State of Rhode Island
Department of Administration / Division of Purchases
One Capitol Hill, Providence, Rhode Island 02908-5855
Tel: (401) 574-8100 Fax: (401) 574-8387

ADDENDUM #1

RFP # 7597609 **TITLE: COMMUTER RAIL PLANNING ASSISTANCE: DATA COLLECTION & SURVEYS**

SUBMISSION DEADLINE: **NOVEMBER 28. 2018 – 11.30 A.M.**

Attached is the previous 2016 Survey Report which may be used as a sample/guide.

Lisa Hill

Lisa Hill
Assistant Administrator

RHODE ISLAND DEPARTMENT OF TRANSPORTATION
Office of Transit, New Starts, Operations & Transportation Alternatives

Addendum Notification

RFP# 7597609 – COMMUTER RAIL PLANNING ASSISTANCE: PASSENGER RIDERSHIP DATA COLLECTION AND SURVEYS
ADDENDUM #1
SUBMISSION DEADLINE: WEDNESDAY, NOVEMBER 28, 2018 at 11:30 am

Per the issuance of the Rhode Island Department of Transportation **ADDENDUM # 7597609A1** the following addition is noted:

RIDOT's 2016 Passenger Survey Report referenced on Page 6 was inadvertently omitted from the RFP. Respondents are advised that the Survey Report listed under Task 2 shall be more comprehensive than the 2016 report since it shall include all inbound trips, not just those in the AM peak. The summary report shall also include a comparison to the 2016 qualitative and quantitative survey and ridership results.

Stephen A. Devine
Administrator, Office of Transit

RIDOT Commuter Rail Planning Assistance

Task 2: Ridership Observations and Survey Key Findings

Final Report

August 4, 2017

Prepared for:

RIDOT

Table of Contents

Table of Figures

Table of Tables

(Remainder of page is intentionally blank)

1 Passengers Counts Methodology and Background

1.1 Quarterly Weekday Ridership Counts

On-platform quarterly weekday ridership counts were performed at Providence Station, T.F. Green Airport, and Wickford Junction Massachusetts Bay Transportation Authority (MBTA) Commuter Rail stations on Tuesdays, Wednesdays, and/or Thursdays during a single week in the months January, April, July, and October, as seen in Table 1. The April, October, and January counts coincided with times when local colleges and universities were in session and none of the counts were performed during public school vacations, major holiday weeks, or the last week of December/first week of January. Quarterly weekday ridership counts were conducted over the span of four shifts covering the early AM Peak, Midday, PM Peak, and Late Night periods from the beginning of service at 4:45 AM to the end of service at 1:10 AM.

Table 1. Quarterly Weekday Passenger Counts – Observation Dates

ROUND	FISCAL YEAR	MONTH	WEEKDAY
1	FY 2016	July 2015	07/21 – 07/23
2	FY 2016	October 2015	10/20 – 10/22
3	FY 2016	January 2016	01/23 – 01/28
4	FY 2016	April 2016	04/26 – 04/28
5	FY 2017	July 2016	07/12 – 07/14
6	FY 2017	October 2016	10/25 – 10/27
7	FY 2017	January 2017	01/10 – 01/12
8	FY 2017	April 2017	04/06 – 04/08

Using two handheld mechanical clickers, a data collector recorded passenger boardings and alightings onto and off of MBTA Commuter Rail trains in both the Inbound and Outbound direction along the single track side platforms at both T.F. Green Airport and Wickford Junction (one collector at each station) during the AM Peak and PM Peak periods. Midday and Late Night counts at T.F. Green Airport and Wickford Junction used a single counter on-board the train located near the front of the locomotive, as only the first two cars located directly behind the locomotive were open on these off-peak trains.

Since Providence Station has two center island platforms that are both potentially open for use by the MBTA and trains operating during the AM Peak and PM Peak periods typically utilized all six or seven cars, two collectors were employed to accurately record passenger boardings and alightings at Providence during those periods. During the peaks at Providence, collectors were positioned on the platform, back-to-back near the base of the southern stairwell to count passenger boardings and alightings from the first three and last four cars, respectively, to avoid double counting. During the Midday and Late Night observation periods, a single collector was stationed at Providence. To help

determine the correct platform from which to count, collectors at Providence Station used the lobby departure board/screens and in-station train announcements.

1.2 Bi-Annual Weekend Ridership Counts

Given the absence of weekend service at T.F. Green Airport and Wickford Junction, ridership counts on Saturday and Sunday were performed only at Providence Station. Weekend counts were conducted on the Saturdays and Sundays immediately following the weekdays covered during the second, fourth, sixth, and eighth rounds of weekday counts, as seen in Table 2. As with the weekday, the April and October weekend counts coincided with times when local colleges and universities were in session and none of the counts were performed during public school vacations, major holiday weeks, or the last week of December/first week of January. Bi-annual weekend ridership counts were conducted on the platforms at Providence Station over the span of two extended shifts covering from the beginning of service at 6:35 AM on Saturdays (11:20 AM on Sundays) to 2:56 PM and then from 4:56 PM to the end of service at 12:15 AM. All weekend counts at Providence Station used a single collector for each shift.

Table 2. Bi-Annual Weekend Passenger Counts Observation Dates

ROUND	FISCAL YEAR	MONTH	SATURDAY	SUNDAY
2	FY 2016	October 2015	10/24	10/25
4	FY 2016	April 2016	04/30	05/01
6	FY 2017	October 2016	10/29	10/30
8	FY 2017	April 2017	04/08	04/09

1.3 Notes on Counting Procedures and Data Processing

All data collectors wore a Class II safety vest and an ID badge that featured the RIDOT logo to identify themselves as a counter or manager for this effort. Prior to the initiation of each count, RIDOT notified the Amtrak and RIAC, which operates T.F. Green Station, to expect data collectors on the platforms. Collectors were instructed to arrive at least 10 minutes before the first train to be counted. Counts from the mechanical clickers were transcribed onto pre-printed forms that were then scanned and entered into an Excel spreadsheet.

Despite ample planning and coordination, there were, nevertheless, a few trains for which an accurate count was not obtained. This was most often due to simultaneous Amtrak and MBTA arrivals along the same platform at Providence Station, which made it difficult to identify the operator/service that each passenger was using. In these instances, RIDOT staff determined that the boardings and/or alightings missed could be estimated by calculating the proportion of the line's total ridership in Rhode Island for the date on which the train was missed to the average of the line's total ridership in Rhode Island based on all previous counts and multiplying that ratio by the average of the last two observations of boardings and/or alightings for the missed train at that particular station. Equation 1 reflects the rule used to impute boardings and/or alightings for a particular missed train at a given station.

Equation 1. RIDOT Missed Trip Imputation Formula

$$Train_{Missed,\ \ Station\ X} = \left(\frac{\sum Daily_t}{\left(\sum_{i=1}^{t-1} Daily_i\right) \frac{1}{t-1}} \right) * \left(\frac{Train_{t-1,\ \ Station\ X} + Train_{t-2,\ \ Station\ X}}{2} \right)$$

Once the counts were digitized, a spreadsheet was developed to compute the line load (i.e., the number of passengers boarding, alighting, and remaining on a train at a given station) for each train run. For Inbound trains, alighting counts at T.F. Green Airport and Providence Station were cross-checked with the boarding counts at Wickford Junction and T.F. Green Airport/Wickford Junction, respectively, to ensure that there were sufficient passengers on-board to alight at T.F. Green Airport or Wickford Junction as recorded in the field. For the Outbound trains, boarding counts at Providence Station and T.F. Green Airport were cross-checked with alighting counts at Wickford Junction and T.F. Green Airport to ensure that there were no remaining passengers recorded as being on the train once it concluded its run at Wickford Junction.

In instances where the boarding and alighting counts recorded in the field resulted in either "ghost" boardings (a passenger was recorded as boarding the train but alighting counts south of Providence suggest that a passenger was not discharged at the end of the run) or alightings (a passenger was recorded as alighting the train but boarding counts south of Providence suggest that a passenger did not board), counts at Providence and T.F. Green Airport were manually adjusted to agree with the observations recorded at the Wickford Junction control point.

It should be noted that the individual observations collected in the field have been aggregated within this report based on Rhode Island's state fiscal year (FY) which begins on July 1st of the preceding year and runs until June 30th of the current year.

(Remainder of page is intentionally blank)

2 May 2016 Weekday Service Changes

Passenger ridership as observed during the first four collection periods was based on a level of service defined by a schedule that went into effect on July 1, 2014 ("old"). Despite changes in service to other MBTA Commuter Rail lines, the introduction of a new schedule on December 14, 2015 did not impact any trains or times along the Providence/Stoughton Line. Thus, ridership counts conducted during FY Year 2016 (i.e., observations from July 2015, October 2015, January 2016, and April 2016) were all based on a consistent level of service defined by the "old" schedule.

However, passenger ridership as observed during the final four collection periods was based on a revised schedule that went into effect on May 23, 2016 ("new") and included changes to weekday service along the Providence/Stoughton Line. Specifically, the "new" schedule provided four new Inbound and three new Outbound trips at Providence Station, modified arrival and departure times at all stations, and maintained existing service levels at T.F. Green Airport and Wickford Junction stations. Once again, despite changes to service along other MBTA Commuter Rail lines, the introduction of a new schedule on November 21, 2016 did not impact any trains or times along the Providence/Stoughton Line. Thus, ridership counts conducted during FY 2017 (i.e., observations from July 2016, October 2016, January 2017, and April 2017) were all based on a consistent level of service defined by the "new" schedule which afforded passengers at Providence Station additional opportunities to board and alight.

For the purposes of this report, the service periods were defined based on the first and last timepoints at Providence Station and Wickford Junction from the "new" schedule which are presented for the Inbound and Outbound directions in Table 3 and Table 4.

Table 3. Weekday – Inbound – Service Period Definitions

SERVICE PERIOD	WICKFORD JUNCTION		PROVIDENCE STATION		EVEN TRAIN NUMBER RANGE
	First	Last	First	Last	
AM Peak	4:45 AM	7:45 AM	5:00 AM	8:25 AM	800-814
Midday	9:20 AM	1:25 PM	9:50 AM	4:08 PM	816-826
PM Peak	5:30 PM	7:45 PM	5:20 PM	8:15 PM	828-834
Late Night	8:53 PM	8:53 PM	9:23 PM	10:30 PM	836-838

Table 4. Weekday – Outbound – Service Period Definitions

SERVICE PERIOD	PROVIDENCE STATION		WICKFORD JUNCTION		ODD TRAIN NUMBER RANGE
	First	Last	First	Last	
AM Peak	4:58 AM	8:29 AM	5:30 AM	9:01 AM	801-805 & 8801-8805
Midday	10:44 AM	4:27 PM	12:58 PM	4:59 PM	807-817

SERVICE PERIOD	PROVIDENCE STATION		WICKFORD JUNCTION		ODD TRAIN NUMBER RANGE
	First	Last	First	Last	
PM Peak	4:58 PM	8:01 PM	6:09 PM	8:33 PM	819-829
Late Night	8:40 PM	1:10 AM	11:43 PM	11:43 PM	831-839

Table 5, Table 6, and the accompanying descriptions in the sections below provide a summary of the relative service changes to Inbound (to Boston) and Outbound (to Providence/Wickford Junction) service between the "old" and "new" schedules. A complete set of schedules that were in place during this data collection effort is available in Attachment 1.

2.1 Weekday Inbound Service Impacts

Table 5. Weekday – Inbound – Service Summary

STATION	PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
INBOUND TRIPS	FY 2017 [1]	Change (FY 2016)	FY 2017	Change (FY 2016)	FY 2017	Change (FY 2016)
AM Peak	8	+1	4	0	4	0
Midday	6	+2	2	-1	2	-1
PM Peak	4	0	3	+1	3	+1
Late Night	2	+1	1	0	1	0
TOTAL	**20**	**+4**	**10**	**0**	**10**	**0**

- Increased AM Peak service at Providence Station by introducing a new Inbound AM Peak trip from Providence to South Station that departs at 7:50 (i.e., new 812).
- Increased Midday service at Providence Station by introducing two new Inbound Midday trips from Providence to South Station that depart at 1:00 (i.e., new 820) and 3:00 (i.e., new 824).
- Transferred the Inbound Midday boardings at Wickford Junction and T.F. Green Airport from the old 820, which departed Wickford at 3:40, to the new 830, which departs Wickford Junction at 5:30 during the PM Peak, based on a change to the Outbound service pattern that is described in the next section.

[1] Count treats local layovers at Providence en route to South Station as a single train (i.e., old 8802 and old 826 counted as a single train despite being listed as two runs that were separated by a 5-minute layover at Providence).

- Shifted the Inbound Late Night stops at Wickford Junction and T.F. Green Airport from the old 830, which departed Wickford Junction at 10:10, to earlier in the night via the new 836 which departs Wickford Junction at 8:53.
- Supplemented Late Night service at Providence Station by introducing an additional Inbound Late Night trip from Providence to South Station that departs at 10:30 (i.e., new 838) after shifting the full service run between Wickford Junction and South Station from the old 830 (departed Providence at 10:40) to the new 836 (departs at 9:23).

2.2 Weekday Outbound Service Impacts

Table 6. Weekday – Outbound – Service Summary

STATION	PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
OUTBOUND TRIPS	FY 2017	Change (FY 2016)	FY 2017	Change (FY 2016)	FY 2017	Change (FY 2016)
AM Peak	5	0	4	0	4	0
Midday	6	+2	2	0	2	0
PM Peak	6	0	3	0	3	0
Late Night	5	+1	1	0	1	0
TOTAL	**22**	**+3**	**10**	**0**	**10**	**0**

- Increased Midday service at Providence Station by introducing two new Outbound Midday trips from South Station to Providence that arrive at 11:36 (i.e., new 809) and 3:39 (i.e., new 815).
- Transferred the Outbound Midday stops at Wickford Junction and T.F. Green Airport from the old 809, which arrived to Wickford Junction at 3:26, to the new 817 which arrives to Wickford Junction at 4:59. The 817 is considered a very attractive trip for promoting in-state ridership. This train departs Providence at 4:27pm, which is convenient for the many State government employees who work at the nearby State Office complex and leave work at 4:00pm.
- Shifted the Outbound Late Night stops at Wickford Junction and T.F. Green Airport from the old 825, which arrived to Wickford Junction at 9:55, to later in the night via the new 835 which arrives to Wickford Junction at 11:43.
- Supplemented Late Night service at Providence Station by introducing an additional Outbound Late Night trip from South Station to Providence that departs South Station at 7:30 (i.e., new 831).

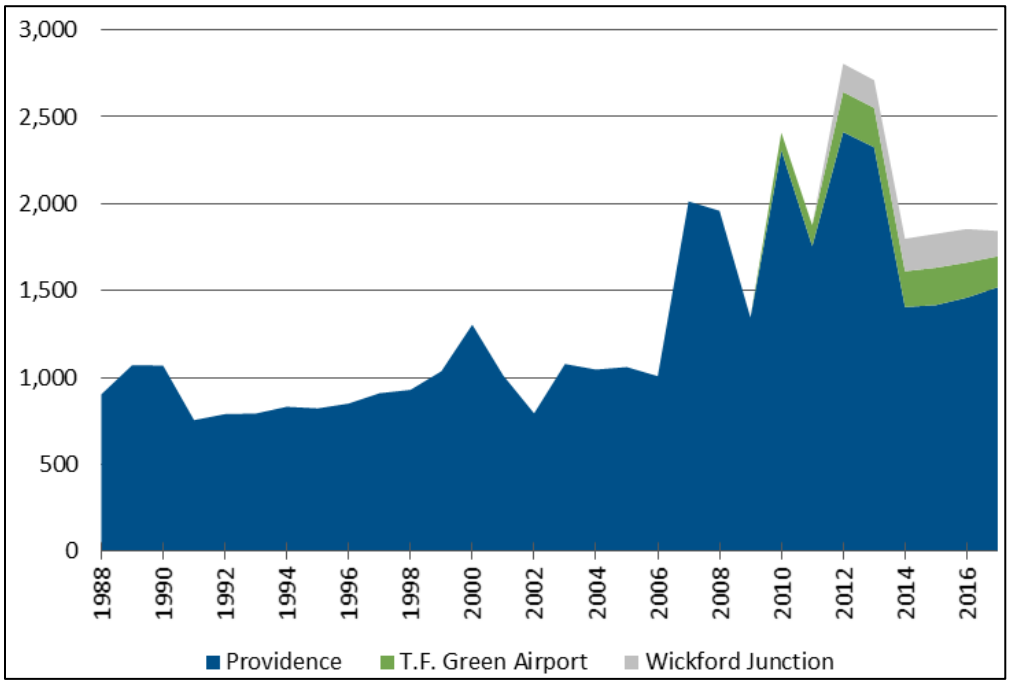
3 Weekday Service

This chapter provides a brief discussion of historical and recent trends in average weekday ridership along the Rhode Island portion of the Providence/Stoughton MBTA Commuter Rail Line and includes an overview of key weekday ridership statistics for the Rhode Island segment of the line, as well as station level statistics for Providence Station, T.F. Green Airport, and Wickford Junction, in FY 2016 and FY 2017 based on the eight rounds of on-platform weekday ridership counts that were completed as part of this effort. Detailed data tables of the results for the quarterly weekday and bi-annual weekend passenger counts are provided in Attachment 2. Processed data for each individual count observation is available in Attachment 5.

