

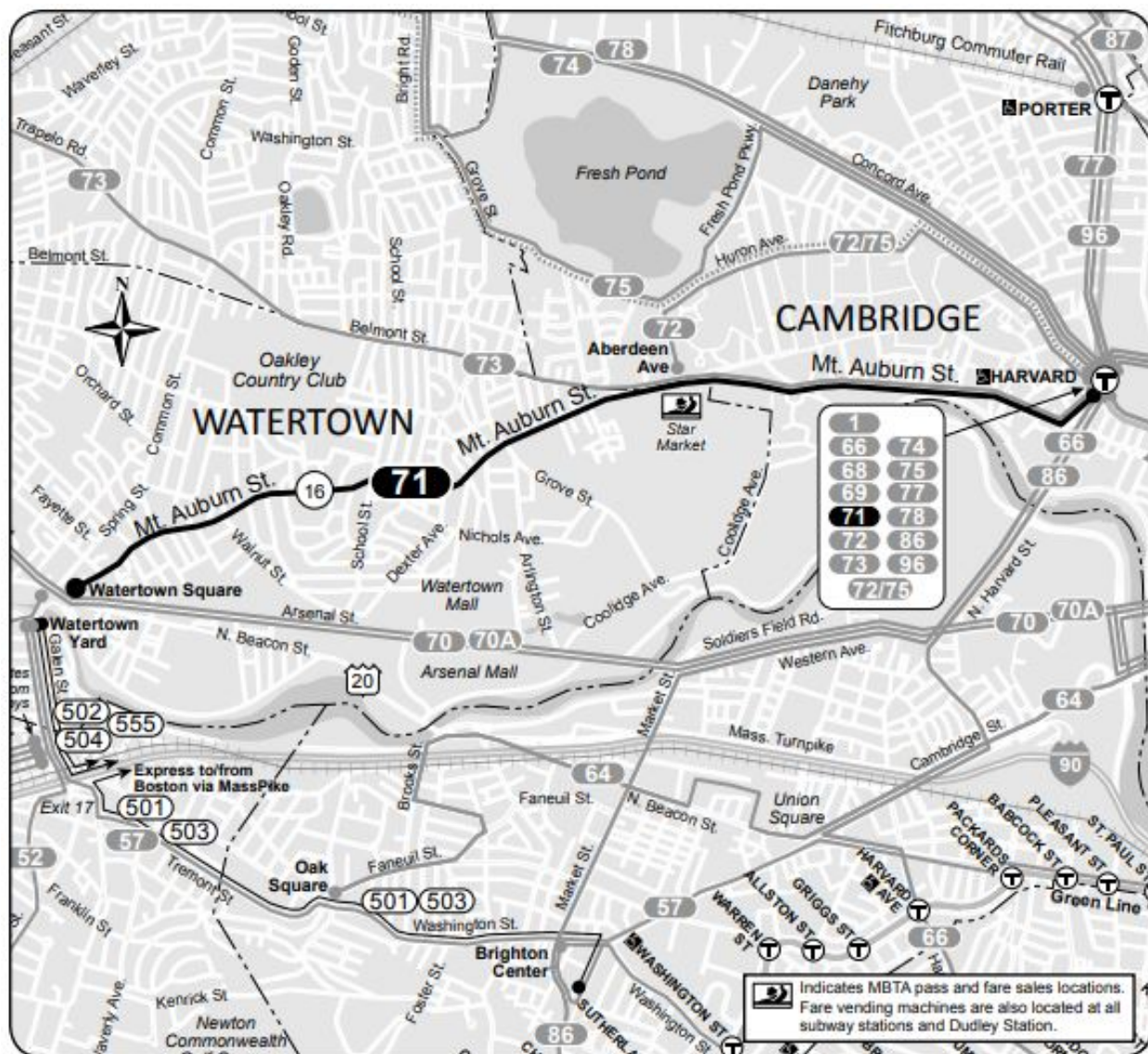
Route 71

Watertown Square – Harvard Square

Route Overview

Route 71 Watertown Square - Harvard Square is a Key Bus route that operates between Watertown Square and Harvard Square (see Figure 1). It operates largely along Mount Auburn Street using trackless trolleys Monday through Saturday. Diesel buses are used on Sundays.

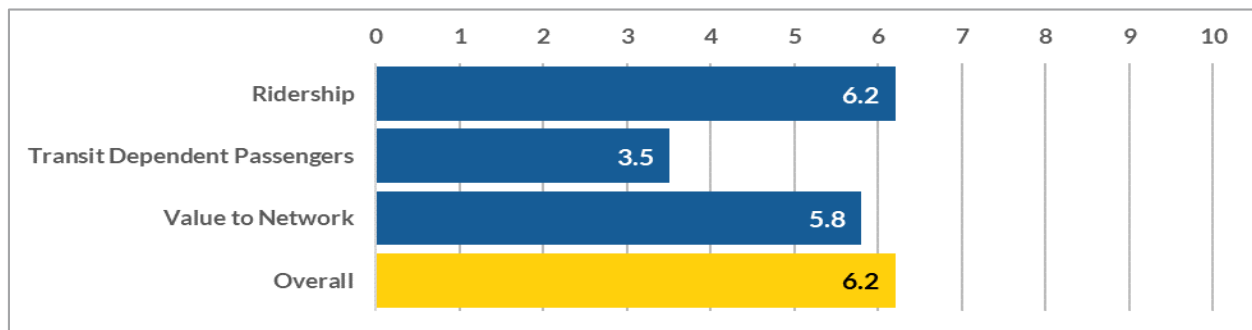
Figure 1 | Route 71 Service Map



Network Importance

Route 71 is of moderately high importance within the overall network (see Figure 2). On a scale of 0 to 10, the route rates 6.2 in terms of ridership, 3.5 in terms of transit dependent ridership, and 5.8 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% weighting to overall ridership and a 15% weight to both other measures, is 6.2.

