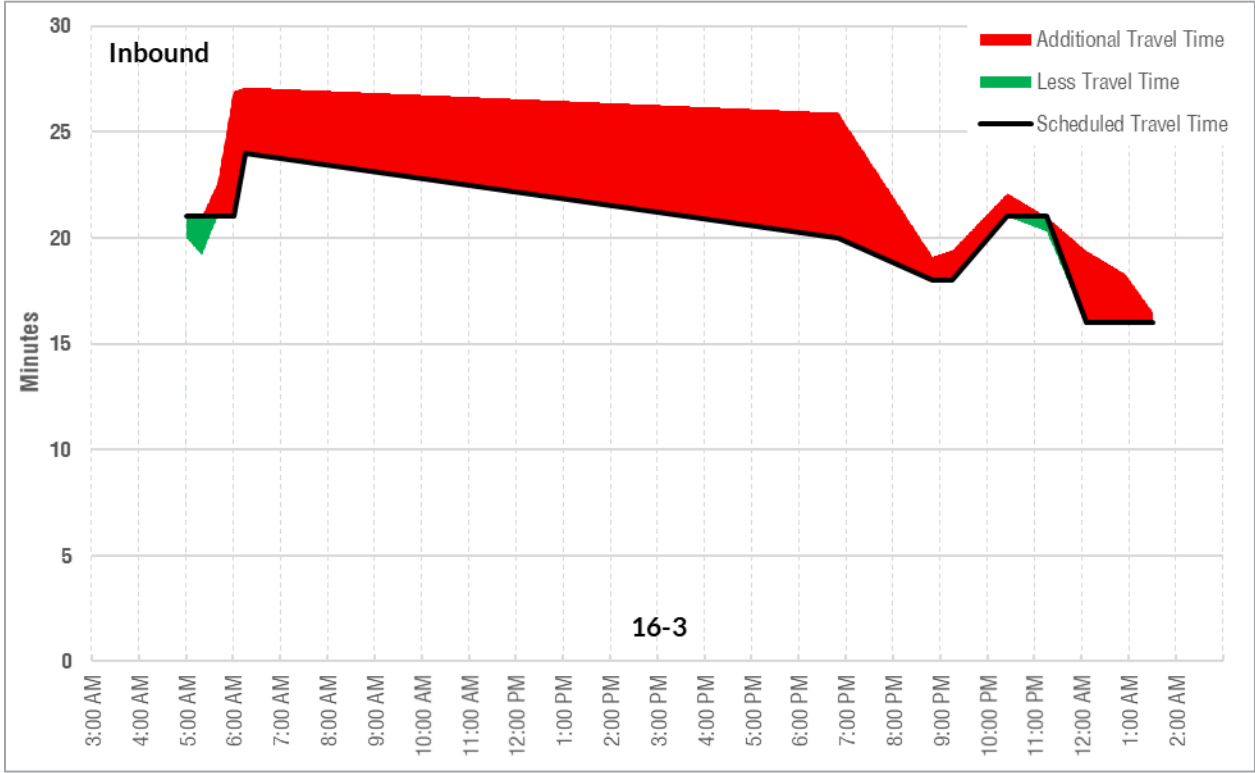


Figure 11 | Scheduled & Median Travel Time by Trip: Route 16.9 Inbound

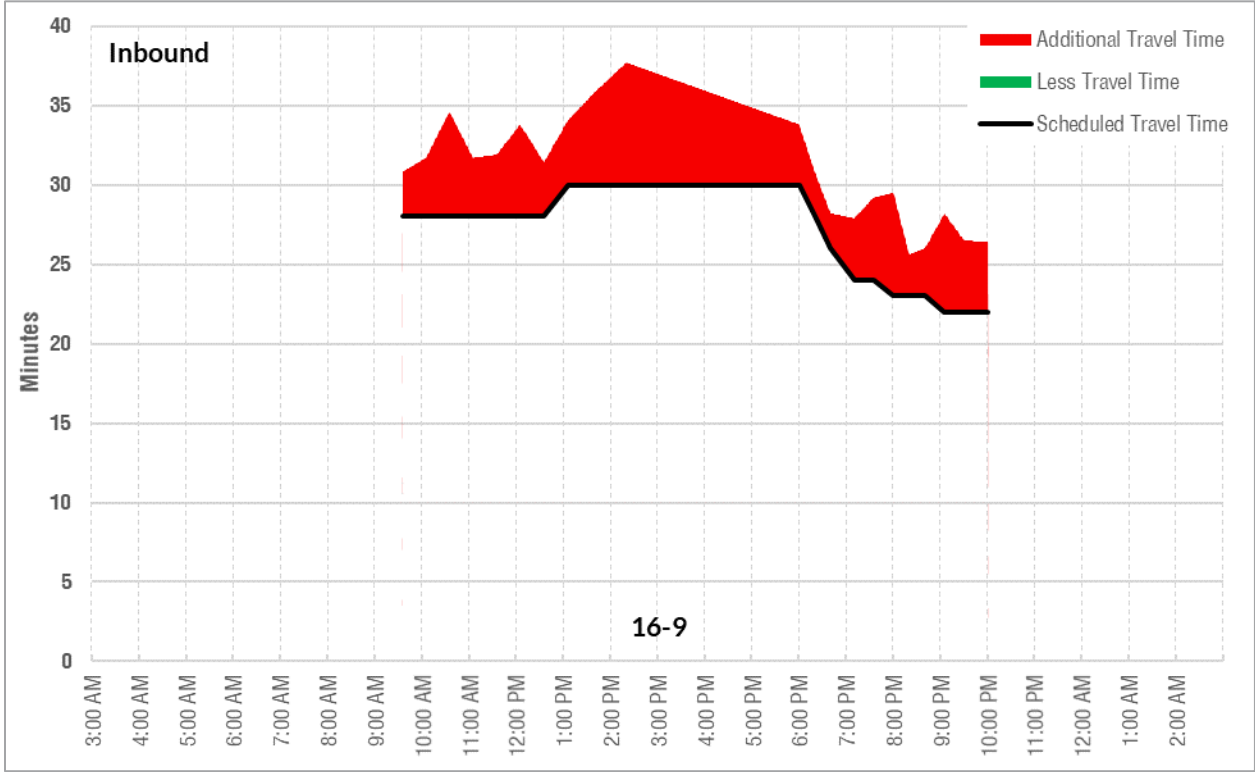


Figure 12 | Scheduled & Median Travel Time by Trip: Route 16.3 Outbound

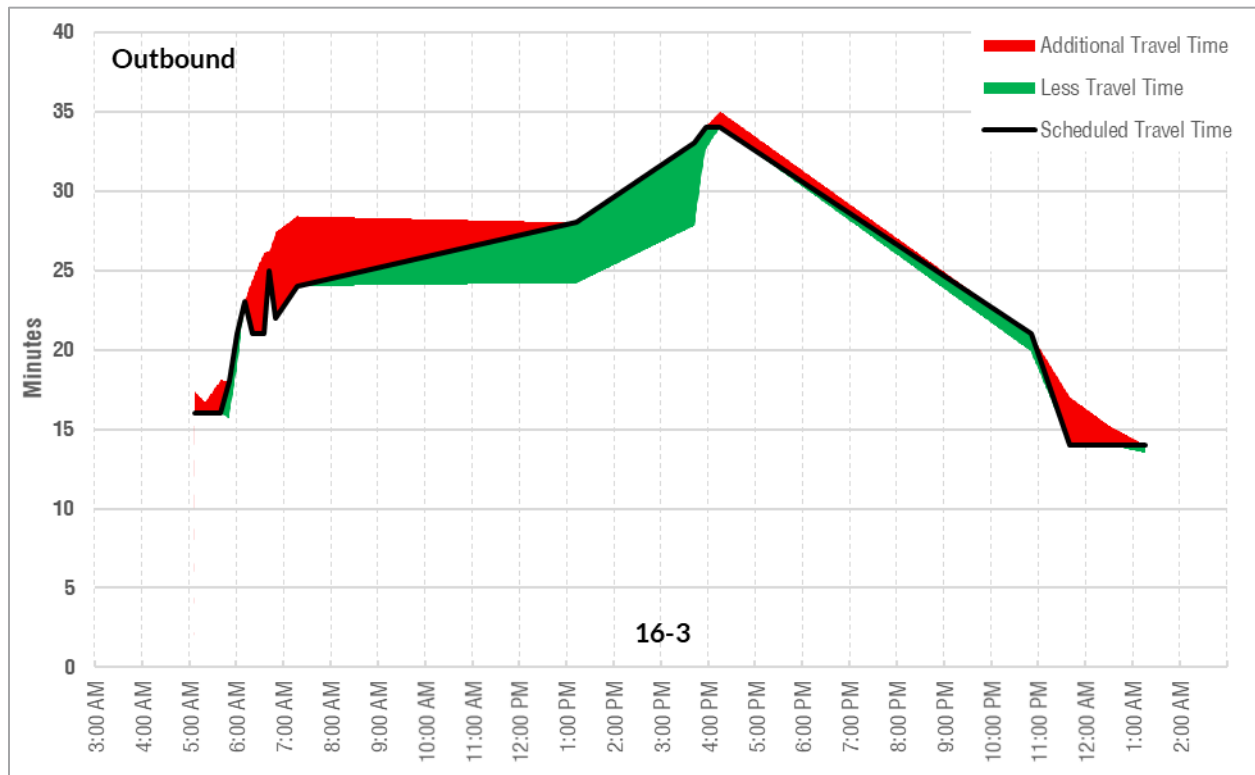
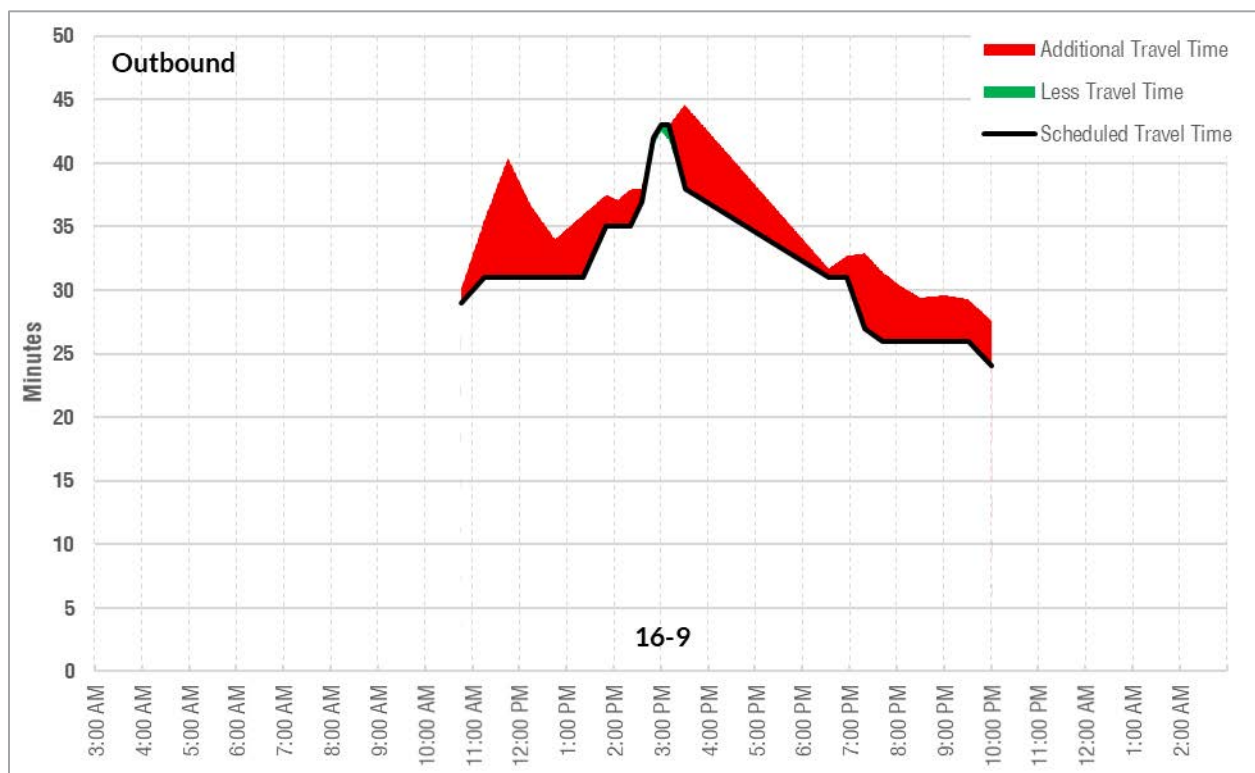


Figure 13 | Scheduled & Median Travel Time by Trip: Route 16.9 Outbound



Stop Spacing

Route 16 has an average of 5.2 stops per mile, or one stop every 1,000 feet, within the four to seven stops per mile recommended for urban areas under MBTA guidelines.

Still, stops are located extremely close in a few areas:

- Inbound stops at Old Road at Ellington Street and Columbia Road at Wolcott Street are only 400 feet apart. The next stop, Columbia Rd at Seaver Street is only 475 feet away. The first stop of the three has more four times the activity as the others on inbound trips.
- Inbound stops at Columbia Road at Hancock Street and at Stoughton Street are only 435 feet apart. Both stops average over 165 people boarding or alighting per day on inbound trips. Outbound, where trips stop once at Columbia Road at Dudley Street surpasses 400 riders daily.

Summary

Route 16, overall, is a strong route that carries high ridership in area with a large number of transit dependent riders. However, it has a number of weakness that detract from its effectiveness:

- Very poor on-time performance.
- Overcrowding on some shoulder of the peak trips.
- Overly complex service patterns, especially with respect to midday trips that either serve or skip South Bay Center