3.1 Historical Trends

Ridership levels along the Providence/Stoughton Line have been subject to ebbs and flows ever since service to Providence Station was reinstated by the MBTA in February 1988. Transit ridership can be viewed through many lenses, including boardings, alightings, total activities (i.e., boardings plus alightings), and combinations of these elements by train direction. Given that historical ridership data from the MBTA is only available in the form of average weekday Inbound boardings, Figure 1 contains a graph of cumulative calendar year average weekday Inbound boardings at the three Rhode Island rail stations based on data collected by the MBTA (1988-2013)[2], the previous commuter rail operator, the Massachusetts Bay Commuter Railroad (2014), and the on-platform weekday counts conducted as part of this effort (2015-2017). Based on available historical data, the compound annual growth rate for average weekday Inbound boardings at Providence Station from 1988 to 2017 was 1.81%.

Figure 1. Rhode Island Commuter Rail Weekday Inbound Boardings – Historical Trend (1988-2017)



[2] Massachusetts Bay Transportation Authority. *Blue Book* 11th Edition (2007) and 14th Edition (2014).

It should be noted that the South County Commuter Rail initiative resulted in the expansion of service from Providence to T.F. Green Airport in December 2010 and Wickford Junction in April 2012. According to MBTA records, average weekday Inbound ridership peaked at 2,413 boardings in 2012 which coincided with the initiation of service at Wickford Junction. Based on the most recent year for which data was available from the MBTA (calendar year 2013), weekday Inbound boardings at the three rail stations in Rhode Island accounted for approximately 26% of the line's average weekday Inbound boardings.

The dramatic year-to-year variation in weekday Inbound boardings seen between 2006 and 2007 and again between 2013 and 2014 is difficult to explain, as the MBTA Blue Book reports 1,009 weekday Inbound boardings in 2006 followed by 2,014 in 2007 and 2,325 in 2013 followed by 1,406 in 2014 as recorded by the previous operator. Even MBTA has publically questioned the accuracy of its commuter rail ridership data. Nevertheless, beginning in July 2015 (the start of observations for this effort), average weekday Inbound boardings have been steadily increasing at Providence Station and, despite decreases at T.F. Green Airport and Wickford Junction, ridership on the Rhode Island segment of the line as a whole has increased by 1% as of April 2017.

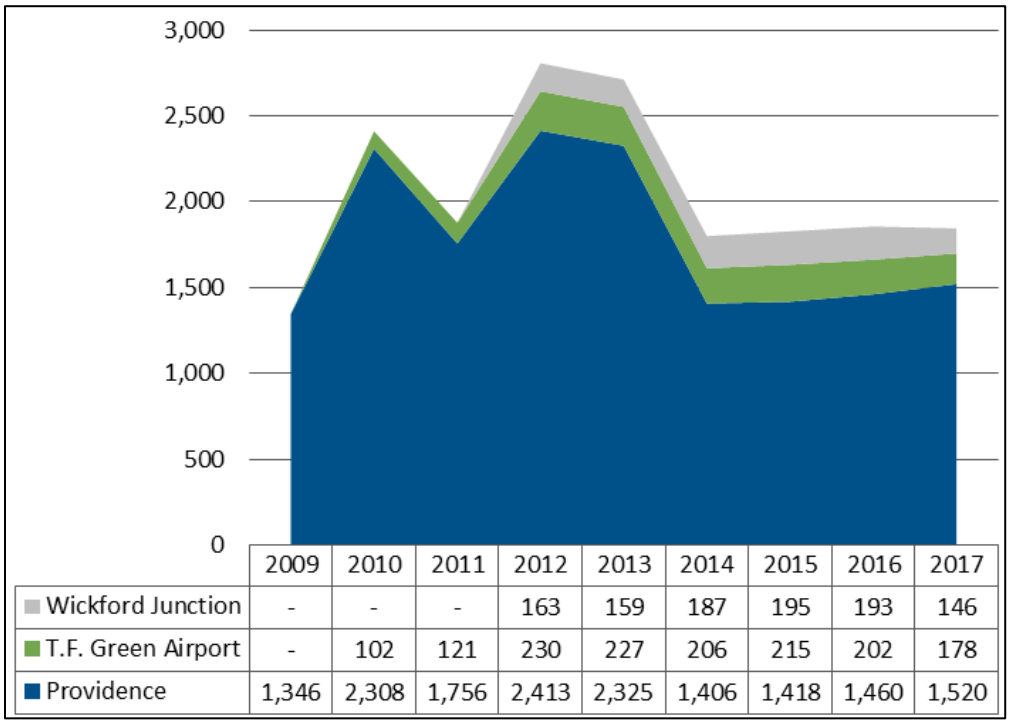
As mentioned previously, the individual counts collected in the field have been aggregated within this report based on Rhode Island's state FY which begins on July 1st of the preceding year and runs until June 30th of the current year. However, as the primary source for historical ridership observations (i.e., MBTA Blue Book) reports figures in terms of the calendar year in which the observation took place, ridership counts collected as part of this effort were adjusted to align with the MBTA's calendar year basis in Figure 1 and Figure 2. All other tables and figures within this report reflect ridership within a given state FY.

3.2 Recent Trends

Figure 2 provides a graph of cumulative average weekday Inbound boardings along the segment of the MBTA's Providence/Stoughton Line that lies within the State of Rhode Island, as well as station level statistics for Providence Station, T.F. Green Airport, and Wickford Junction, from calendar year 2009 to April 2017.

Weekday Inbound boardings at Providence Station grew nearly 13% from 2009 to 2017 and have increased 7% during the course of this effort which started in July 2015. Since service began at T.F. Green Airport in 2010 Inbound trips have grown by nearly 75%; however, Inbound boardings recently dropped by 17% from 2015 to 2017. Despite a positive trend from 2013 to 2015, Inbound boardings at Wickford Junction have decreased by 10% since the station opened in 2012 and recently fell by 25% between 2015 and 2017. On the whole, average weekday Inbound boardings along the Rhode Island segment of the line have increased by approximately 1% between 2015 and 2017.

Figure 2. Rhode Island Commuter Rail Weekday Inbound Boardings – Recent Trend (2009-2017)



	2009	2010	2011	2012	2013	2014	2015	2016	2017
Wickford Junction	-	-	-	163	159	187	195	193	146
T.F. Green Airport	-	102	121	230	227	206	215	202	178
Providence	1,346	2,308	1,756	2,413	2,325	1,406	1,418	1,460	1,520

3.3 Weekday Service Summary

To provide context as to the level of service provided at each station during the observation period, Table 7 summarizes the number of weekday MBTA Commuter Rail train trips in a given period serving each station during FY 2016 and FY 2017.

Table 7. Weekday – Service Summary by Station and Time of Day

STATION	PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
TRIPS	FY 2017 [3]	Change (FY 2016)	FY 2017	Change (FY 2016)	FY 2017	Change (FY 2016)
AM Peak	13	+1	8	0	8	0
Midday	12	+4	4	-1	4	-1
PM Peak	10	0	6	+1	6	+1
Late Night	7	+2	2	0	2	0
TOTAL	**42**	**+7**	**20**	**0**	**20**	**0**

[3] Count treats local layovers at Providence en route to South Station as a single train (i.e., old 8802 and old 826 counted as a single train despite being listed as two runs that were separated by a 5-minute layover at Providence.)

As discussed above, opportunities for boarding and alighting increased by 20% at Providence Station (seven additional trains per weekday) during the observation period and the majority of this increase in service was concentrated during the Midday period. While the timing of trains was adjusted at T.F. Green Airport and Wickford Junction, the total number of trains serving the two stations remained constant during this effort.

3.4 Activities

Figure 3 contains three frames (total activities, boardings, and alightings) each of which include a bar chart and accompanying table, which report average weekday statistics at the station and line levels for FY 2016 and FY 2017, as well as a donut chart reflecting each station's contribution to the line's performance as a whole for the relevant weekday statistic. Unless otherwise noted, the inner ring within each donut chart reflects the FY 2016 data while the outer ring corresponds to the FY 2017 observations.

On average, Providence Station accounted for approximately 80% of all boardings and alightings along the Rhode Island segment of the line in FY 2016 and FY 2017 while T.F. Green Airport and Wickford Junction were responsible for roughly 10% of total activities. Despite a 4% decrease in total activities at Wickford Junction, total weekday activities along the Rhode Island segment of the line still increased by 12% due to a significant gain at Providence Station (16%) and a modest 2% increase at T.F. Green Airport.

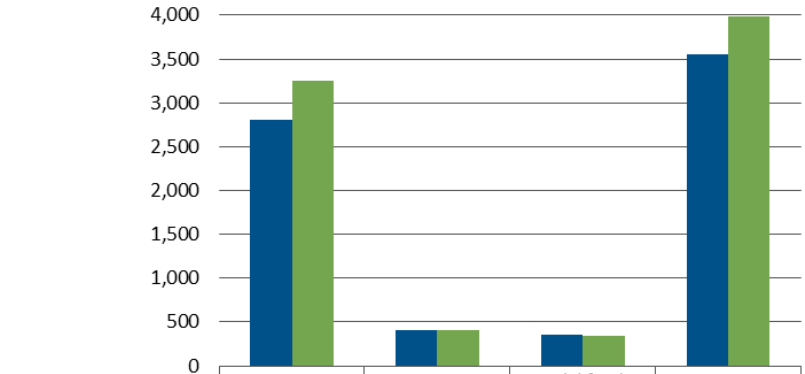
In terms of total boardings and alightings, the same general relationship between the stations holds true (i.e., Providence accounts for approximately 80% with the others providing 10% each). Average weekday boardings along the Rhode Island segment of the line grew by 7%, with a 10% increase at Providence Station proving sufficient to counteract a 1% and nearly 4% decrease at T.F. Green Airport and Wickford Junction, respectively. Similar to the proportional change for total activities, Providence Station's share of the line's boardings grew by 2% while the other stations both decreased by 1%. Average weekday alightings increased by approximately 17%, with gains at Providence Station (21%) and T.F. Green Airport (5%) overcoming a 4% decrease at Wickford Junction.

While FY 2017 ridership statistics at T.F. Green Airport and Wickford Junction remained relatively constant, the consistent increase in ridership statistics at Providence Station demonstrates that an increase in service levels, like the seven additional trains that were introduced as part of the May 2016 schedule update, can produce a positive change in ridership.

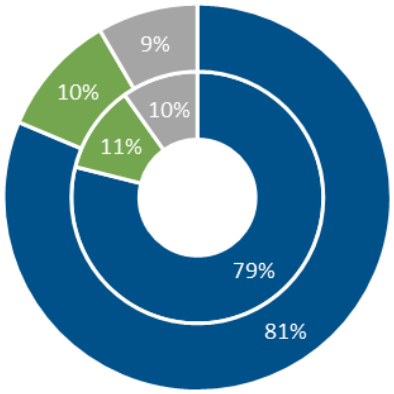
(Remainder of page is intentionally blank)

Figure 3. Weekday – Average Ridership Statistics by Station (FY 2016 and FY 2017)

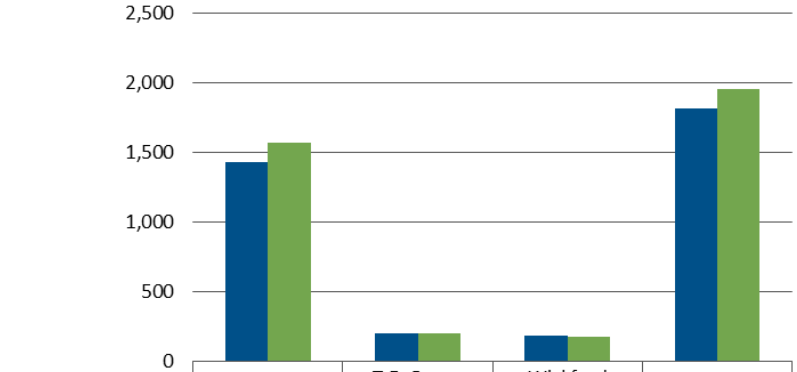
Average Weekday Total Activities



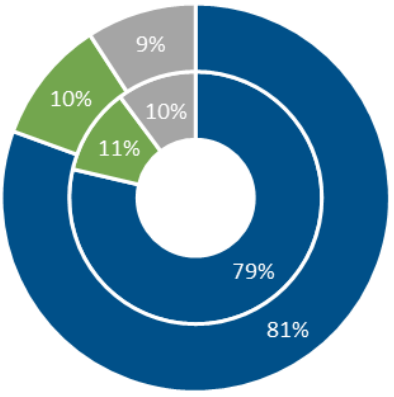
	Providence	T.F. Green Airport	Wickford Junction	TOTAL
FY 2016 All Activities	2,809	401	349	3,559
FY 2017 All Activities	3,247	409	335	3,991

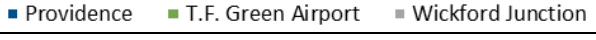


Average Weekday Boardings

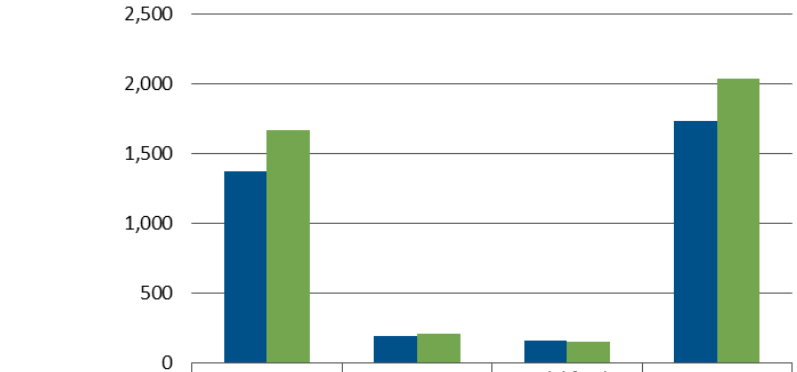


	Providence	T.F. Green Airport	Wickford Junction	TOTAL
FY 2016 Boardings	1,433	203	186	1,822
FY 2017 Boardings	1,576	201	179	1,956

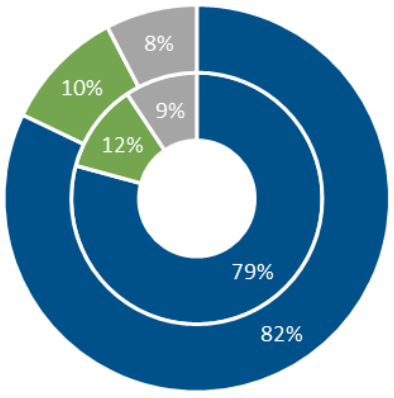


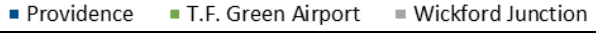


Average Weekday Alightings



	Providence	T.F. Green Airport	Wickford Junction	TOTAL
FY 2016 Alightings	1,376	198	163	1,737
FY 2017 Alightings	1,671	208	156	2,035

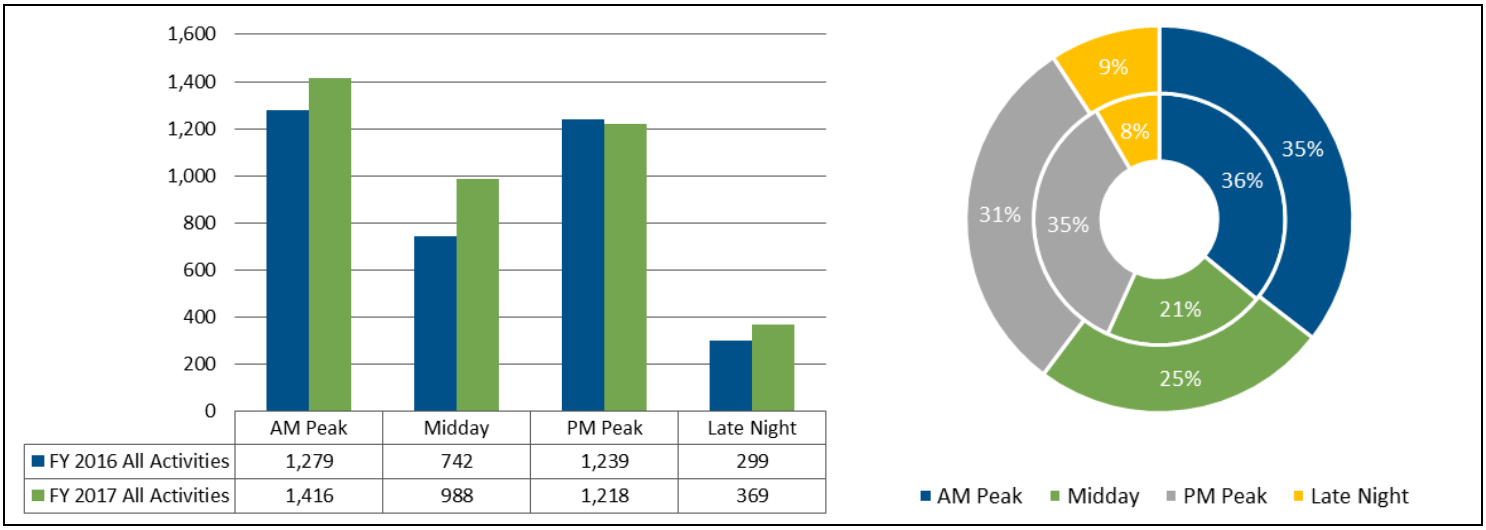




3.5 Time of Day Analysis

Figure 4 displays total activities across all three Rhode Island stations by time of day to assist in understanding when within the service day ridership grew between FY 2016 and FY 2017.