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



Service Overview

Schedule

Route 71 provides frequent service for most of the day every day of the week. On weekdays, it operates from 4:51 AM to 1:19 AM with the following service frequencies (see Table 1):

- Every six to 20 minutes from the beginning of service through 6:00 AM, with average headways of 15 minutes.
- Every six to 14 minutes in the early AM and AM peak periods, with average headways of 7 to 8 minutes.
- Every five to 15 minutes in the midday base and school periods, with average headways of 10 to 13 minutes.
- Every seven to 12 minutes in the PM peak period, with average headways of every nine minutes
- Every eight to 25 minutes in the evening and late evening periods, with average frequencies of 14 to 21 minutes.
- Every 16 to 25 minutes during the night period, average frequencies of every 20 minutes.

Table 1 | Schedule Statistics

SERVICEDAY	SPAN OF SERVICE	FREQUENCY (RANGE)	FREQUENCY (AVERAGE)	DAILY TRIPS (INBOUND/OUTBOUND)
Monday-Friday	4:51 AM to 1:19 AM			105/105
Sunrise	4:51 AM to 5:59 AM	6 - 20	15	3/6
Early AM	6:00 AM to 6:59 AM	6 - 14	8	7/7
AM Peak	7:00 AM to 8:59 AM	4 - 10	7	17/18
Midday Base	9:00 AM to 1:29 PM	5 - 15	13	21/19
Midday School	1:30 PM to 3:59 PM	7 - 15	10	14/15
PM Peak	4:00 PM to 6:29 PM	7 - 12	9	16/16
Evening	6:30 PM to 9:59 PM	8 - 21	14	16/15
Late Evening	10:00 PM to 11:59 PM	20 - 25	21	6/5
Night	12:00 AM to 1:19 AM	19 - 25	20	5/4
Saturday	4:57 AM to 1:19 AM	5 - 25	19	64/64
Sunday	6:30 AM to 1:03 AM	20 - 44	21	55/53

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

On Saturdays, service operates from 4:57 AM to 1:19 AM. Service operates every five to 45 minutes throughout the day, generally with service every 15 minutes between 7:00 AM and 6:30 PM, and every 20 minutes before and after those times. On Sundays, service operates from 6:30 AM to 1:03 AM, every 20 minutes for the entire day except for the last two trips which are spread up to 44 minutes apart.

Route 71 exceeds the MBTA’s span of service guidelines, but fails to meet some service frequency guidelines:

- On weekdays, during the late evening period, some trips operate up to 25 minutes apart versus the standard of 20 minutes.
- On Saturdays and Sundays when the all-day minimum service frequency standard is 20 minutes, some late trips run up to 44 minutes apart.

Note also that Route 71 uses the same alignment as Route 73 Waverly-Harvard Station from the intersection of Belmont Street and Mount Auburn Street to Harvard Station. The two routes operate with schedules that are very similar, but different, and as a result, the schedules of the two routes are generally not coordinated. This is impart because Route 71 is slightly shorter than Route 73, which makes coordination schedules more challenging. In addition, the use of trackless trolleys restricts the ability of buses to pass each other when routes fall behind schedule.

Service Patterns

From a passenger perspective, all service operates consistently between Watertown Square and Harvard Station as shown in Figure 1. Pattern 71 makes up most trips, and

operates beyond Harvard Station to a layover point at the intersection on Waterhouse Street near the intersection with Massachusetts Avenue, Pattern 71.1 begins at Harvard Station.

Table 2 | Service Patterns

PATTERN	ORIGIN	DESTINATION	UNIQUE FEATURE	TRIPS PER WKD	TRIPS PER SAT	TRIPS PER SUN
INBOUND				105	64	55
71.0	Watertown Square	Waterhouse Street at Massachusetts Avenue	Surface layover	90	58	-
71.1	Watertown Square	Harvard Station	Terminates at Harvard Station	15	6	-
71.2	Watertown Square	Harvard Station	Uses diesel bus and serves upper busway	-	-	55
OUTBOUND				105	64	53
71.0	Waterhouse Street at Massachusetts Avenue	Watertown Square	Surface layover	92	58	-
71.1	Harvard Station	Watertown Square	Begins at Harvard Station	13	6	-
71.2	Harvard Station	Watertown Square	Uses diesel bus and serves upper busway	-	-	53

Ridership

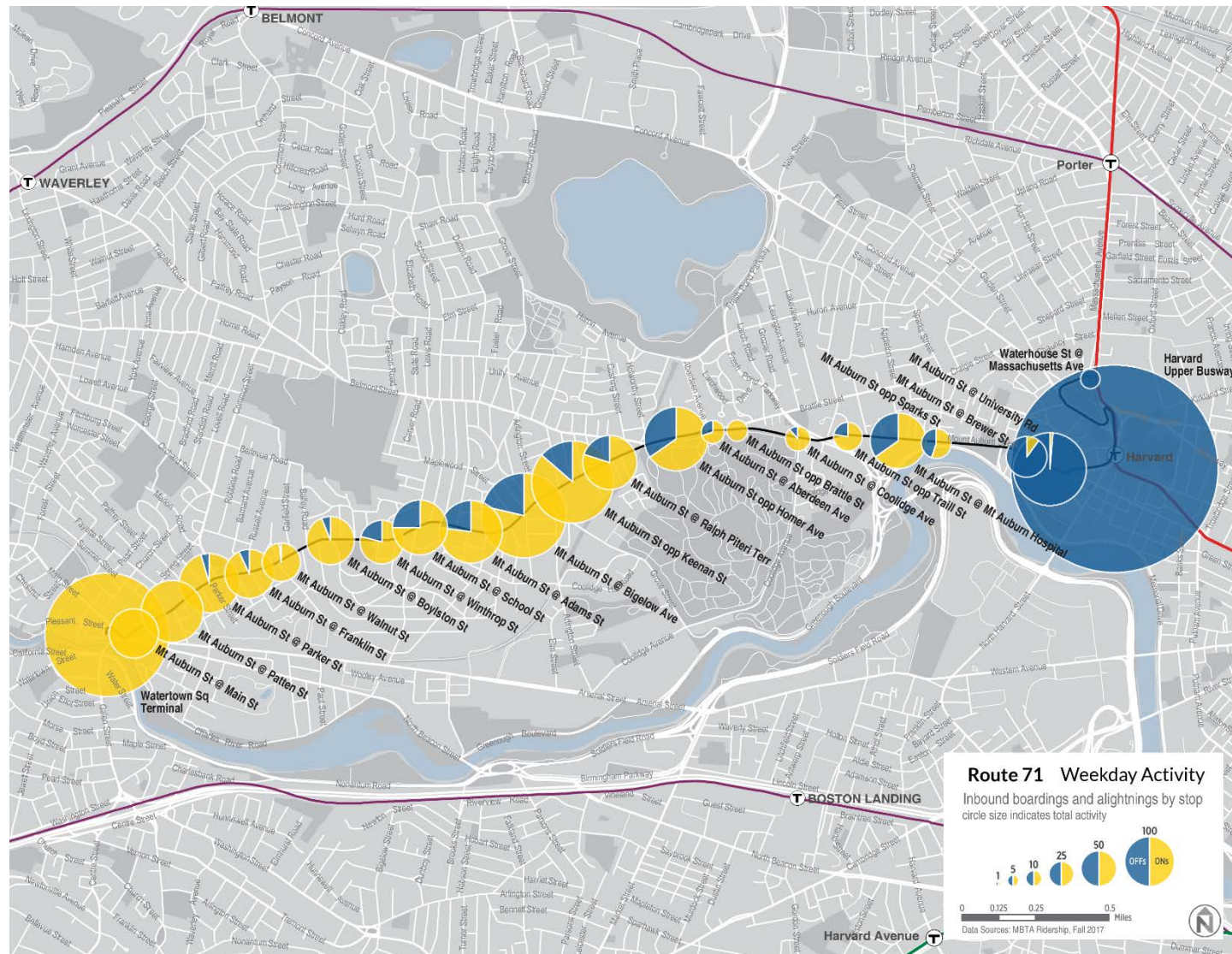
Route 71 carries 4,960 riders on weekdays, 2,080 riders on Saturdays, and 1,490 riders on Sundays. Although these numbers are high, Route 71 is the lowest ridership Key Bus route and six local routes have higher ridership.

Ridership by Stop

An overwhelming majority of Route 71 riders travel to and from Harvard Station. On weekday inbound trips (see Figure 3):

- 650 passengers board at the first stop in Watertown Square. This is the route's highest inbound boarding stop.

Figure 3 | Weekday Inbound Ridership by Stop Map



- A total of 1,530 passengers board and 240 alight at the 12 stops along Mount Auburn Street before Belmont Street.
- A total of 320 passengers board and 430 alight at the nine stops along Mount Auburn Street inbound from Belmont Street. Over half of the alightings (220) are University Road, which is the surface stop closest to Harvard Square. This segment is also served by Route 73 Waverley Square-Harvard Station, which has 500 boardings along this segment.
- 1,820 passengers, or 73% of all inbound riders, alight at Harvard Station.

Outbound ridership patterns are essentially the inverse of inbound patterns. Weekend patterns are also similar but with lower passenger volumes.

Ridership by Trip

On weekdays, Route 71's ridership is very peak oriented with its highest ridership inbound in the AM and outbound in the PM. On weekday inbound trips (see Figure 4):

- Ridership is approximately 20 passengers per trip from the start of service at 5:13 AM through close to 7:00 AM.
- Ridership then increases rapidly to 60 to 70 passengers per trip between 7:00 AM and close to 8:30 AM. Because the large majority of passengers are traveling to Harvard Station, maximum loads are nearly as high as total ridership per trip, and maximum loads on many trips exceed the MBTA's loading standards (by up to 16 passengers).
- Ridership then declines to around 20 passengers per trip at around 10:30 AM. However, the decline is not linear, with some spikes to over 40 passengers.
- Ridership per trip is then around 30 passengers per trip through around 3:30 PM, but with some spikes to over 40 passengers.
- Between 3:30 PM and 6:00 PM, there is an outbound peak, with ridership per trip that varies from 25 passengers per trip to over 60.
- Ridership per trip then generally ranges from less than 10 to 20 passengers through 11:00 PM.
- Ridership is then less than five passengers per trip through the end of service.

On weekday outbound trips (see Figure 5):

- AM ridership is generally low until around 6:30 AM, when a small outbound peak begins.
- From 7:30 AM to 8:30 AM, most trips carry 20 to nearly 40 passengers.
- From 8:30 AM to 2:00 PM, most trips carry 20 to 30 passengers.