Figure 4. Weekday – Average Total Activities by Time of Day – All Stations (FY 2016 and FY 2017)



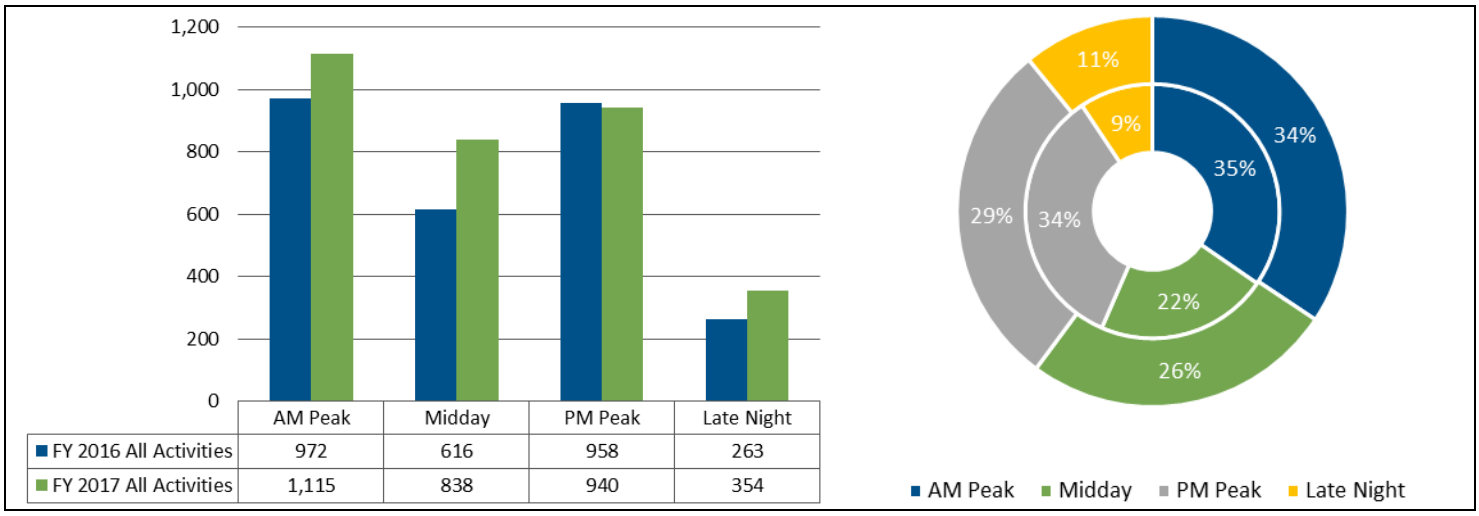
On average, the AM and PM Peak periods combine to account for over two-thirds of all activities within Rhode Island while the Midday and Late Night total activities constitute around 20% and 10% of all activities, respectively. Interestingly, total activities across the line as a whole increased for every service period in which at least one additional train serving Providence was added in May 2016 (11% AM Peak with one new train, 33% Midday with four additional trains, and 23% Late Night with two more trains) while a 2% decrease in total activities was observed during the PM Peak, the only period for which service levels at Providence Station remained constant throughout this effort. The substantial increase in ridership during the Midday period shows that investing in additional frequency can lead to more ridership. In addition, this indicates that trips between Providence and Boston are more diverse than traditional commuter rail trips.

3.5.1 Station Level Activities by Time of Day

Figure 5 through Figure 7 offer visual summaries of the proportion of each station's average weekday total activities that was carried during each of the service periods in FY 2016 and FY 2017.

As seen in Figure 5, the temporal distribution of activities at Providence Station aligns closely with the distribution observed for the line. The introduction of seven additional trains outside of the PM Peak coincided with an overall 16% increase in total activities at the station. The extra AM Peak train generated a 15% increase in activities while an additional four and two trains during the Midday and Late Night periods, respectively, produced a 36% and 35% increase in total activities. Moving from the inner ring to the outer ring, the additional ridership created by an increase in service levels outside of the PM Peak can be observed in the form of a widened band on the outer ring within a given service period.

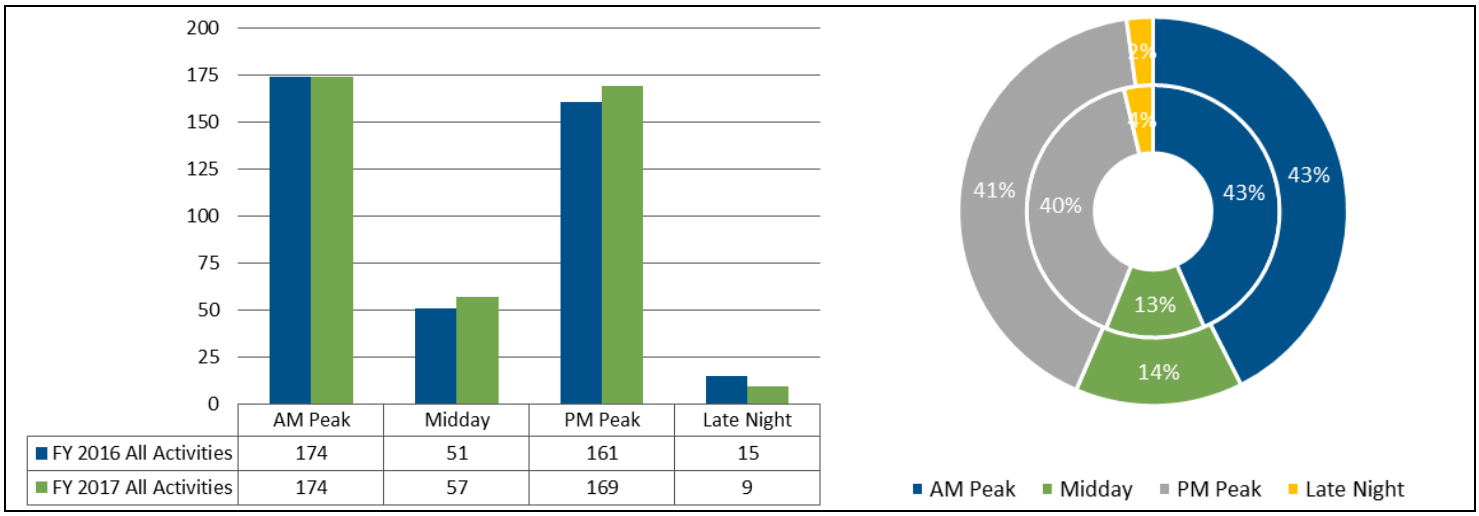
Figure 5. Weekday – Average Total Activities by Time of Day – Providence Station (FY 2016 and FY 2017)



	AM Peak	Midday	PM Peak	Late Night
FY 2016 All Activities	972	616	958	263
FY 2017 All Activities	1,115	838	940	354

At T.F. Green Airport, total activities increased by 2% from FY 2016 to FY 2017, as modest absolute increases during the Midday and PM Peak service periods were sufficient to balance a decrease in Late Night activities. As seen in Figure 6, relative to the temporal distribution observed for Providence Station and the line as a whole, activities at T.F. Green Airport were heavily concentrated during the AM and PM Peak service periods, with the two intervals combining for nearly 85% of all activities at the station. As potential passengers, most notably business travelers using the airport, were only afforded three opportunities to travel Inbound from the station towards Boston between 9:34 AM and 5:44 PM, the low proportion of activities during the Midday service period, relative to other stations, is to be expected. Furthermore, the low level of nighttime flight activity at T.F. Green International Airport, coupled with the industrial land use patterns surrounding the station and airport, contribute to a relative lack of Late Night activity at the station.

Figure 6. Weekday – Average Total Activities by Time of Day – T.F. Green Airport (FY 2016 and FY 2017)

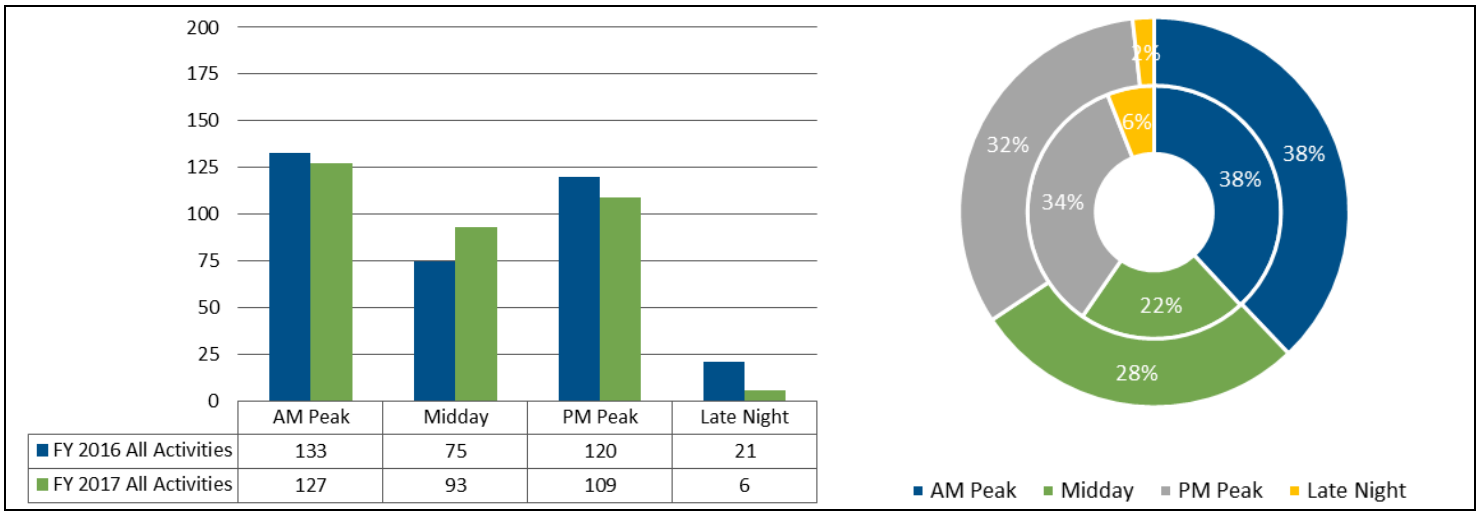


	AM Peak	Midday	PM Peak	Late Night
FY 2016 All Activities	174	51	161	15
FY 2017 All Activities	174	57	169	9

For Wickford Junction, total activities decreased by 4% from FY 2016 to FY 2017, with the only gain in activities occurring during the Midday service period (24%). As seen in Figure 7, the largest decrease

in activities occurred during the Late Night service period (71%), primarily due to the low magnitude of activities observed in both FY 2016 and FY 2017. The temporal distribution of activities at Wickford Junction is similar to that observed for the line as a whole; however, the Midday contributions were slightly larger while the Late Night proportions were smaller.

Figure 7. Weekday – Average Total Activities by Time of Day – Wickford Junction (FY 2016 and FY 2017)



Aside from the homogeneous land uses abutting the stations at T.F. Green Airport and Wickford Junction, the low magnitude of activities during the Late Night service period may also be influenced by the large gap in service coverage in the Outbound direction. While the MBTA Commuter Rail system was built with the intent to provide those living outside of metro Boston with access to employment, educational, and consumer opportunities in the Hub, these large gaps in service do little to encourage passengers to use the system for anything other than weekday commutes. During the Late Night period, there is only one train in each direction that provides service to stations south of Providence. Similarly, in the nine hour interval between the end of the AM Peak and the start of the PM Peak, passengers that need to board or alight at a station south of Providence are afforded only two opportunities in each direction to do so.

3.6 Internal Trips

To understand the degree to which rail service between Providence Station, T.F. Green Airport, and Wickford Junction has been used to serve trips exclusively within the State of Rhode Island, as opposed to long-haul trips oriented towards metro Boston, the observations presented previously were modified to distinguish between “internal” trips (i.e., boarding and alighting both take place at MBTA Commuter Rail stations within Rhode Island) and “external” trips (i.e., boarding or alighting occurs at an MBTA Commuter Rail station within Massachusetts) without double-counting passengers using the definitions provided in Table 8.

Table 8. Trip Type Definitions by Direction

TRIP TYPE	INBOUND	OUTBOUND
Internal	Alightings	Alightings – Boardings
External	Boardings - Alightings	Boardings

For the Inbound direction, external trips take passengers from Rhode Island into Massachusetts while internal trips carry passengers northward between stations in Rhode Island. For the Outbound direction, external trips bring passengers from Massachusetts into Rhode Island whereas internal trips move passengers southward between stations in Rhode Island. Since T.F. Green Airport serves as an intervening facility and this effort relied on platform counts, the ability to identify origin-destination pairs from these ridership observations is inherently limited (e.g., for Inbound internal trips ending at Providence the boarding location could be either Wickford Junction or T.F. Green Airport). By convention, internal trips at Wickford Junction were set to zero because it served as a control point (the current terminus avoids ambiguity as each train consists only of boarding or alightings). However, internal trips made by passengers boarding or alighting at Wickford Junction have been incorporated into the tallies for T.F. Green Airport and Providence Station.

Figure 8 presents average weekday internal trips classified by station (top) and time of day (bottom) for the FY 2016 and FY 2017 observations. Overall, internal trips constituted 2.2% of all trip-level activities along the Rhode Island segment of the line in FY 2016 and this proportion grew to 2.7% in FY 2017. Internal trips grew by 38% across the line between FY 2016 and FY 2017, with internal trips with an end at Providence Station increasing by 42% (30 trips) and internal trips with an end at T.F. Green Airport decreasing by 20% at T.F. Green Airport (one trip). Internal trips aboard MBTA Commuter Rail were heavily focused on Providence Station, with T.F. Green Airport accounting for less the 10% of internal trips in either year. As seen in Figure 9, internal trips increased across all service periods with the exception of the Late Night service period, which decreased by 50% (one trip).