Figure 4 | Weekday Ridership by Trip: Inbound

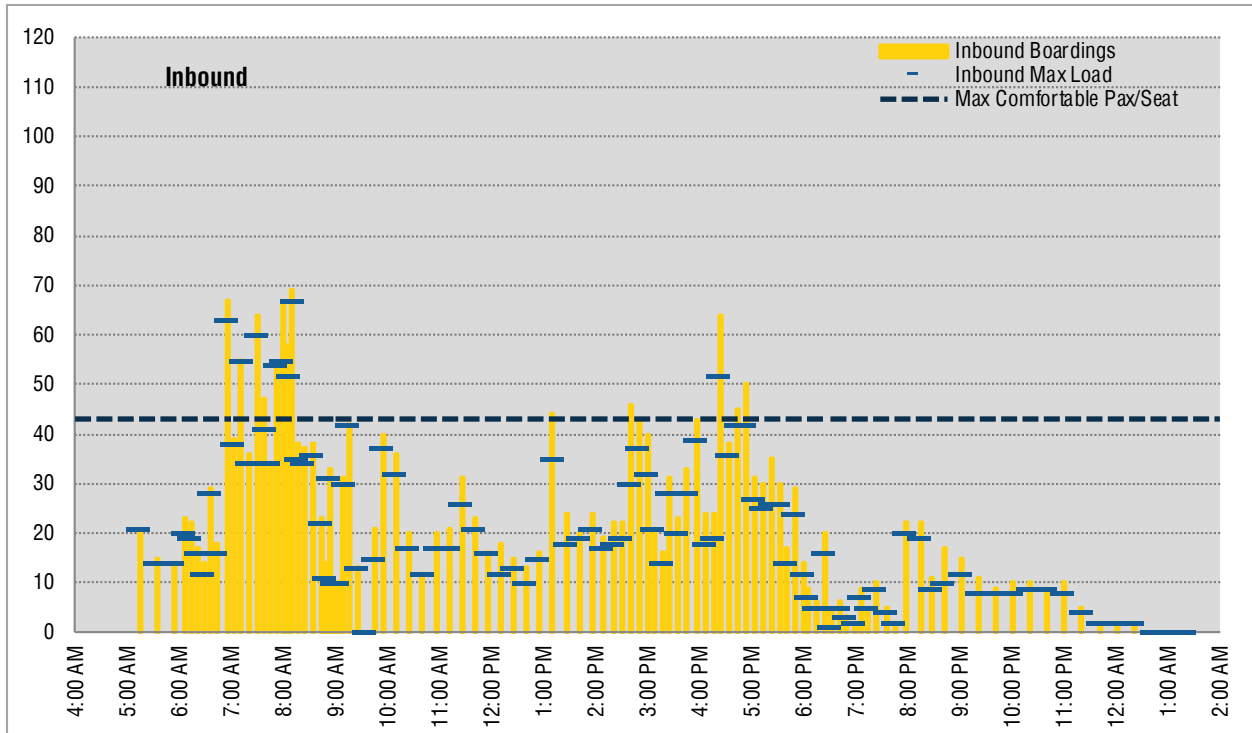
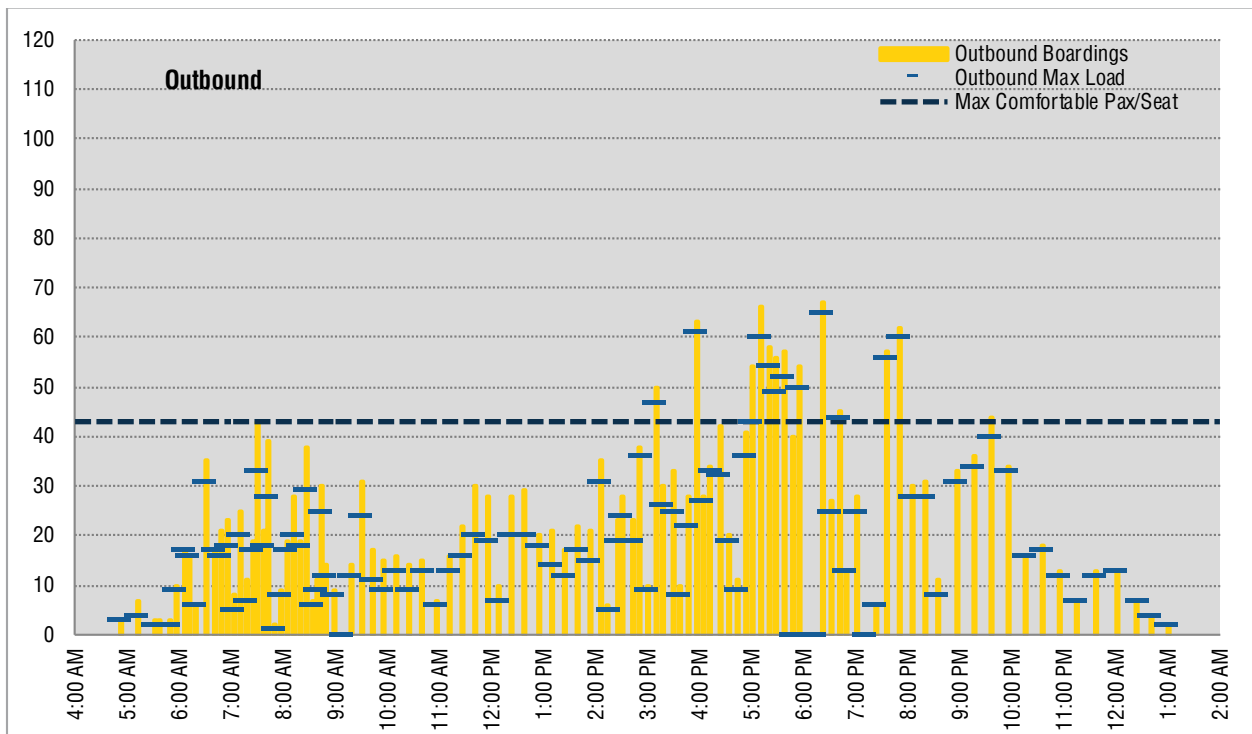


Figure 5 | Weekday Ridership by Trip: Outbound



- From 2:00 PM to around 3:30 PM, ridership increases to 20 to 40 passengers per trip, with some higher spikes.
- Beginning at around 3:30 PM until close to 8:00 PM, many trips carry over 50 passengers and some over 60. As in the AM inbound, maximum loads are very close to total ridership, and many trips are very overcrowded.
- From 8:00 PM to 10:30 PM, most trips carry 30 to over 40 passengers.
- Ridership then declines steadily to only two passengers on the last outbound trip at 1:07 AM.

As described above, many AM inbound and PM outbound trips are overcrowded. However, during other periods, maximum loads are low, and often only around 20 passengers. This indicates that while too little service is provided during peak periods, more is provided than warranted by demand during other periods.

On Saturdays, inbound ridership is highest between 9:30 AM and 5:00 PM, when most trips carry 20 to 30 passengers (see Figure 6). Outbound ridership is highest between 2:00 PM and 10:30 PM, when most trips carry 20 to 30 passengers (see Figure 7).

Figure 6 | Saturday Ridership by Trip: Inbound

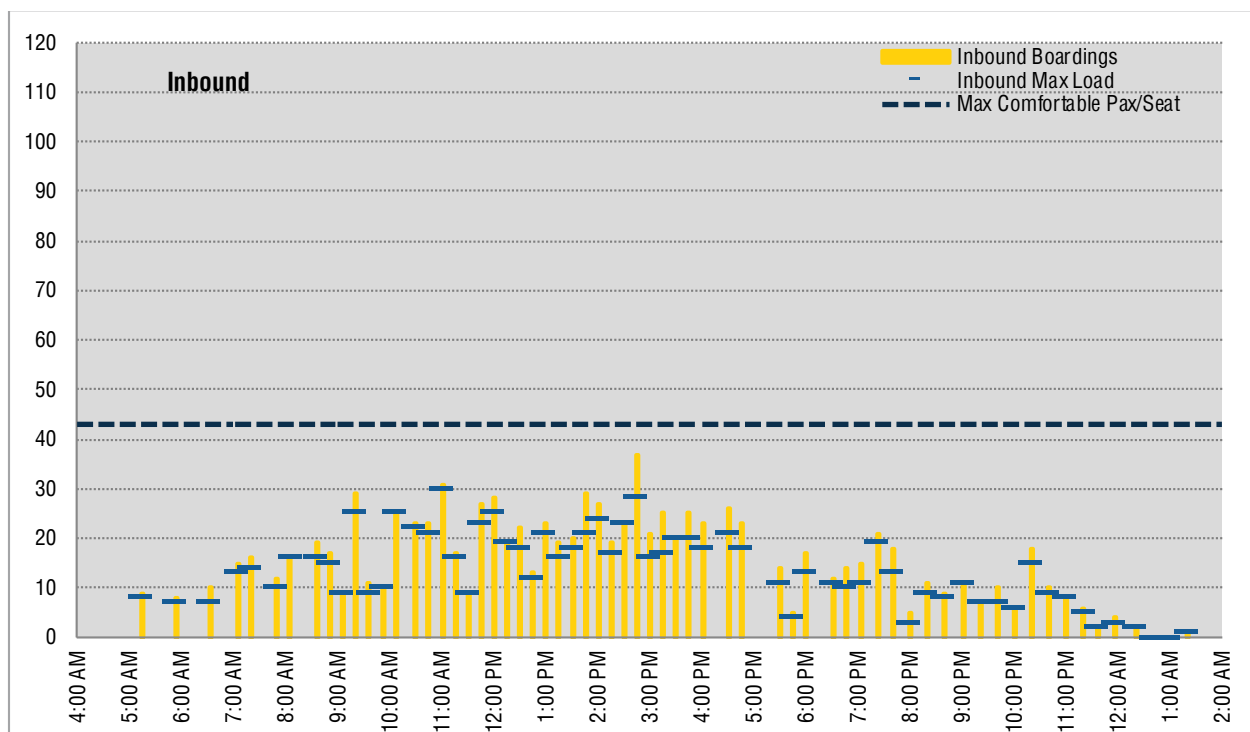
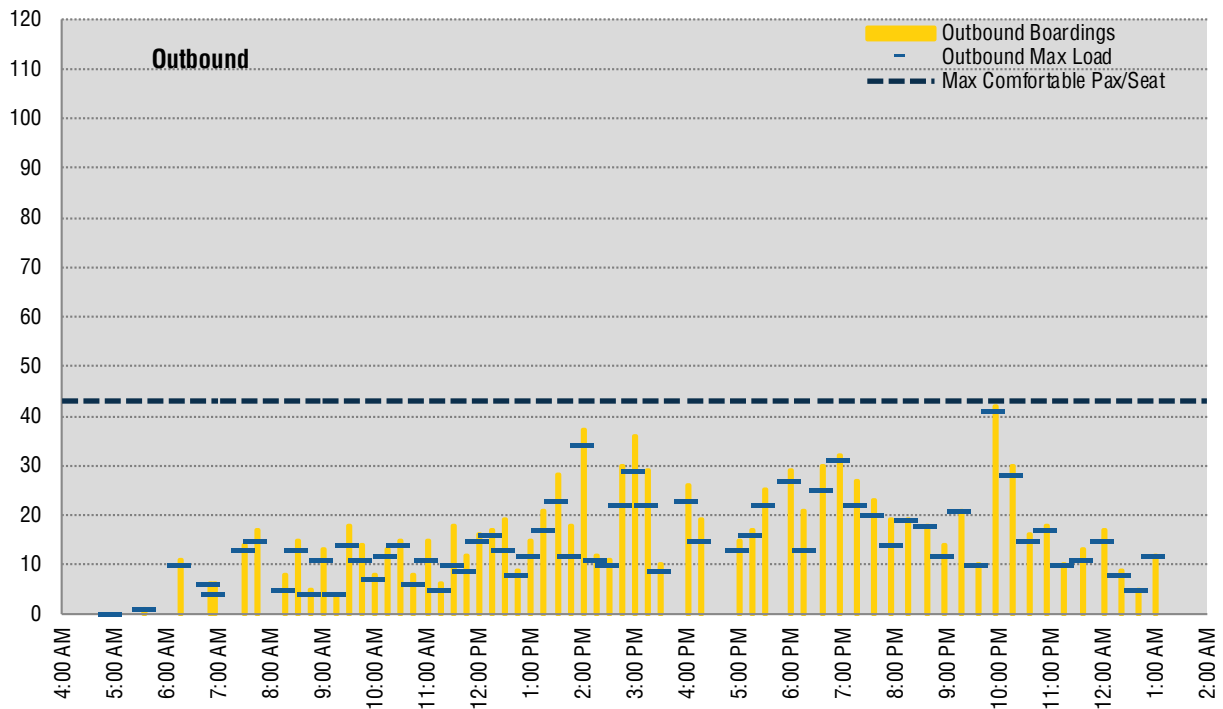
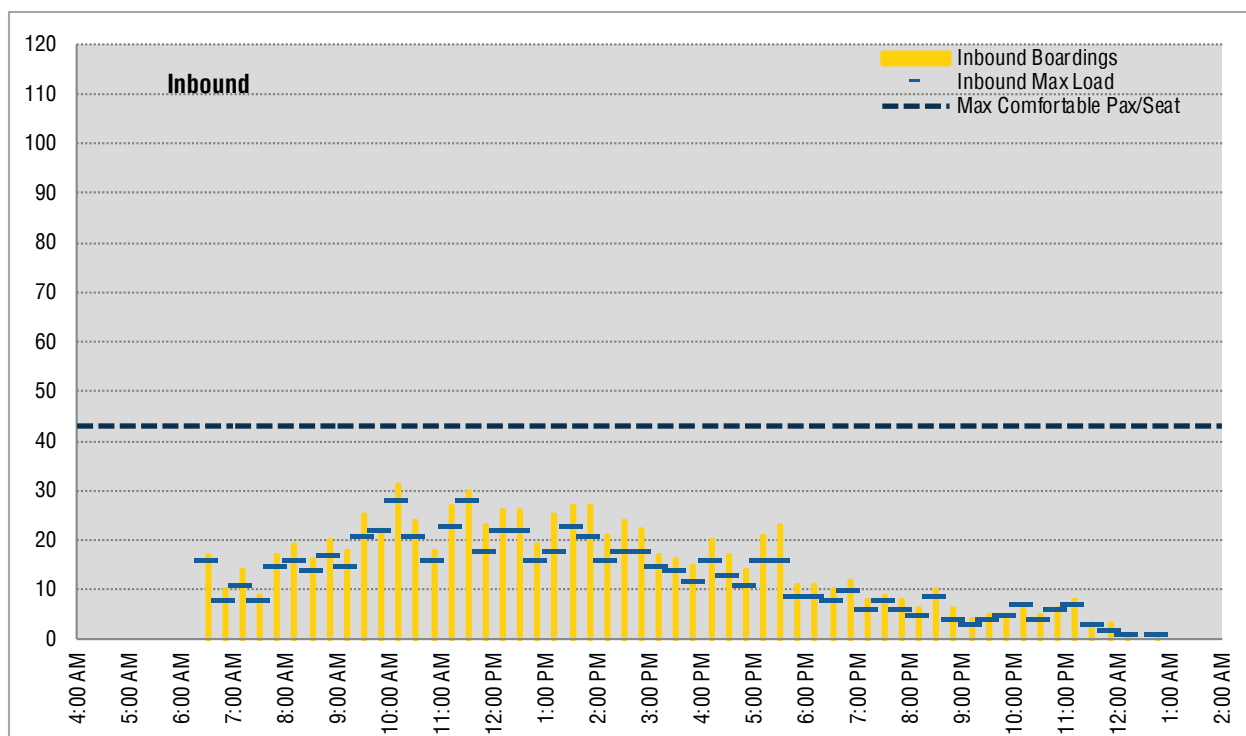