Figure 8. Weekday – Average Internal Trips by Station (FY 2016 and FY 2017)

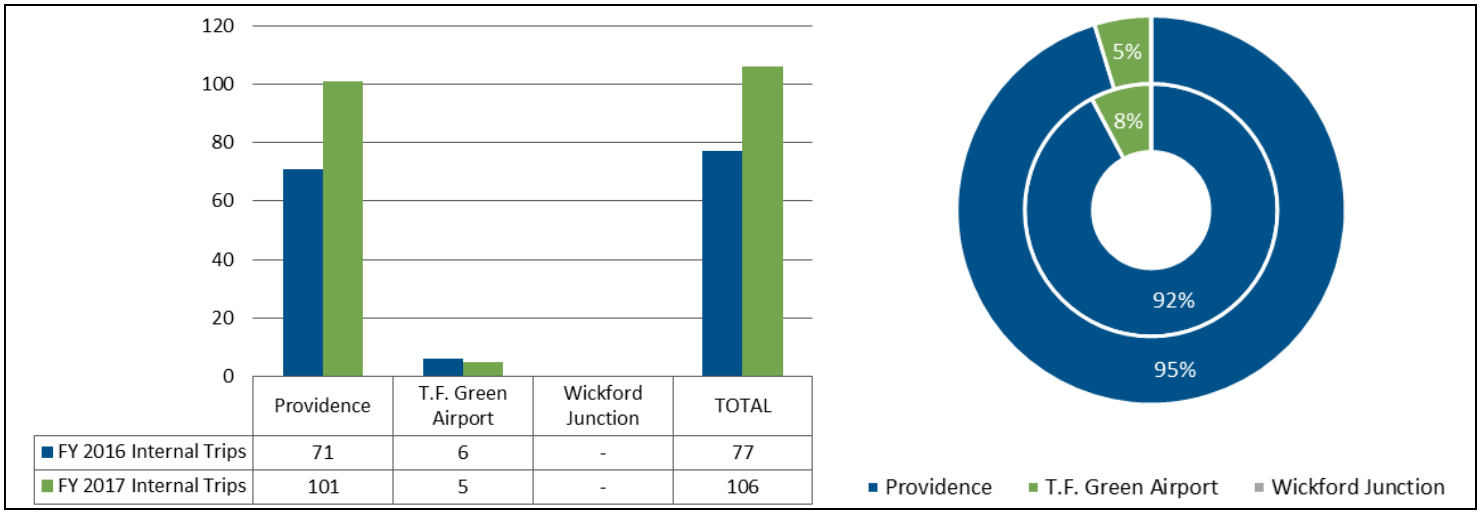
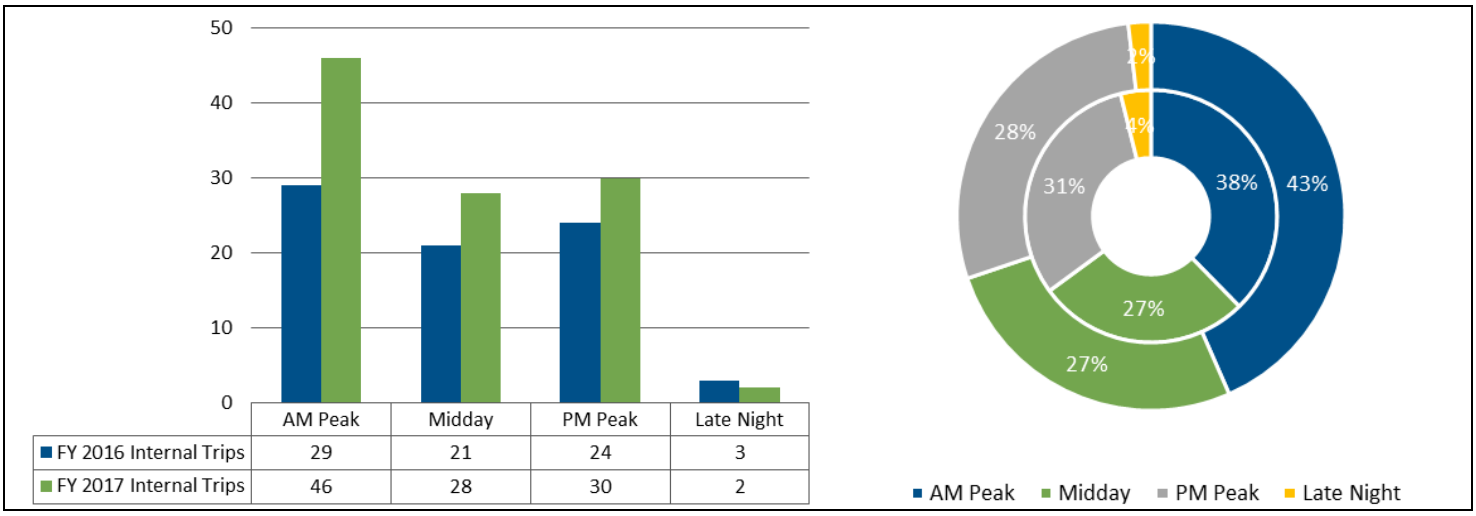
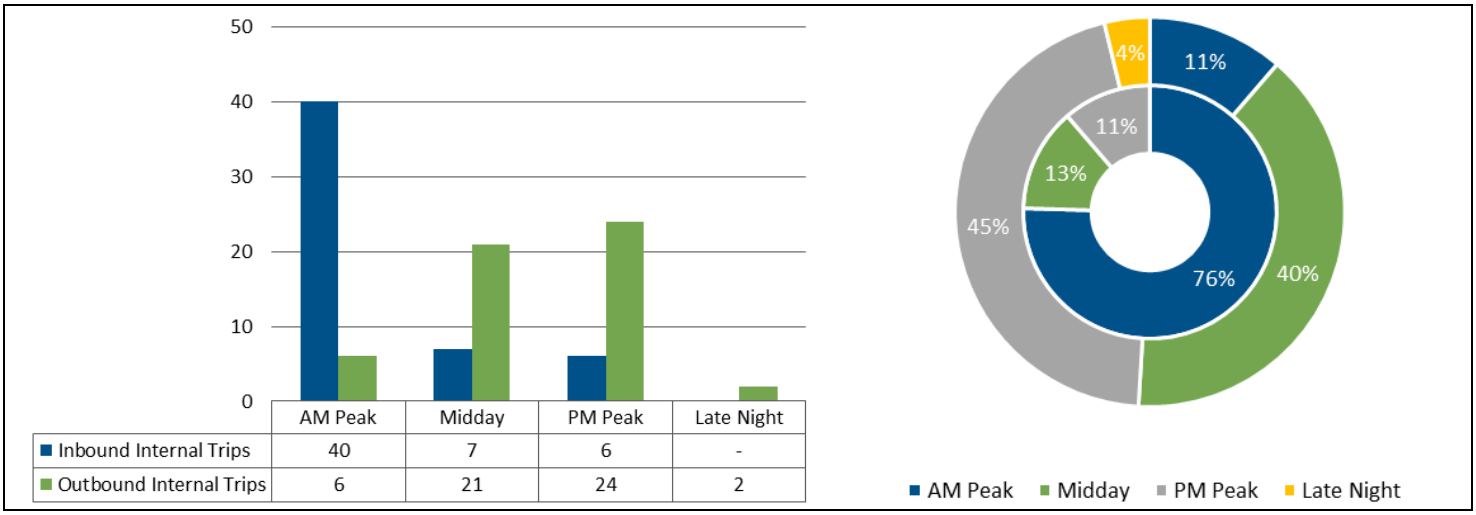


Figure 9. Weekday – Average Internal Trips by Time of Day –All Stations (FY 2016 and FY 2017)



To better understand when and where these weekday internal trips were being taken, Figure 10 shows the split between internal trips taken in the Inbound and Outbound directions by service period, with the inner ring representing Inbound internal trips and the outer ring corresponding to those in the Outbound direction. As expected, Inbound internal trips were concentrated primarily during the AM Peak (76%), reflecting the fact that some passengers who live in the vicinity of T.F. Green Airport or Wickford Junction use the service for daily commute purposes. Outbound internal trips, on the other hand, were more evenly dispersed throughout the day, with the majority taking place during the Midday and PM Peak service periods.

Figure 10. Weekday – Average Internal Trips by Train Direction and Time of Day – All Stations (FY 2017)



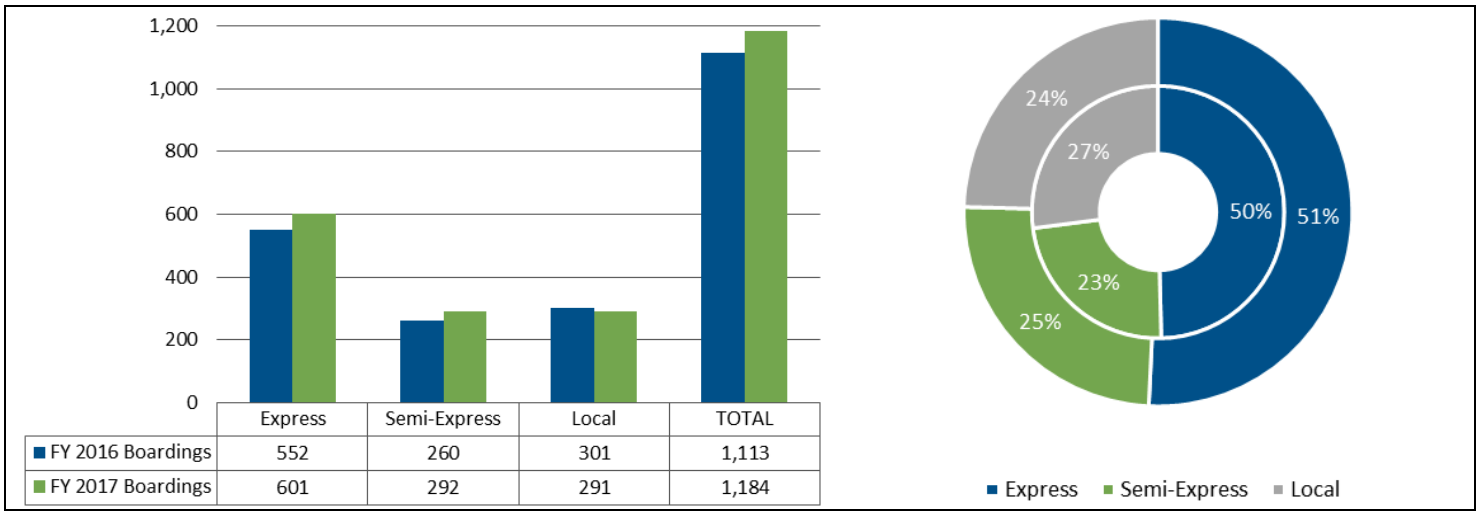
3.7 Service Type

The MBTA Commuter Rail offers three different service types along the Providence/Stoughton Line on weekdays – Express, Semi-Express, and Local. Express trains are defined as trains that skip at least three stops between South Station and Providence, with the most common skips occurring at Hyde Park, Canton Junction, and occasionally Ruggles. Semi-Express trains are those that skip one or two

stops between South Station and Providence. Local trains provide passengers with an opportunity to board or alight at every station along the line between South Station and Wickford Junction. All weekend service at along the Providence/Stoughton Line is operated as Local.

Figure 11 shows the average weekday Inbound AM Peak boardings. Inbound boardings during the AM Peak grew by 6% (71 passengers) across all service types. The amount of passengers on Express and Semi-Express trains increased by 9% (49 additional passengers) and 12% (32 passengers), respectively, while Local trains served 3% fewer passengers (10 fewer passengers) between FY 2016 and FY 2017. Overall, Express trains accounted for approximately half of the Inbound AM Peak ridership while the Semi-Express and Local trains each carried roughly a quarter of the passengers.

Figure 11. Weekday – Average Inbound AM Peak Boardings by Service Type – All Stations (FY 2016 and FY 2017)

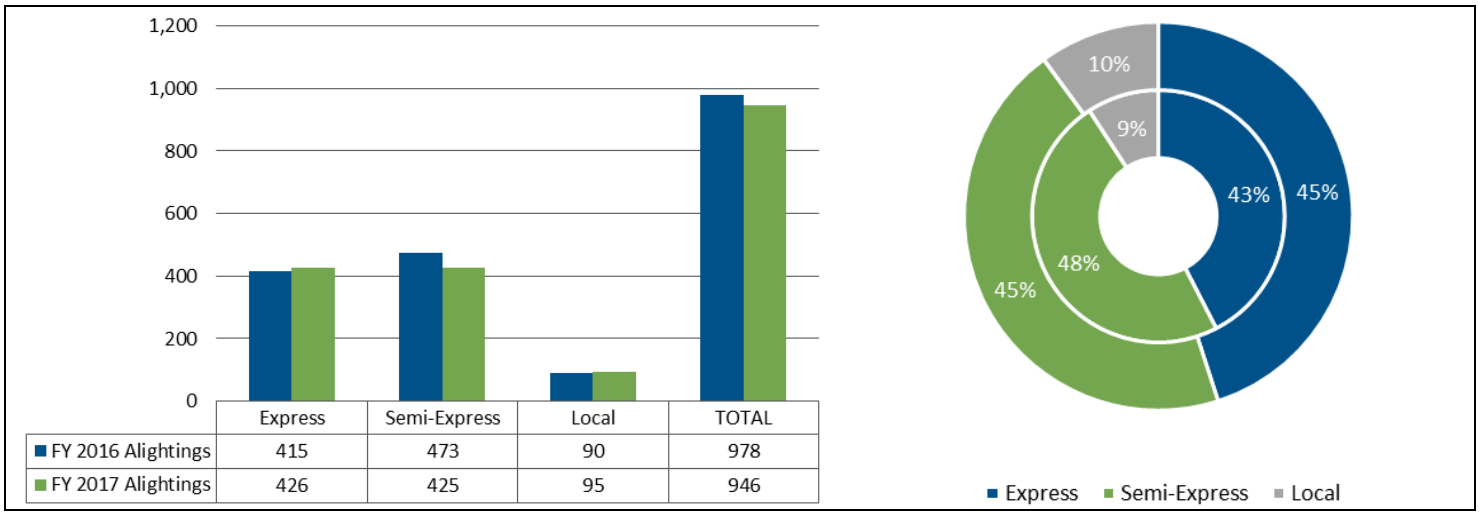


	Express	Semi-Express	Local	TOTAL
FY 2016 Boardings	552	260	301	1,113
FY 2017 Boardings	601	292	291	1,184

Given the number of Inbound AM Peak trains for each service type (three Express, two Semi-Express, and three Local), the disproportionate share of passengers choosing Express service indicates that there exists a preference among passengers for Express trains relative to Local trains (i.e., in the absence of a preference for service type and a distinction in frequency among service types, one would expect 444 passengers for both service types, but the Express trains garner 601 passengers while the Locals only manage 291 passengers).

Figure 12 shows the average weekday Outbound PM Peak alightings. Outbound alightings during the PM Peak fell by 3% (32 passengers) across all service types. The amount of passengers on Express and Local trains increased by 3% (11 additional passengers) and 6% (5 passengers), respectively, while Semi-Express trains served 10% fewer passengers (48 fewer passengers) between FY 2016 and FY 2017. Overall, alightings of Semi-Express trains were slightly greater than the Express, both carrying approximately 45% of the service period's passengers, and Local trains only served 10% of the service period's alightings. Whereas Inbound AM Peak boardings in Rhode Island demonstrate a clear preference for Express trains over Local trains, Outbound PM Peak alightings in Rhode Island suggest a preference for Semi-Express trains over Express trains, as the two Semi-Express runs carry more passengers than the three Express trains operating Outbound during the PM Peak.

Figure 12. Weekday – Average Outbound PM Peak Alightings by Service Type – All Stations (FY 2016 and FY 2017)



	Express	Semi-Express	Local	TOTAL
FY 2016 Alightings	415	473	90	978
FY 2017 Alightings	426	425	95	946

3.8 Peak Passenger Loads

Table 9 displays the top 20 trains that were observed to have the highest weekday Inbound passenger loads at the Rhode Island-Massachusetts border. For the Inbound direction, the number of passengers headed to Massachusetts was equal to the sum of all boardings in Rhode Island on that particular train minus the sum of all alightings at T.F. Green Airport and Providence Station (i.e., internal trips). The most tightly packed weekday Inbound trains crossing the state line northward were observed to occur during the AM Peak which aligns with the typical pattern of commuter rail passenger flows being oriented toward the regional employment center (i.e., Boston) at the beginning of the business day.

The 808 Express, which currently departs Wickford Junction at 6:35 AM (Providence Station at 7:15 AM) and arrives to South Station at 8:16 AM, occupied the top eight spots (i.e., consistently carried the highest weekday Inbound load). The 808 Express tends to carry well over 325 passengers from Rhode Island into Massachusetts each weekday. Other popular options for morning passengers included the 806 Semi-Express (second Inbound train departing Wickford Junction at 5:45 AM, arriving to South Station at 7:35 AM), 812 Express (departs Providence at 7:50 AM, arrives to South Station at 8:55 AM), and the 814 Local (departs Wickford Junction at 7:45 AM, arrives to South Station at 9:39 AM). It should be noted that relatively high shares of internal trips (above 5% of passengers) were observed on the old 812 (departed Wickford Junction at 7:42 AM, stopped at Providence at 8:15 AM) and the current 814 (currently departs Wickford Junction at 7:45 AM, stops at Providence at 8:25 AM).

Table 9. Weekday – Inbound – Trains with Highest Outgoing Passenger Loads (FY 2016 and FY 2017)

RANK	TRAIN	SAMPLING PERIOD	BEGIN RUN	SERVICE TYPE	ONS			INTERNAL TRIPS	TO MASS.
					Wickford Junction	T.F. Green Airport	Providence Station		
1	808	July 2016	6:35 AM	Express	54	86	293	19	414
2	808	July 2015	6:37 AM	Express	44	67	288	1	398
3	808	April 2016	6:37 AM	Express	52	67	275	3	391
4	808	April 2017	6:35 AM	Express	37	80	250	0	367
5	808	October 2016	6:35 AM	Express	53	72	236	1	360
6	808	January 2016	6:37 AM	Express	42	65	235	2	340
6	808	October 2015	6:37 AM	Express	37	76	230	3	340
8	808	January 2017	6:35 AM	Express	49	73	209	5	326
9	806	January 2017	5:45 AM	Express	26	44	147	0	217
10	812	April 2017	7:50 AM	Local	No Stop Here	No Stop Here	216	No Local Stops	216
11	812	October 2015	7:42 AM	Local	45	32	148	15	210
12	806	January 2016	5:58 AM	Express	30	53	129	3	209
13	806	October 2016	5:45 AM	Express	19	46	144	1	208
14	806	April 2017	5:45 AM	Express	13	38	144	2	193
15	806	July 2016	5:45 AM	Express	22	57	112	1	190
16	806	July 2015	5:58 AM	Express	23	50	115	1	187
17	814	October 2016	7:45 AM	Local	51	27	129	31	176
17	812	April 2016	7:42 AM	Local	47	24	123	18	176
19	814	July 2016	7:45 AM	Local	53	30	121	31	173
20	806	October 2015	5:58 AM	Express	27	45	99	4	167

Table 10 shows the top 20 trains that were observed to have the highest weekday Outbound passenger loads at the Massachusetts-Rhode Island border. For the Outbound direction, the number of passengers coming from Massachusetts was equal to the sum of all alightings in Rhode Island on that particular train minus the sum of all boardings at Providence Station and T.F. Green Airport (i.e., internal trips). The most tightly packed weekday Outbound trains crossing the state line southward were observed to occur during the PM Peak which aligns with the typical pattern of commuter rail passenger flows being oriented away from the regional employment center (i.e., Boston) at the close of the business day.

Table 10. Weekday – Outbound – Trains with Highest Incoming Passenger Loads (FY 2016 and FY 2017)

RANK	TRAIN	SAMPLING PERIOD	ARRIVE TO PVD	SERVICE TYPE	FROM MASS.	OFFS			INTERNAL TRIPS
						Providence Station	T.F. Green Airport	Wickford Junction	
1	825	July 2016	6:43 PM	Express	326	188	81	61	4
2	825	January 2017	6:43 PM	Express	293	203	70	23	3
3	825	April 2017	6:43 PM	Express	290	178	71	46	5
4	821	April 2017	5:37 PM	Semi-Express	276	179	67	43	13
5	825	October 2016	6:43 PM	Express	275	194	55	32	6
6	819	July 2015	6:46 PM	Express	262	117	86	59	0
7	813	July 2015	5:12 PM	Semi-Express	254	133	69	70	18
8	821	July 2016	5:37 PM	Semi-Express	252	159	65	45	17
9	819	April 2016	6:46 PM	Express	249	177	50	23	1
10	821	January 2017	5:37 PM	Semi-Express	244	133	87	38	14
11	813	January 2016	5:23 PM	Semi-Express	243	115	59	74	5
12	821	October 2016	5:37 PM	Semi-Express	228	144	67	46	29
13	817	January 2016	6:10 PM	Express	223	138	57	28	0
14	819	October 2015	6:46 PM	Express	221	168	35	25	7
15	819	January 2016	6:46 PM	Express	220	147	41	32	0
16	817	October 2015	6:10 PM	Express	212	144	47	29	8
17	813	April 2016	5:23 PM	Semi-Express	200	102	58	51	11
18	817	April 2016	6:10 PM	Express	186	122	50	16	2
19	813	October 2015	5:23 PM	Semi-Express	180	71	66	59	16
20	823	July 2016	6:07 PM	Semi-Express	175	175	No Stop Here	No Stop Here	No Local Stops

However, unlike the Inbound direction, the top spots for the Outbound direction were not consistently dominated by a single train and the May 2016 service changes complicate comparison between the different rounds of counts (i.e., the current 827 departs South Station at 6:10 PM while the old 827 departed at 9:05 PM). The 825 Express, which currently departs South Station at 5:40 PM and arrives to Providence Station at 6:43 PM (Wickford Junction at 7:15 PM), occupied four of the top five spots[4]. Other popular options for afternoon commuters included the 821 Semi-Express (departs South Station at 4:30 PM and arrives to Providence at 6:09 PM), the old 819 Express (prior to May 2016 this was the equivalent of the current 825 Express), the old 821 Semi-Express (prior to May 2016 this was the time equivalent of the current 827 Express), and the old 813 (departed South Station at 4:08 PM,

[4] It should be noted that, prior to the May 2016 service changes, the 825 Outbound was a Late Night train and the old 819 Outbound served similar timepoints as the current 825 Outbound.

arrived to Providence Station at 5:23 PM). It should be noted that relatively high shares of Outbound internal trips were observed for the 821 (currently departs Providence at 5:37 PM, arrives to Wickford Junction at 6:09 PM) and the old 813 (departed Providence Station at 5:23 PM, arrived to Wickford Junction at 5:54 PM).

3.9 Influence of Other Variables

Microeconomists often use the concept of price elasticity to consider the relationship between changes in the demand for a good (i.e., riding a train) based on changes to the price (e.g., fare or cost of gasoline) or supply (i.e., number of weekday trains). As a point of convention, positive numbers for elasticity coefficients reflect a direct relationship (i.e., an increase in the first variable produces a corresponding increase in the second) while negative values represent an inverse relationship (i.e., a decrease in the first variable creates an increase in the second variable). Elasticities with absolute values greater than one signify that the relationship between the two variables is "elastic" (i.e., X% change in the variable leads to a >X% change in ridership) while absolute values less than one suggest that the relationship is "inelastic" (i.e., Y% change in the variable leads to a <Y% change in ridership).

Table 11 provides midpoint price elasticities between weekday ridership at each station based on fluctuations in the average price of gasoline, zone-specific fares, and the amount of service provided using observations from July 2015 and April 2017.

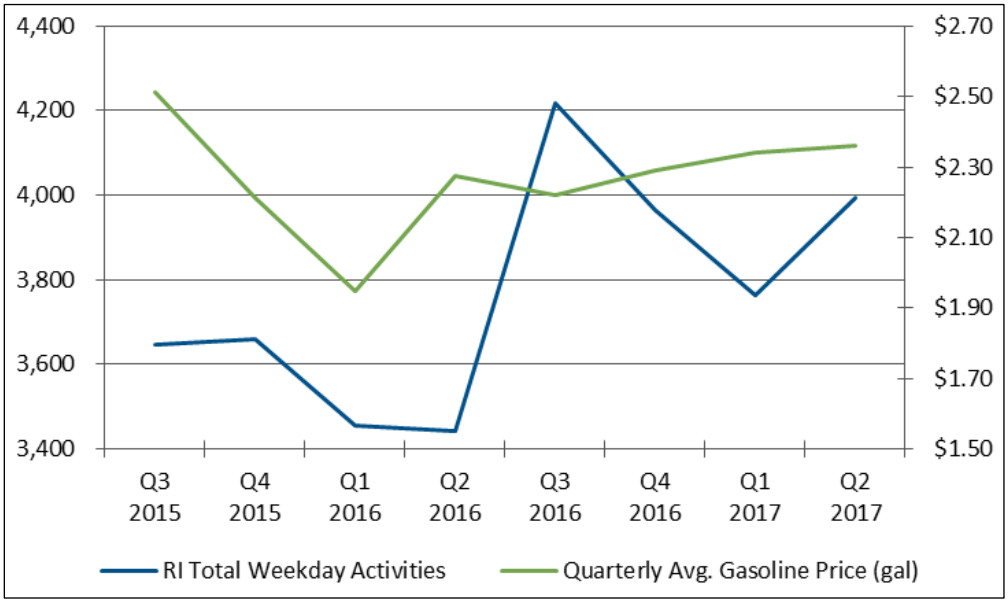
Table 11. Weekday – Price Elasticities for Other Variables

VARIABLE OF INTEREST	PROVIDENCE	T.F. GREEN AIRPORT	WICKFORD JUNCTION	ALL RI STATIONS
Gas Prices	-2.85	1.31	7.74	-1.45
Fares	1.98	-0.95	-5.86	N/A
Service Frequency	0.99	N/A	N/A	N/A

In terms of the effect of gasoline prices on ridership, the traditional relationship is positive (i.e., a decrease in the cost of gasoline leads to a decrease in rail ridership) and this is demonstrated on weekdays at T.F. Green Airport and Wickford Junction. However, weekday observations for Providence Station and statewide MBTA Commuter Rail ridership suggest a counterintuitive relationship between gasoline prices and rail ridership. Figure 13 compares quarterly observations of Rhode Island average weekday ridership with the quarterly average price of a gallon of conventional gasoline as published by the US Energy Information Administration[5].

[5] Fuel price data was retrieved from the US EIA on April 18, 2017 and quarterly averages were derived by taking the quarterly average of the weekly observations of regional fuel prices for conventional gasoline (i.e., Weekly New England Regular Conventional Retail Gasoline Prices [EMM_EPMRU_PTE_R1X_DPG]) during the periods from January to March (i.e., Q1), April to June (Q2), July to September (Q3), and October to December (Q4). https://www.eia.gov/petroleum/gasdiesel/xls/pswrgvwall.xls

Figure 13. Weekday – Comparison of Total Activities versus Quarterly Gas Prices in New England – All Stations



Relative to the influence of changes in MBTA Commuter Rail fares on ridership, the traditional relationship is negative (i.e., an increase in fare leads to a decrease in ridership) and this trend was observed at T.F. Green Airport and Wickford Junction. Observations for Providence Station, yet again, indicate a counterintuitive relationship between fares and MBTA Commuter Rail ridership. One potential explanation for these unexpected weekday trends is that the change in the level of service provided at Providence Station is confounding the influence of the other two variables.

As discussed above, despite some modifications to the timing of trains, the level of weekday service at T.F. Green Airport and Wickford Junction (i.e., number of weekday trains) did not vary between FY 2016 and FY 2017. Given the constant level of service at those stations, weekday ridership, as expected, decreased in response to both a decrease in the price of a competing alternative (i.e., cost of gasoline) and an increase in the cost of the good (i.e., fare). However, at Providence Station, a 20% increase in the level of service (i.e., addition of seven new weekday train runs) was sufficient to counteract these unfavorable cost trends. As the elasticity coefficient is 0.99, the relationship between weekday ridership at Providence and the number of trains provided is nearly unitary. Thus, the seven weekday train increase produced a nearly one-to-one increase in weekday ridership relative to the ridership levels attained in FY 2016 when 35 weekday trains served the station.

4 Weekend Service

This chapter begins with a summary of weekend train service at Providence Station[6] and then provides separate discussions of statistics for Saturday and Sunday service. Bi-annual weekend ridership counts were performed at Providence Station on the Saturdays and Sundays following the second, fourth, sixth, and eighth rounds of quarterly weekday ridership counts. As the MBTA does not publish weekend ridership statistics, historical and recent trends of weekend ridership cannot be analyzed. Detailed data tables of the results for the bi-annual weekend and quarterly weekday passenger counts are provided in Attachment 2.

4.1 Weekend Service Summary

Despite multiple changes to weekday service along the Providence/Stoughton Line during the study period, the level of weekend service provided at Providence, as well as the arrival and departure times offered to passengers, remained unchanged. Table 12 summarizes the existing Saturday and Sunday service levels at Providence Station. The MBTA does not operate AM Peak trains on Sundays along the Providence/Stoughton Line.

Table 12. Weekend – Service Summary for Providence Station by Time of Day

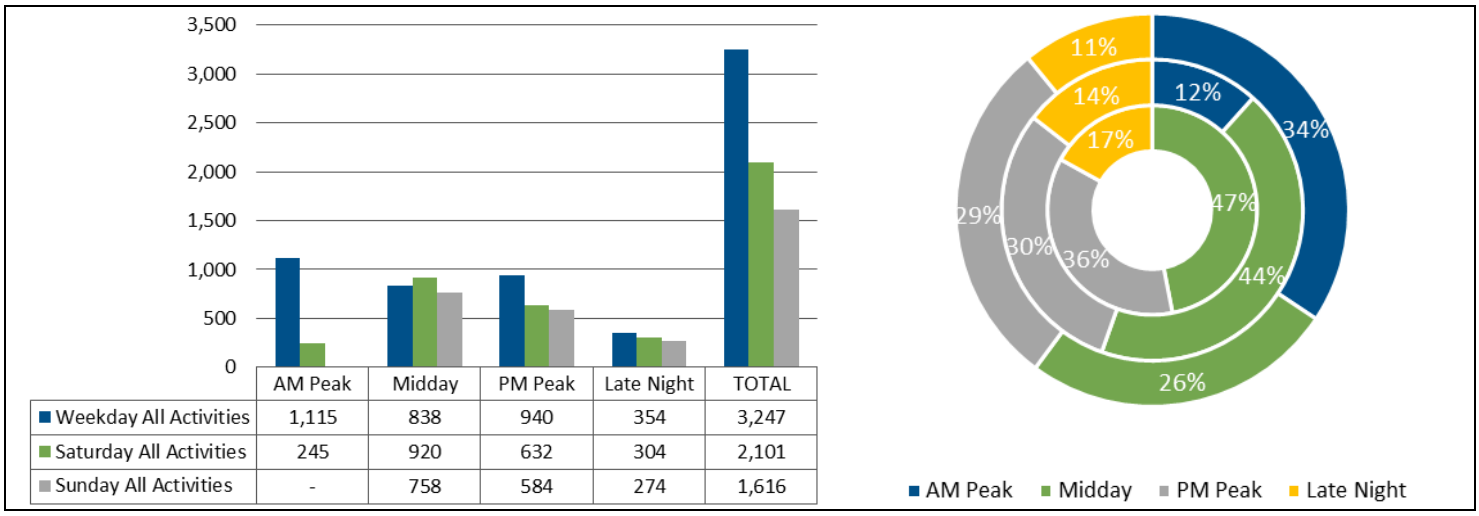
TIME OF DAY	SATURDAY			SUNDAY		
	Inbound	Outbound	Both	Inbound	Outbound	Both
AM Peak	2	1	3	0	0	0
Midday	4	5	9	4	4	8
PM Peak	1	1	2	1	1	2
Late Night	2	2	4	2	2	4
TOTAL	**9**	**9**	**18**	**7**	**7**	**14**

Figure 14 compares the average total activities observed at Providence Station on weekdays, Saturdays, and Sundays during FY 2017 by service period. Within the donut chart, the outer and inner rings reflect temporal distributions for the average weekday and Sunday, respectively, with Saturday represented by the middle ring. As Providence Station serves as the southern terminus for the Providence/Stoughton Line on weekends, boardings reflect Inbound ridership while alightings signify Outbound ridership.

In FY 2017, the average activity levels for Saturday and Sunday equate to 65% and 50% of average weekday activities. However, weekend activities within the Midday and Late Night service periods were quite comparable to the observed weekday activity levels during those periods.

[6] As previously noted, T.F. Green Airport and Wickford Junction are not currently served on weekends.

Figure 14. Comparison of Weekday, Saturday and Sunday Total Activities – Providence Station (FY 2017)



	AM Peak	Midday	PM Peak	Late Night	TOTAL
Weekday All Activities	1,115	838	940	354	3,247
Saturday All Activities	245	920	632	304	2,101
Sunday All Activities	-	758	584	274	1,616

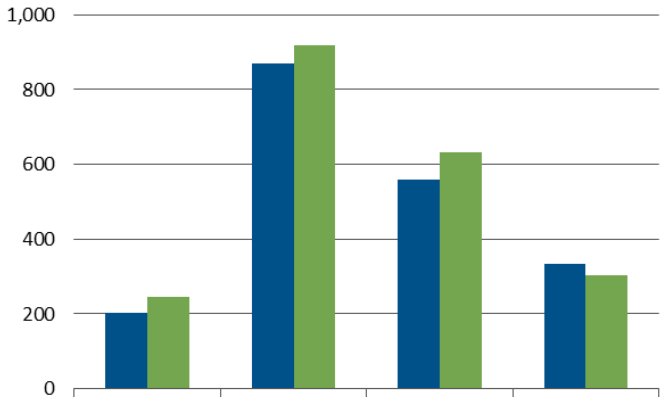
4.2 Saturday Service

Figure 15 contains three frames (total activities, boardings, and alightings) each of which include a bar chart, accompanying table, and a donut chart that compare average Saturday statistics for the FY 2016 and FY 2017 observations across different service periods. Total activities for Saturday increased 7% between FY 2016 and FY 2017, with the largest absolute gain observed during the PM Peak (73 activities or 13%) and the greatest percentage increase during the AM Peak (43 activities or 21%). On average, the Midday service period accounted for nearly 45% of Saturday ridership, followed by the PM Peak with approximately 30%, and the Late Night with around 15%. As there were only three trains operating during the traditional AM Peak (two Inbound and one Outbound), a modest contribution of 10% is to be expected.