Figure 7 | Saturday Ridership by Trip: Outbound



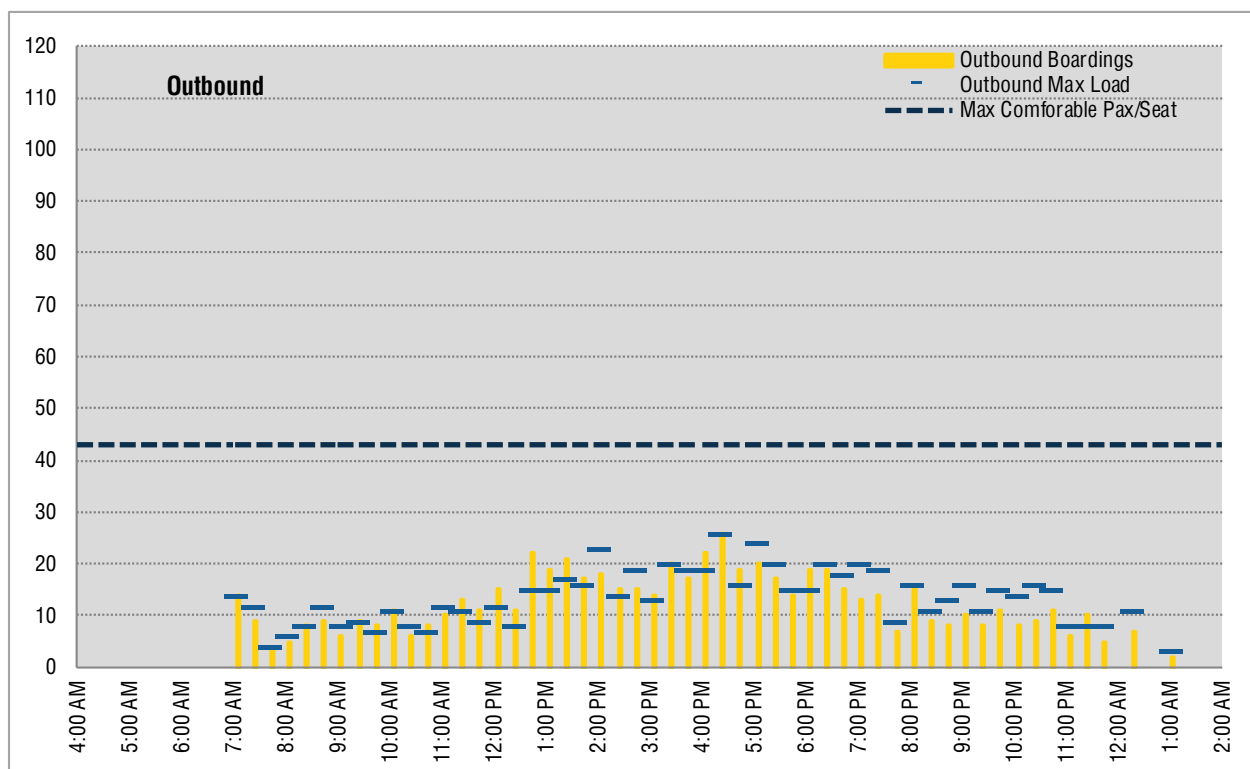
On Sundays, inbound ridership per trip is highest between 9:00 AM and 4:30 PM, when most trips carry 20 to 30 passengers (see Figure 8). Outbound ridership per trip is

Figure 8 | Sunday Ridership by Trip: Inbound



relatively low in the morning, with most trips carrying fewer than 20 passengers through 1:30 PM (see Figure 9). It then increases to 20 to over 30 passengers through 10:30 PM. After 10:30 PM ridership per trip drops to fewer than 10 riders per trip.

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.

Only limited comfort data is available for trackless trolley service. However, considering that many weekday peak period trips are overcrowded and that a high percentage of trips are not run (see next section), it is almost certain that comfort levels are below both the minimum and target levels of 92% and 96%, respectively. However, on Saturdays, given that maximum loads are low, it is certain that comfort levels are very high. On Sundays, available data confirms that comfort levels are very high (100%).

Table 3 | Passenger Time Spent Traveling in Comfortable Conditions

	WEEKDAYS	SATURDAYS	SUNDAYS
Minimum Standard	92%	92%	92%
Target	96%	96%	96%
Actual	-	-	100%

Reliability and Speed

Reliability

Route 71’s overall reliability is 81% on weekdays, 78% on Saturdays, and 73% on Sundays (see Table 4). These levels exceed the target standard for Key Bus routes of 80% on weekdays and the minimum standard of 75% on Saturdays. However, Sunday reliability is below the minimum standard, in part due to the use alignment required to serve the Upper Harvard Busway in both directions, which is only done in the inbound direction on weekdays and Saturdays.

Table 4 | Reliability

SERVICE DAY	ORIGIN/MID-ROUTE ON-TIME PERFORMANCE	DESTINATION ON-TIME PERFORMANCE	OVERALL RELIABILITY	DROPPED TRIPS
Monday-Friday	79%	91%	81%	2.6%
Saturday	77%	83%	78%	-
Sunday	76%	61%	73%	-

Dropped trips are an issue, with 2.6% of weekday trips dropped in the Fall of 2017. These dropped trips exacerbate the overcrowding problems described above.

Running Times

Reliability is also adversely impacted by actual running times that exceed scheduled running times. As show in Figure 10, on weekdays, AM peak inbound running times exceed scheduled times by up to six minutes. Differences during the rest of the day are only a few minutes, but actual times are still longer than scheduled times.