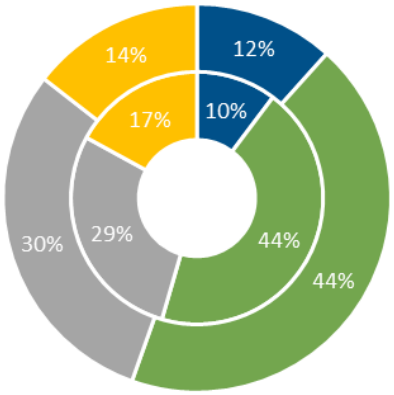
Saturday boardings increased overall by 18% (152 boardings) between FY 2016 and FY 2017, led by a 29% increase during the Midday service period (106 boardings) and followed by a 21% increase during the AM Peak service period (36 boardings). The Late Night service period was the only interval that exhibited a relative decrease in FY 2017 (17% or 17 boardings). Saturday alightings overall fell by 1% (16 alightings) between FY 2016 and FY 2017, led by an 11% decrease during the Midday service period (55 alightings) and a 6% drop during the PM Peak (14 alightings). Alightings during the AM Peak increased by 22% (seven alightings) and the PM Peak experienced a 12% increase (46 alightings).

Figure 15. Saturday – Average Ridership Statistics by Time of Day – Providence Station (FY 2016 and FY 2017)

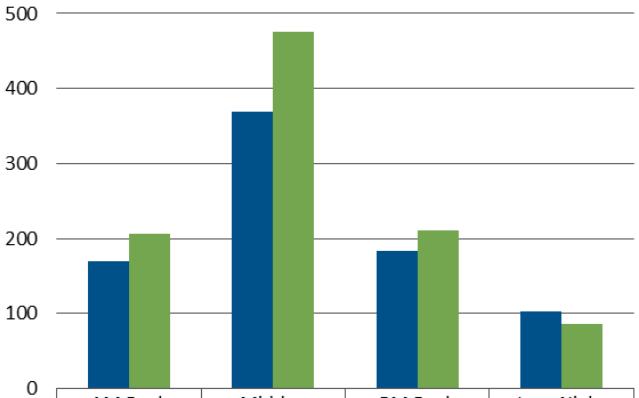
Average Saturday Total Activities



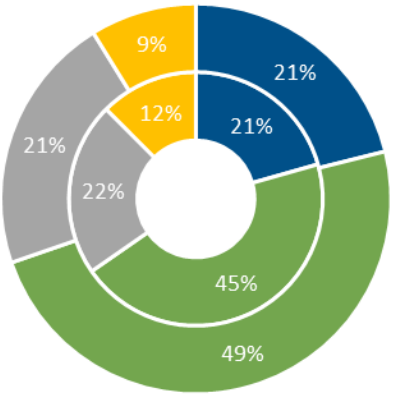
	AM Peak	Midday	PM Peak	Late Night
FY 2016 All Activities	202	869	559	335
FY 2017 All Activities	245	920	632	304



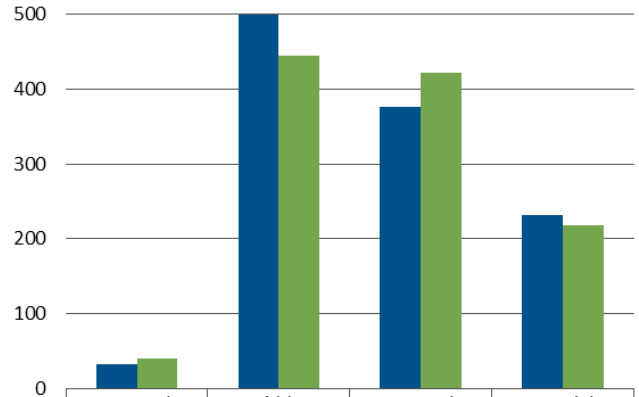
Average Saturday Inbound Boardings



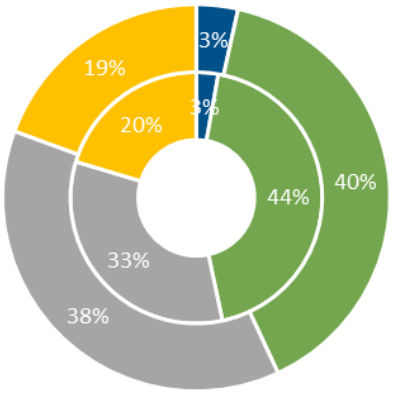
	AM Peak	Midday	PM Peak	Late Night
FY 2016 IB Boardings	170	369	183	103
FY 2017 IB Boardings	206	475	210	86



Average Saturday Outbound Alightings



	AM Peak	Midday	PM Peak	Late Night
FY 2016 OB Alightings	32	500	376	232
FY 2017 OB Alightings	39	445	422	218



4.3 Sunday Service

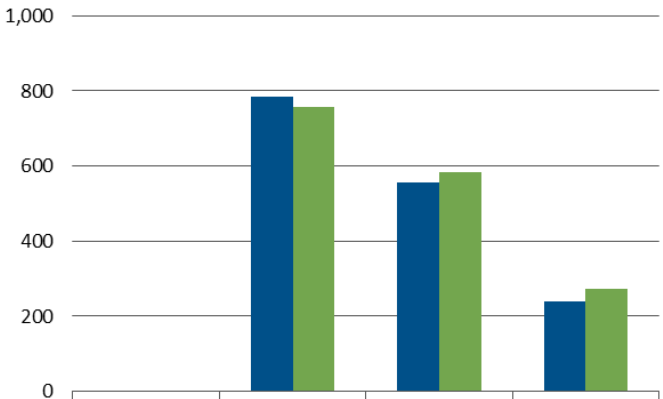
Figure 16 on the following page contains three frames (total activities, boardings, and alightings) each of which include a bar chart, accompanying table, and a donut chart that compare average Sunday statistics for the FY 2016 and FY 2017 observations across different service periods. Total activities for Sunday increased 2% between FY 2016 and FY 2017, with the largest gain observed during the Late Night (33 activities or 13%) and a transfer of almost 30 passengers from the Midday to the PM Peak service period. Aside from the absence of AM Peak service, the average Sunday temporal distribution was similar to that of Saturday, with the Midday service period accounting for 50% of Sunday ridership, followed by the PM Peak with approximately 35%, and the Late Night near 15%.

Sunday boardings overall decreased by 4% (35 boardings) between FY 2016 and FY 2017 due to a 6% decrease in the Midday service period (26 boardings) and a 4% drop in the PM Peak (11 boardings). The Late Night service period was the only interval for which a relative increase FY 2017 was observed (2% or two boardings). Sunday alightings overall rose by 9% (69 alightings) between FY 2016 and FY 2017, led by an 22% increase during the PM Peak (31 alightings) and a 15% surge during the Midday (40 alightings). Alightings during the AM Peak decreased by less than 1% (two alightings).

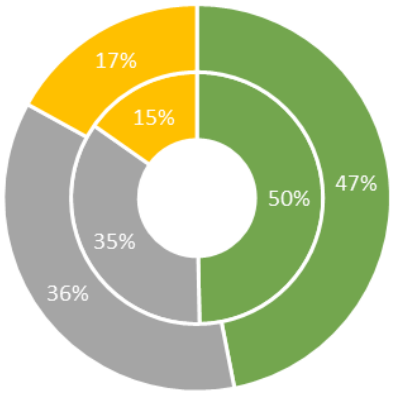
(Remainder of page is intentionally blank)

Figure 16. Sunday – Average Ridership Statistics by Time of Day – Providence Station (FY 2016 and FY 2017)

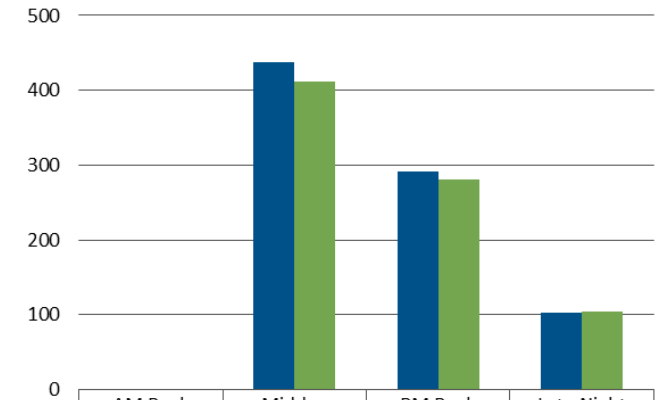
Average Sunday Total Activities



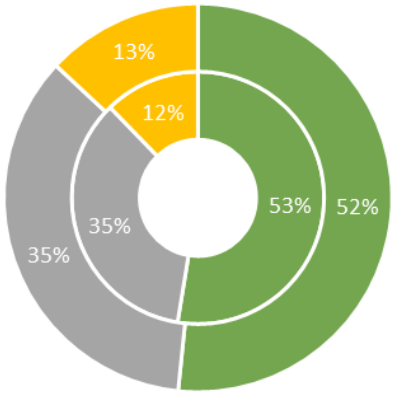
	AM Peak	Midday	PM Peak	Late Night
FY 2016 All Activities	-	786	555	241
FY 2017 All Activities	-	758	584	274



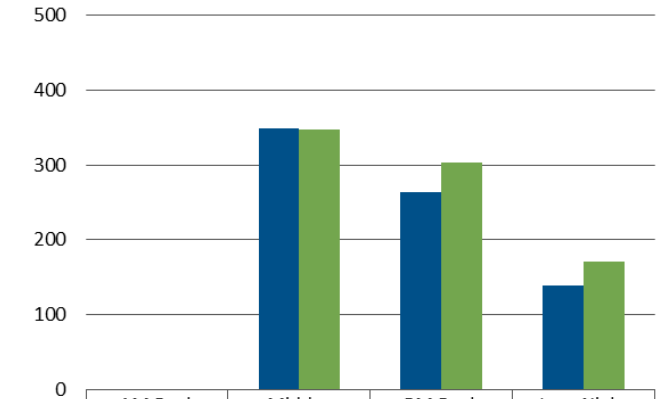
Average Sunday Inbound Boardings



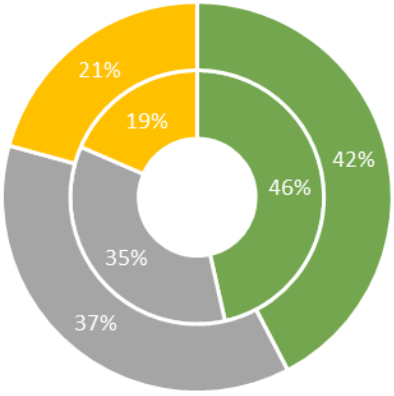
	AM Peak	Midday	PM Peak	Late Night
FY 2016 IB Boardings	-	437	292	102
FY 2017 IB Boardings	-	411	281	104



Average Sunday Outbound Alightings



	AM Peak	Midday	PM Peak	Late Night
FY 2016 OB Alightings	-	349	263	139
FY 2017 OB Alightings	-	347	303	170



4.4 Weekend Passenger Loads

Table 13 lists the top 20 trains with the highest weekend Inbound passenger loads from Providence Station based on the FY 2016 and FY 2017 observations. The most tightly packed weekend Inbound trains heading into Massachusetts were observed during the Midday service period, followed by the PM Peak. Sunday had 65% of the high load trains which is likely due to running eight fewer trains than Saturday. The 1806 and 2806 (departs Providence Station at 11:20 AM, arrives to South Station at 12:30 PM) accounted for five of the top seven trains and tended to carry well over 165 passengers. The 1810 and 2810 (departs Providence Station at 2:56 PM, arrives to South Station at 4:07 PM) claimed 30% of the top 20 spots and the 2814 occupied 15% (departs Providence Station at 7:05 PM, arrives to South Station at 8:13 PM).

Table 13. Weekend – Inbound – Trains with Highest Outgoing Passenger Loads (FY 2016 and FY 2017)

RANK	TRAIN	DAY OF WEEK	SAMPLING PERIOD	DEPART PVD	TIME OF DAY	ONS TO MASS.
1	1806	Saturday	October 2016	11:20 AM	Midday	214
2	2806	Sunday	October 2015	11:20 AM	Midday	212
3	2806	Sunday	April 2017	11:20 AM	Midday	209
4	1806	Saturday	April 2017	11:20 AM	Midday	192
5	2812	Sunday	April 2017	4:56 PM	PM Peak	185
6	SPECIAL	Game Day Only	October 2015	11:00 AM	Pats Only	171
7	2806	Sunday	April 2016	11:20 AM	Midday	165
8	1810	Saturday	April 2016	2:56 PM	Midday	158
9	2814	Sunday	October 2015	7:05 PM	PM Peak	156
10	1810	Saturday	April 2017	2:56 PM	Midday	155
11	2810	Sunday	April 2016	2:56 PM	Midday	152
12	2814	Sunday	April 2016	7:05 PM	PM Peak	149
13	2812	Sunday	October 2015	4:56 PM	PM Peak	146
14	2814	Sunday	April 2017	7:05 PM	PM Peak	145
15	2808	Sunday	October 2016	12:55 PM	Midday	144
16	2810	Sunday	October 2016	2:56 PM	Midday	143
17	1804	Saturday	April 2017	8:35 AM	AM Peak	142
17	2810	Sunday	April 2017	2:56 PM	Midday	142
19	1804	Saturday	October 2016	8:35 AM	AM Peak	138
19	1810	Saturday	October 2016	2:56 PM	Midday	138

Table 14 ranks the top 20 trains with the highest weekend Outbound passenger loads to Providence Station based on the FY 2016 and FY 2017 observations. The most tightly packed weekend Outbound trains heading from Massachusetts were observed to occur during the PM Peak service period, followed by the Midday. As opposed to the Inbound direction, the split of high load trains was relatively even between Saturday (nine entries) and Sunday (10 entries plus one Patriots Special Game Day train). The 1811 and 2811 (departs South Station at 4:35 PM, arrives to Providence at 5:40 PM) claimed 35% of the top 20 spots and tended to carry well over 150 passengers. The 1813 and 2813 (departs South Station at 6:45 PM, arrives to Providence Station at 7:50 PM) accounted for 30% of the top 20 high load trains and the 2805 (departs South Station at 11:05 AM, arrives to Providence Station at 12:15 PM) claimed 15% of the top 20 high load trains in the Outbound direction.

Table 14. Weekend – Outbound – Trains with Highest Incoming Passenger Loads (FY 2016 and FY 2017)

RANK	TRAIN	DAY OF WEEK	SAMPLING PERIOD	ARRIVE TO PVD	TIME OF DAY	OFFS FROM MASS.
1	1813	Saturday	October 2015	7:50 PM	PM Peak	232
2	1811	Saturday	October 2016	5:40 PM	PM Peak	228
3	1811	Saturday	April 2017	5:40 PM	PM Peak	224
4	2805	Sunday	October 2015	12:15 PM	Midday	207
5	1803	Saturday	October 2015	11:10 AM	Midday	205
6	1813	Saturday	October 2016	7:50 PM	PM Peak	204
7	1811	Saturday	October 2015	5:40 PM	PM Peak	198
8	1811	Saturday	April 2016	5:40 PM	PM Peak	192
8	2805	Sunday	April 2017	12:15 PM	Midday	192
10	1813	Saturday	April 2017	7:50 PM	PM Peak	187
11	2805	Sunday	April 2016	12:15 PM	Midday	177
12	2811	Sunday	April 2017	5:40 PM	PM Peak	172
13	2815	Sunday	April 2017	9:50 PM	Late Night	153
14	SPECIAL	Game Day Only	October 2015	5:58 PM	Pats Only	152
15	2813	Sunday	October 2015	7:50 PM	PM Peak	150
16	2811	Sunday	October 2016	5:40 PM	PM Peak	149
17	2811	Sunday	October 2015	5:40 PM	PM Peak	147
18	2813	Sunday	April 2017	7:50 PM	PM Peak	146
19	1815	Saturday	October 2016	9:50 PM	Late Night	144
20	2813	Sunday	October 2016	7:50 PM	PM Peak	139

4.5 Influence of Other Variables

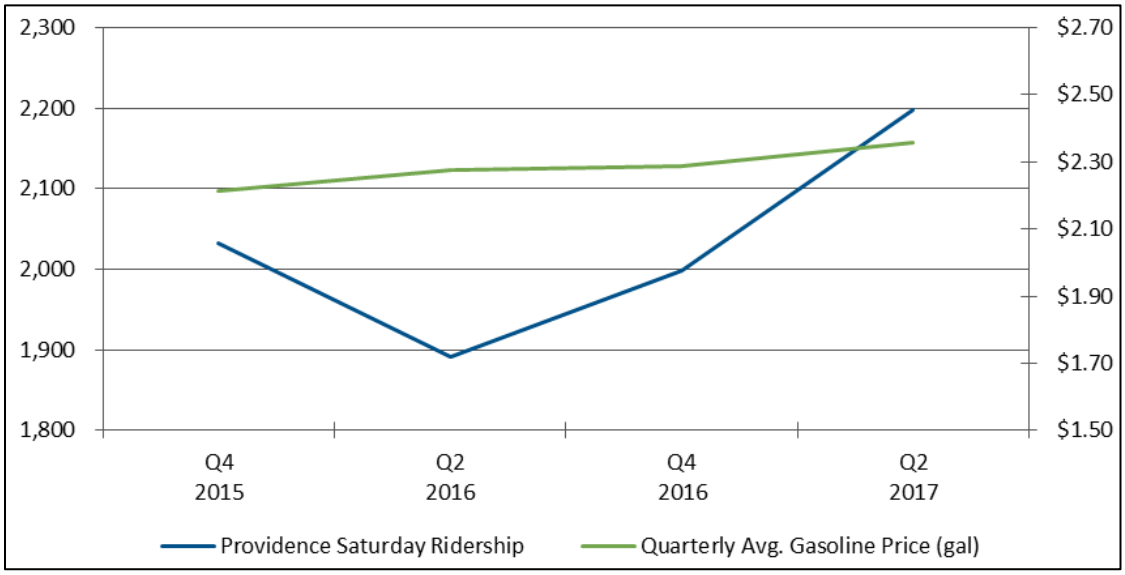
Table 15 provides midpoint price elasticities between Saturday and Sunday ridership at Providence Station based on fluctuations in the average price of gasoline and zone-specific fares using observations from July 2015 and April 2017. Given that weekend service levels remained consistent throughout the study period, elasticity coefficients for the influence of service frequency on weekend ridership were not calculated.

Table 15. Weekend – Price Elasticities for Other Variables

VARIABLE OF INTEREST	SATURDAY	SUNDAY
Gas Prices	1.21	1.76
Fares	0.86	1.25

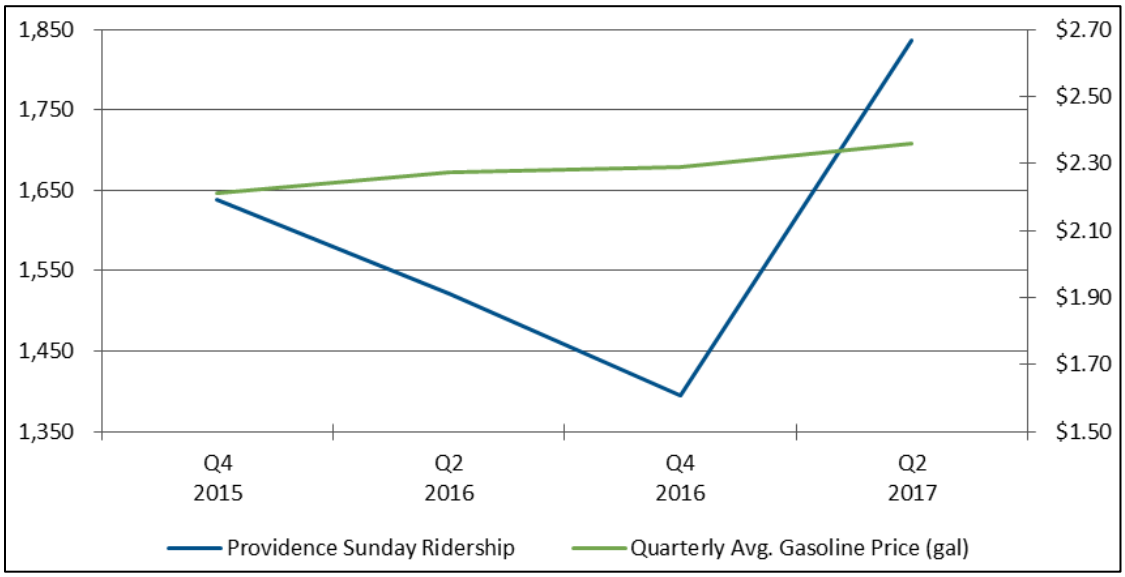
Figure 17 and Figure 18 compare bi-annual observations of Saturday and Sunday weekend ridership at Providence Station, respectively, with the quarterly average price of a gallon of conventional gasoline as published by the US Energy Information Administration[7].

Figure 17. Saturday – Comparison of Ridership versus Quarterly Gas Prices in New England – Providence Station



[7] Ibid.

Figure 18. Sunday – Comparison of Ridership versus Quarterly Gas Prices in New England – Providence Station



For the Saturday observations, the price elasticity of demand between the first weekend count observation in Q4 2015 (i.e., October 2015) and the final weekend count observation in Q2 2017 (i.e., April 2017) was 1.21 which indicates that there is an elastic relationship between Saturday MBTA Commuter Rail ridership along the Providence/Stoughton Line and the regional price of conventional gasoline. In other words, for every 1% increase in the cost of gasoline, there is a corresponding 1.21% increase in Saturday ridership at Providence Station. For the Sunday observations, the price elasticity of demand was determined to be 1.76, signifying an even stronger elastic relationship between Sunday ridership at Providence Station and the regional price of conventional gasoline. Thus, in addition to providing weekday commuters with access between Providence and Boston, MBTA Commuter Rail service at Providence Station also functions as a competitive substitute to driving a personal vehicle for discretionary trips on the weekend.

Relative to the influence of changes in MBTA Commuter Rail fares on ridership, the traditional relationship is negative (i.e., an increase in fare leads to a decrease in ridership). However, as was the case for weekday ridership at Providence Station, the assumed trend was observed for neither Saturday nor Sunday service. As the elasticity coefficients between weekend ridership and gasoline prices are approximately 40% greater than the coefficients calculated for fares, it is clear that the cost of fuel, for both private vehicles and MBTA Commuter Rail trains, served as the determinant that led to the growth in overall weekend ridership.

5 On-Board Passenger Survey

This chapter begins with an overview of the methodology, instrument, and data processing techniques employed for the on-board MBTA passenger survey, followed by a discussion of response rates and the degree to which results of the on-board passenger survey can be generalized. The remainder of the chapter consists of a question by question presentation of the data collected from MBTA Commuter Rail Inbound AM Peak weekday passengers.

5.1 Methodology

An on-board passenger survey was conducted on two Thursdays, September 22 and 29, 2016 to solicit responses from Inbound AM Peak weekday passengers at Providence Station, T.F. Green Airport, and Wickford Junction. The survey instrument consisted of a paper form that prompted respondents for their one-way trip origin-destination, commuter rail use, and demographic information. To provide respondents with flexibility in completing the survey, a digital, web-based version of the survey instrument, which contained identical content to that which was included on the paper form, was also made available via a QR code that was readily displayed on the front page of the paper-based instrument. A copy of the paper-based version of the passenger survey instrument is provided in Attachment 3. There were also paper and web-based versions of the survey in Spanish.

To deploy the survey, a team of four survey distributors, five survey collectors, and two drivers was used. Distributors were responsible for arriving to each station at least 20 minutes before the first Inbound departure towards South Station, handing out the paper forms (and golf pencils) to potential Inbound passengers, and continuously distributing forms along the platforms until Train #816 (first train past the AM Peak) departed their station. Inbound passengers who replied that they were interested in providing responses, but were currently pressed for time, were handed a paper link containing a QR code that forwarded to the digital instrument.

Given the high passenger activity at Providence Station, two distributors were allocated to Providence while T.F. Green Airport and Wickford Junction were each served by a single distributor. To proactively target Inbound passengers at Providence Station, distributors periodically checked the status of Inbound MBTA trains with station personnel at least 20 minutes in advance of the next Inbound train's scheduled departure to ensure that they knew the correct platform at which they needed to distribute the forms prior to the public announcement of the upcoming Inbound train's track number. At T.F. Green Airport, the share of Outbound passengers during the AM Peak was low which allowed distributors to screen out the Outbound riders by simply asking, "Are you headed towards Boston or Providence today?" Given that Wickford Junction served as the southern terminus for the line and all departing service is Inbound, screening was not necessary.

Collectors were tasked with boarding trains at their southernmost terminus (i.e., Wickford Junction or Providence Station); riding Inbound until before alighting at Mansfield (located approximately 30 minutes north of Providence via rail); making multiple passes through their train to collect the paper forms while providing respondents from all boarding stations with sufficient time to complete the survey (five to 10 minutes); and distributing the paper forms to any passenger on-board who requested to complete the survey. Once on-board collectors waited at least 10 minutes since the previous stop before completing another pass through the train to gather completed surveys.

Drivers were initially used to transport distributors and collectors to the stations in the early morning and were later responsible for repeatedly shuttling the two Providence collectors from Mansfield back to Providence.

After fielding the survey, the paper-based results were digitized into a spreadsheet for processing and analysis. Each survey was screened for completeness in terms of origin-destination, demographic, and other information. Responses for which any of the following origin-destination variables were not provided were set aside and omitted from the results that follow: boarding station, boarding time, origin place type, origin location, ingress mode, ingress duration, alighting station, alighting mode, alighting duration, destination place type, and destination location. The screening of demographic information was accomplished by verifying that questions regarding age, sex, race, household size, household income, and Hispanic status were completed by the respondent. The screening of other elements consisted of checking that there was an answer to the remaining questions, including fare type used, weekday commuter rail use frequency, weekend commuter rail use frequency, household usable vehicles, Limited English Proficiency (LEP) status, preferred language, and reasons for using commuter rail.

After a respondent's survey passed the three initial screenings, the responses were further scrutinized to ensure that the method by which the passenger reported getting from their origin to their boarding station and from their alighting station to their destination origin-destination was realistic (e.g., Could one reasonably complete a trip within the duration provided based on the distance between the two points? If a respondent claims to have used transit service between two points, is service actually available to complete that trip?). A survey was considered "wholly valid" if it passed all three initial screenings as well as the final trip details test. All surveys that did not meet these criteria were set aside and the responses from those surveys have been purposefully omitted from the results displayed in this chapter.

5.2 Response Rate and Confidence Level

Table 16 presents data related to total surveys collected, counts for each screening test, counts of "wholly valid" responses (i.e., those that passed all three screenings), and the retrieved margin of error for each boarding station. The completion rate for the Rhode Island segment of the Providence/Stoughton Line as a whole was 69%, with similar rates observed at Providence Station and T.F. Green Airport (68%) and a higher rate at Wickford Junction (76%). Relative to the 90% confidence goals established for the survey, wholly valid responses exceeded station level requirements by at least two responses. Given the distribution of responses to Question 1: Boarding Station, the station level, as well as aggregated, results of this survey can be confidently generalized with a margin of error less than 10%.

Table 16. Summary of Responses and Retrieved Margin of Error by Station

BOARDING STATION	TOTAL RESPONSES	RESPONSES PASSING SCREENING			WHOLLY VALID RESPONSES	RETRIEVED MARGIN OF ERROR
		Trip Details	Demo-graphics	Other Elements		
Providence	174	144	134	164	118	8.6%
T.F. Green Airport	102	91	80	94	69	9.3%
Wickford Junction	78	65	69	70	59	9.6%
TOTAL	**354**	**300**	**283**	**328**	**246**	**N/A**

5.3 Results

Based on the 246 wholly valid responses collected, results for each of the 24 multiple choice questions included in the MBTA on-board passenger survey instrument, as well as a summary of the open-ended comments, are provided in this section. The questions have been grouped into four categories, which form the sub-sections that follow, based on the nature of the information being collected – Origin Information, Destination Information, Commuter Rail Use Information, and Demographic Information. Within each sub-section the question prompt is reprinted in italicized quotes, followed by a graphic and/or results table and a discussion of the responses. Detailed results tables for "wholly valid" responses for each question from the on-board passenger survey are provided in Attachment 4.

5.3.1 Origin Information

This section reviews responses pertaining to the first six questions of the on-board passenger survey that focused on the passenger's origin information for the one-way trip reported.

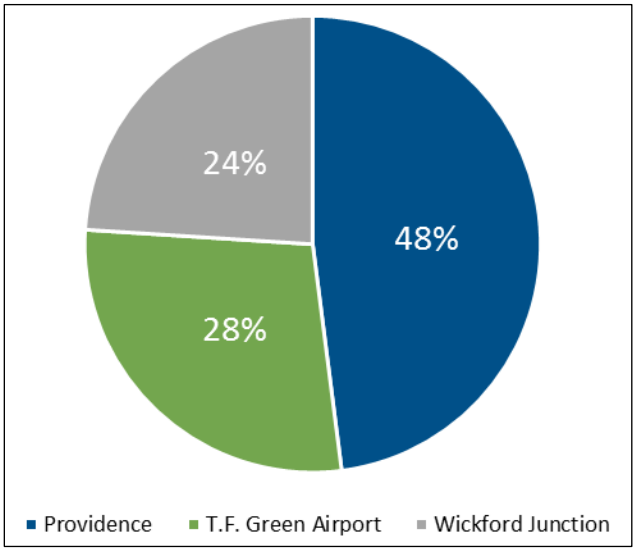
(Remainder of page is intentionally blank)

5.3.1.1 Boarding Station

Figure 19 summarizes participant responses to the following question prompt:

"Where did you board the train today?"

Figure 19. Boarding Station



Based on the accepted responses, this survey reflects a sample in which approximately two respondents boarded the train at Providence Station for every passenger boarding at either T.F. Green Airport or Wickford Junction.

5.3.1.2 Boarding Time

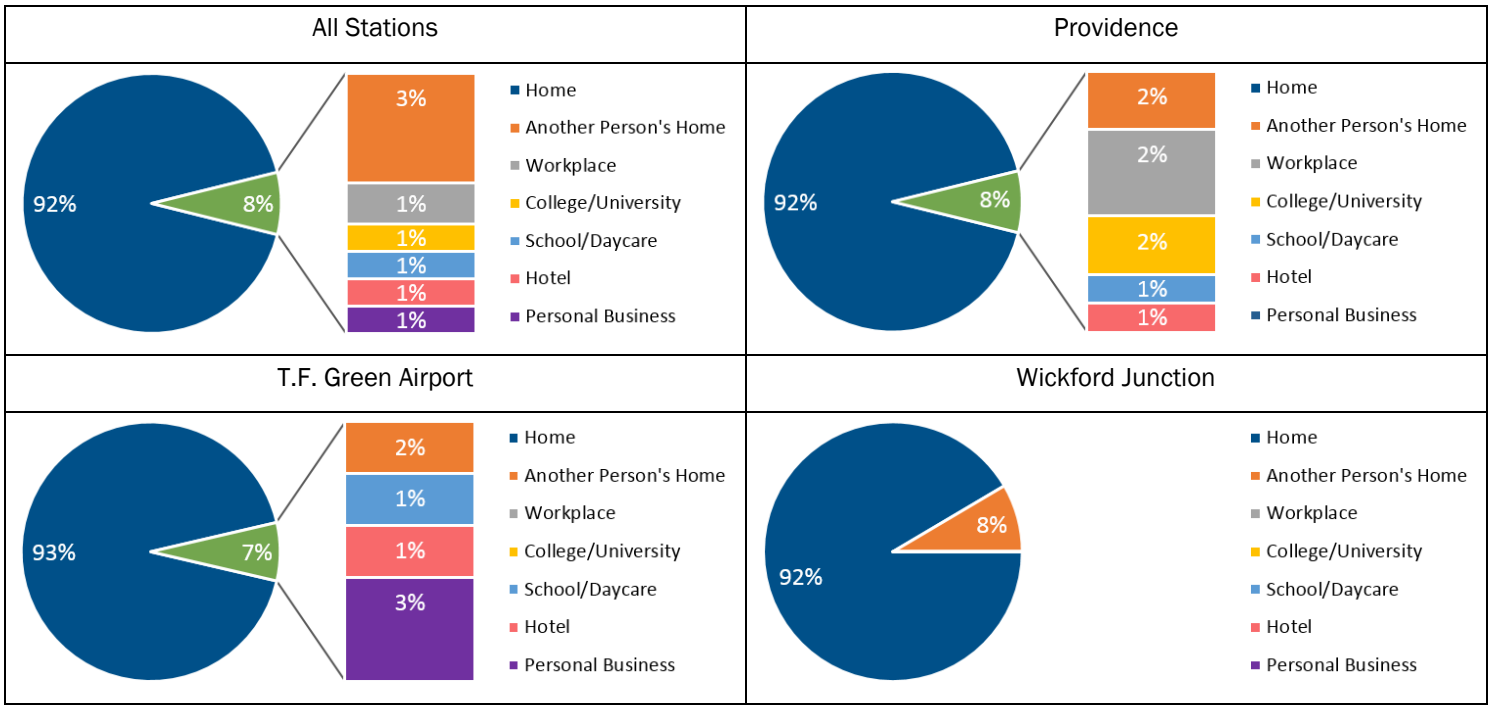
"About what time did you board the train?"

This question was originally included in the survey instrument as a means to assist in determining the extent of crowding for a given train run. However, given that more detailed passenger load data was developed as part of the passenger counts (see Section 3.8 Peak Passenger Loads of this report), results for this question are not reported.

5.3.1.3 Origin Place Type

"We are interested in knowing more about your current one-way trip. What type of place were you coming from when you received this survey? Please check one box representing the ORIGIN of your one-way trip below:"

Figure 20. Origin Place Type by Boarding Station



As seen in Figure 20, for the Rhode Island segment of the Providence/Stoughton Line, 92% of Inbound passengers boarding during the AM Peak were at their residence prior to arriving at their boarding station. The second most common origin prior to boarding was another person's residence (3%). Each of the following choices accounted for approximately 1% of all responses: Workplace, College/University, School/Daycare, Hotel, and Personal Business.