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

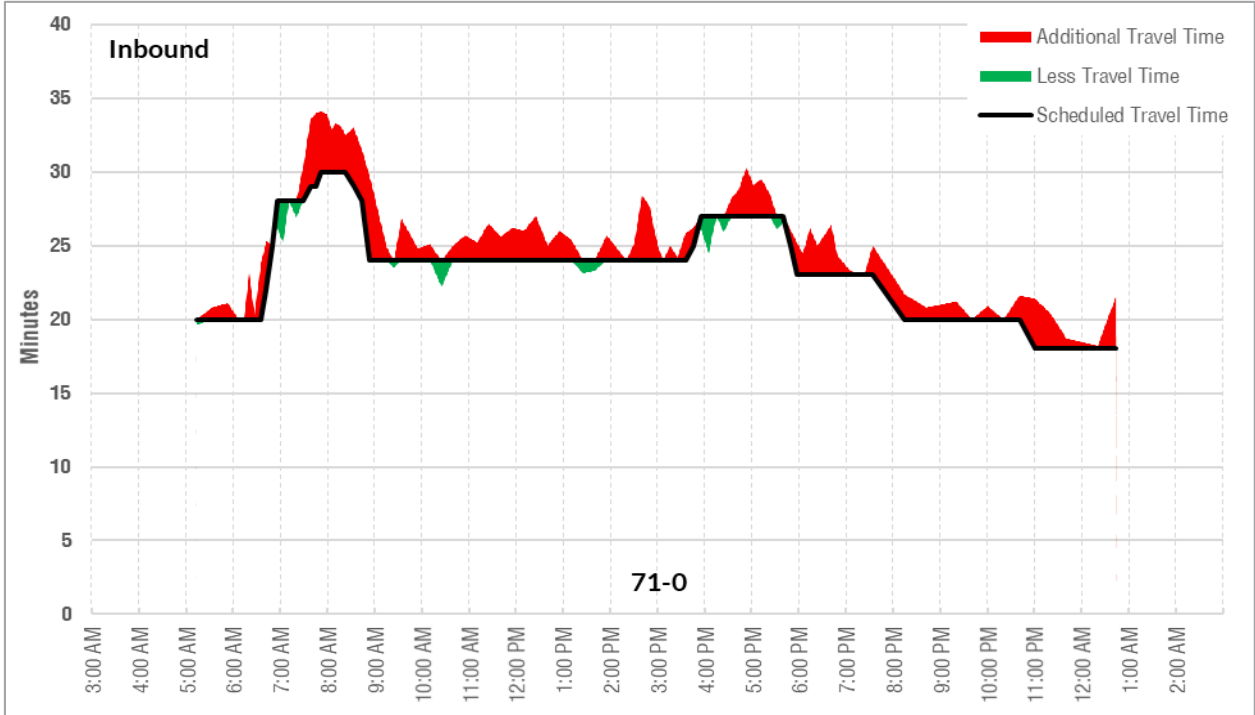
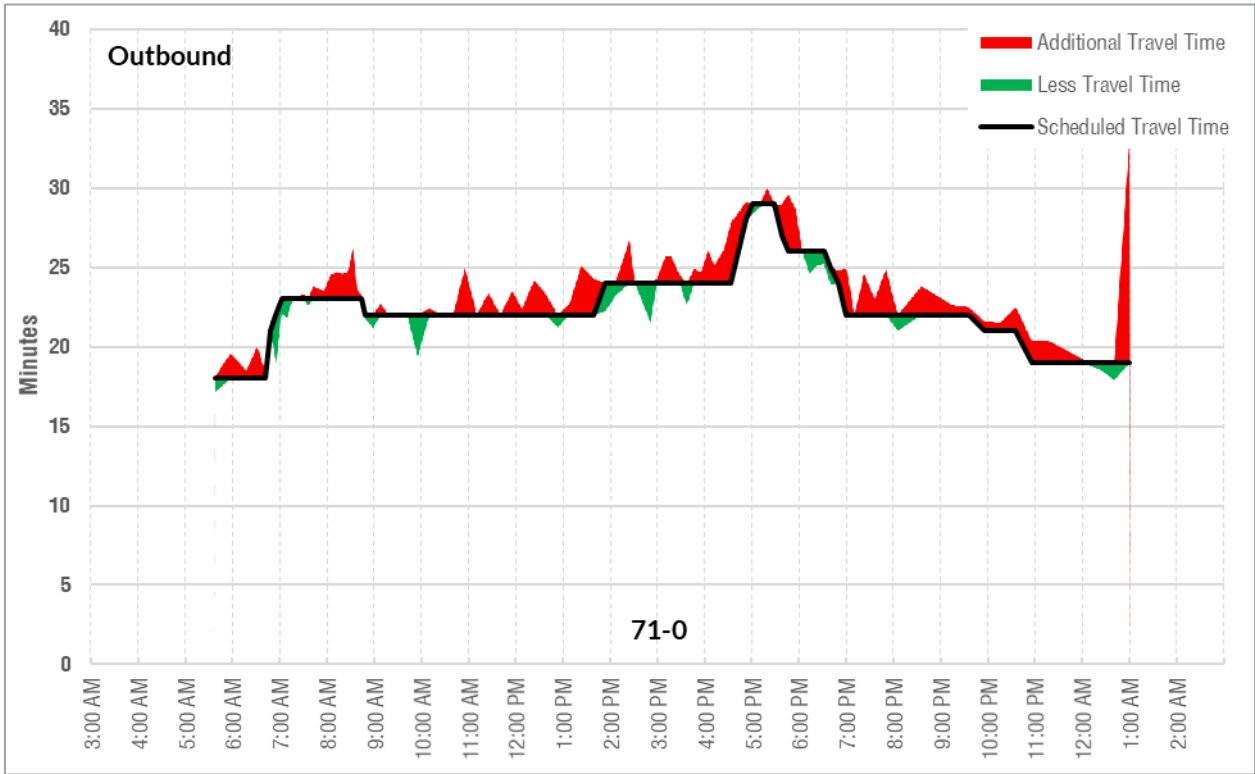


Figure 11 | Scheduled & Median Travel Time by Trip: Outbound



Stop Spacing

Route 71 has an average of 6.3 stops per mile, which is at the high end of the MBTA's guideline of four to seven stops per mile for Key Bus routes. Further stop consolidation could produce modest improvements in operating speeds and on-time performance.

Summary

Overall, Route 71 is a strong route with very high ridership (4,950 passengers per weekday). However, it is more commuter-oriented than most other Key Bus routes, with very high weekday AM inbound and PM outbound ridership and proportionally lower weekday off-peak ridership.

Route 71's major issue is peak period overcrowding, with many AM inbound and PM outbound trips overcrowded. This overcrowding is exacerbated by dropped trips (2.6% in the Fall of 2017). Conversely, off-peak trips have light loads.