The distribution at Providence Station was similar to that of the Rhode Island segment, with the majority of passengers leaving from their residence. While 2% of respondents left another person's residence prior to arriving at the station, nearly 3% of those boarding at Providence Station came from their place of work and 2% came from an institution of higher learning. It should be noted that Providence Station was the only facility with responses for Workplace and College/University.

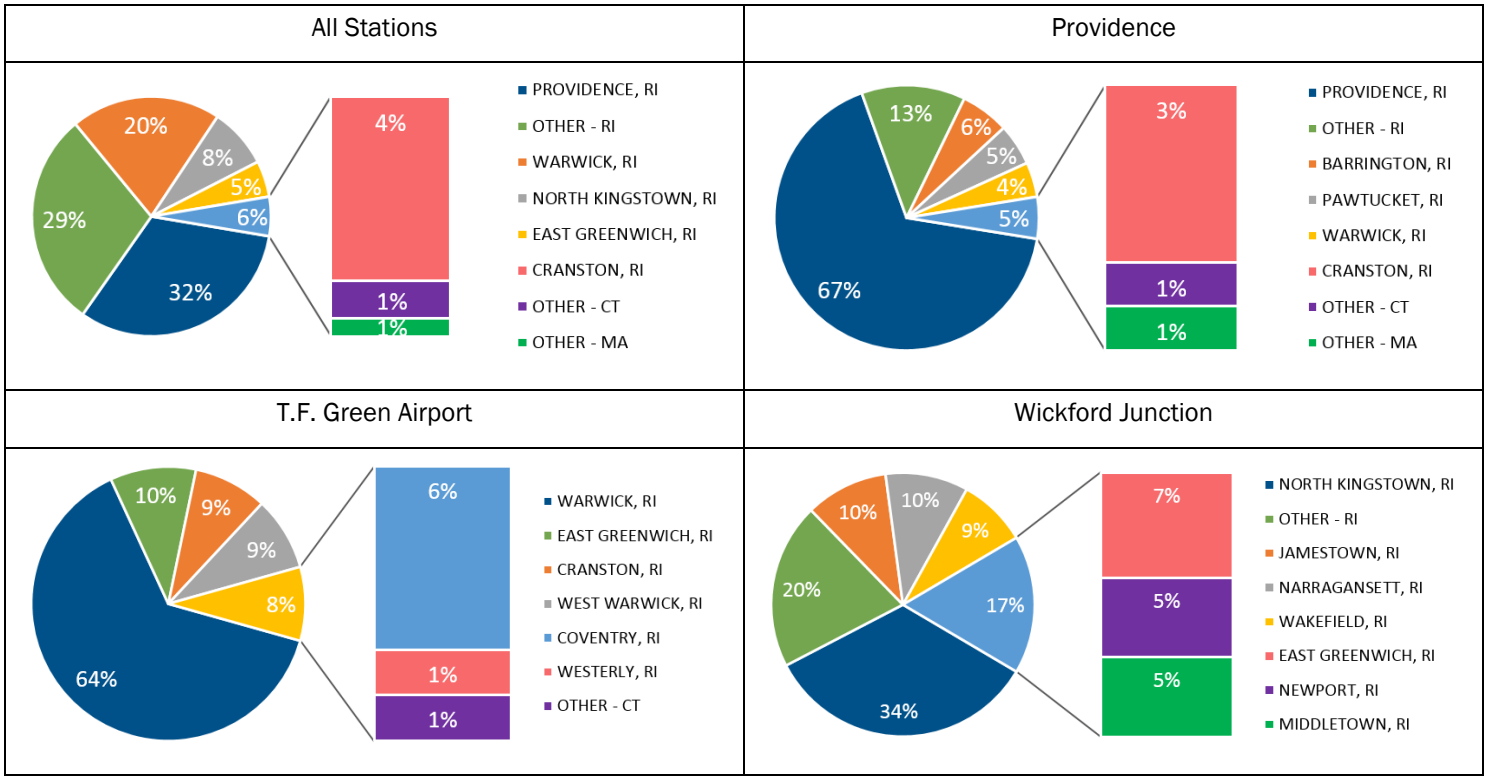
For T.F. Green Airport, 93% of respondents were at their residence prior to arriving at the station while 3% left a place of personal business. The following choices accounted for 1% of responses at T.F. Green Airport: Another Person's Home, School/Daycare, and Hotel.

The distribution at Wickford Junction was by far the least varied with 92% of boarding passengers having been at their residence prior to arriving at the station. Unlike the overall results and those for the other two stations, a disproportionate share of boarding passengers at Wickford Junction originated from another person's residence (8%). It should be noted that, despite accounting for approximately one in every four surveys collected, Wickford Junction was responsible for 63% of the Another Person's Home responses along the Rhode Island segment. The disproportionate share likely signals that some of the passengers boarding at the station were visiting family, friends, or relatives who live near Wickford Junction and are using the service to complete a discretionary trip like visiting tourist attractions in Boston.

5.3.1.4 Origin Location

"Please tell us the nearest street intersection or landmark of the one-way trip ORIGIN you checked above:"

Figure 21. Origin Location by City



Based on the results presented in Figure 21, the majority of Inbound passengers boarding stations along the Rhode Island segment during the AM Peak originated within the State of Rhode Island (98%), with Providence (32%), Warwick (20%), North Kingstown (8%), East Greenwich (5%), and Cranston (4%) being the most common origin cities. Two responses were collected with an origin near New London, CT and another was retrieved from southeastern Massachusetts (Swansea). With the exception of Wickford Junction, the city in which the station is located accounted for approximately two-thirds of the origins retrieved at the facility.

Aside from two-thirds of boarding passengers originating from the City of Providence, other popular origins for those boarding at Providence Station included Barrington (6%), Pawtucket (5%), Warwick (4%), and Cranston (3%). Providence Station served as the boarding station for two of the three out of state origins retrieved in this survey – one near New London, CT and another from Swansea, MA.

While 64% of boarding passengers stayed within Warwick en route to T.F. Green Airport, 10% arrived from East Greenwich, 9% from Cranston, 9% from West Warwick, and 6% from Coventry. T.F. Green Airport served as the boarding station for the other trip originating from New London, CT.

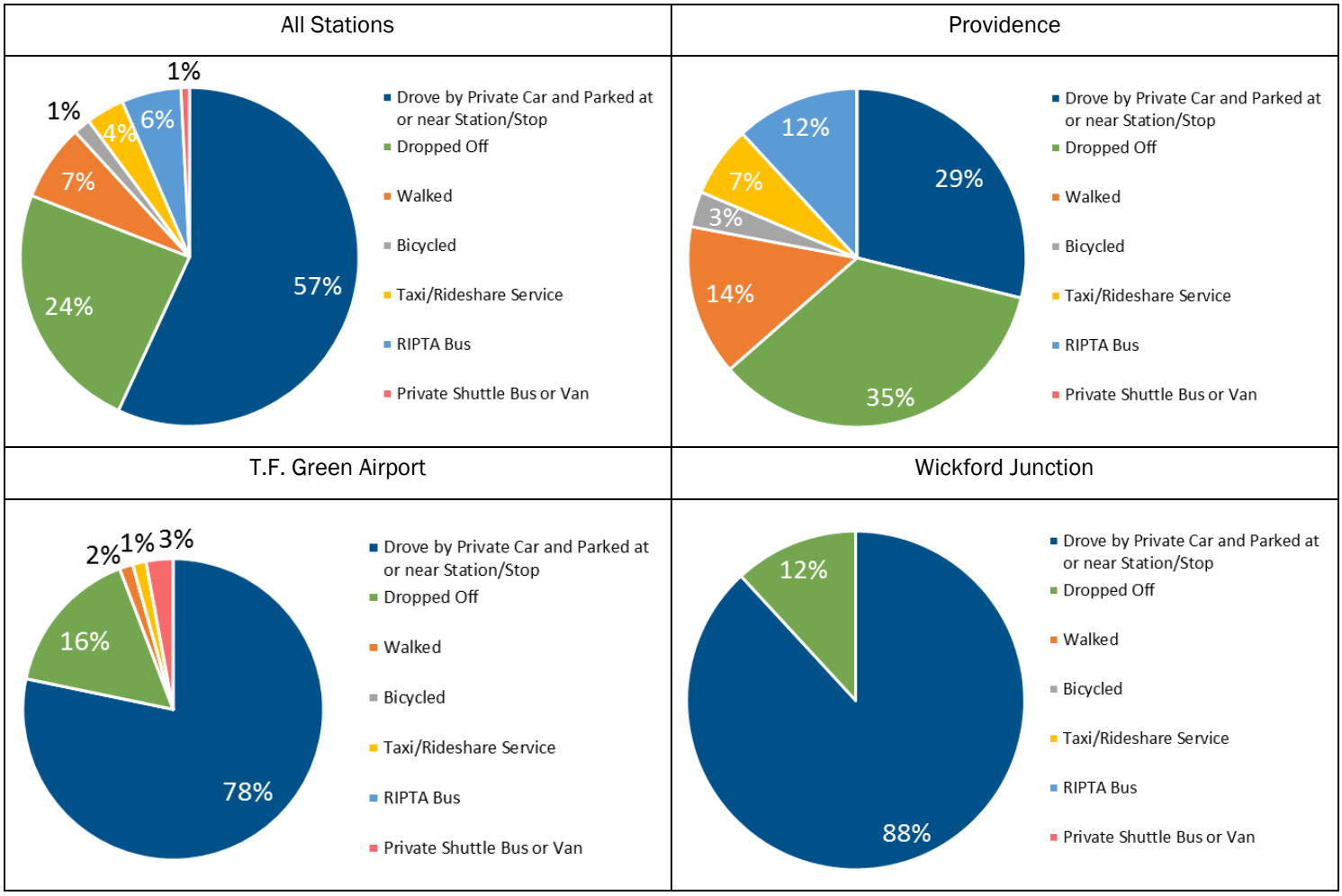
The distribution for Wickford Junction was by far the most varied, with the home municipality accounting for just over one-third of the responses. The coastal communities located near the transition between the Narragansett Bay and the Atlantic Ocean accounted for nearly 40% of boardings

at Wickford Junction (Jamestown (10%), Narragansett (10%), the Wakefield section of South Kingstown (9%), Newport (5%), and Middletown (5%).

5.3.1.5 Ingress Mode

"Please tell us how you got to the Commuter Rail station today:"

Figure 22. Ingress Mode



As seen in Figure 22, the majority of passengers boarding along the Rhode Island segment arrived to their boarding station via the use of a personal vehicle, with 57% having driven a private vehicle and parked at or near the station and 24% that were dropped off. Active transportation modes were the third most popular option, with walking accounting for 7% of origin trips and biking nearly 2%. Transit use accounted for 6% of arrivals to boarding stations. Finally, private, for-hire vehicles accounted for only 5% of arrivals, with taxi/rideshare contributing 4% and private shuttles constituting 1% of all station arrivals.

Given its relatively dense, urbanized built environment, Providence Station, as expected, had the lowest proportion of passengers arriving by private vehicle and the highest proportion of those who reached the station via active transportation, transit, or taxi/rideshare. Nevertheless, the use of a personal vehicle still accounted for nearly two-thirds of all arrivals. While the proportion of passengers

arriving by personal vehicle and parking at the station was the lowest of all stations surveyed (29%), the drop-off results accounted for 35% of all arrivals. 14% of boarding passengers at Providence Station arrived on foot and 3% arrived via bicycle. Connecting RIPTA services carried 12% of respondents to the station and traditional taxis, coupled with Transportation Network Companies like Uber and Lyft, accounted for 7% of all arrivals to the station. It should be noted that respondents at Providence Station were responsible for all transit arrivals retrieved for this survey and all but one of the taxi/rideshare responses.

The most popular arrival options for those boarding at T.F. Green Airport were involved the use of a personal vehicle (94%), with 78% having driven and parked at or near the station and another 16% to that were dropped off. The station had the highest proportion of passengers who arrived by private shuttle bus or van (3%), likely due to the concentration of hotels surrounding the airport adjacent to the station. Other options for arriving to T.F. Green Airport took active forms, with walking constituting 2% and biking accounting for the remaining 1%.

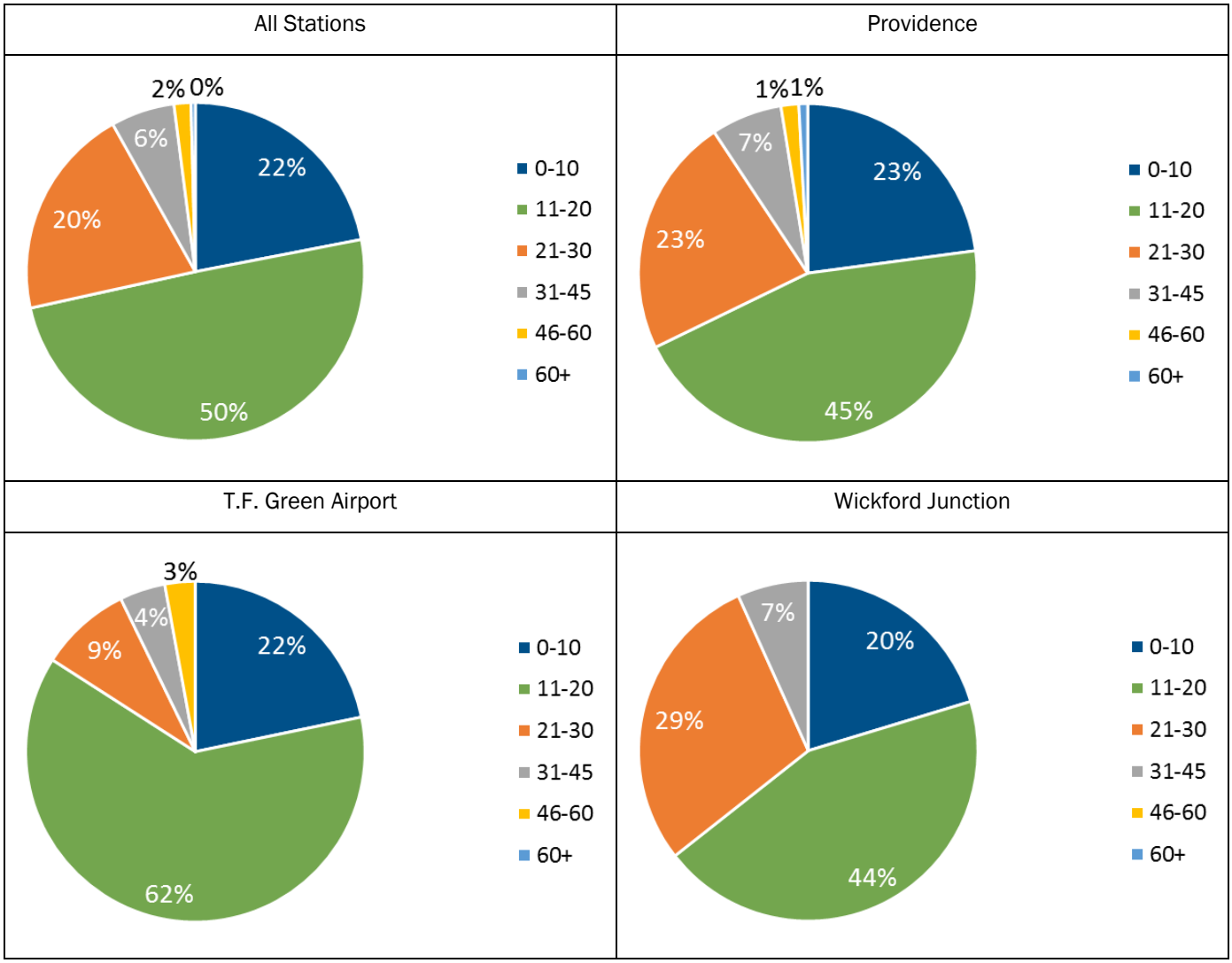
Ingress mode choice at Wickford Junction was binary; Inbound AM Peak weekday passengers reported either having driven a personal vehicle and parked at or near the station or having been dropped off. 88% of respondents chose to drive their personal vehicle and park at or near the station while the remaining 12% arranged from someone to drop them off. Given its suburban setting and the relatively high speed roads that lead to the station and auto-oriented adjacent development, taxi/rideshare, active transportation, and transit, as expected, did not play a major role in in serving ingress trips to Wickford Junction. However, the fact that these modes played no role whatsoever is rather surprising, especially since RIPTA's 65X (peak direction express only) and 66 provide direct connections from Narragansett, Wakefield, and URI to the Station. Clearly, the use of RIPTA for first mile connections to Wickford Junction is below potential.

(Remainder of page is intentionally blank)

5.3.1.6 Origin Duration

"About how long did it take you to get to the station?"

Figure 23. Origin Duration

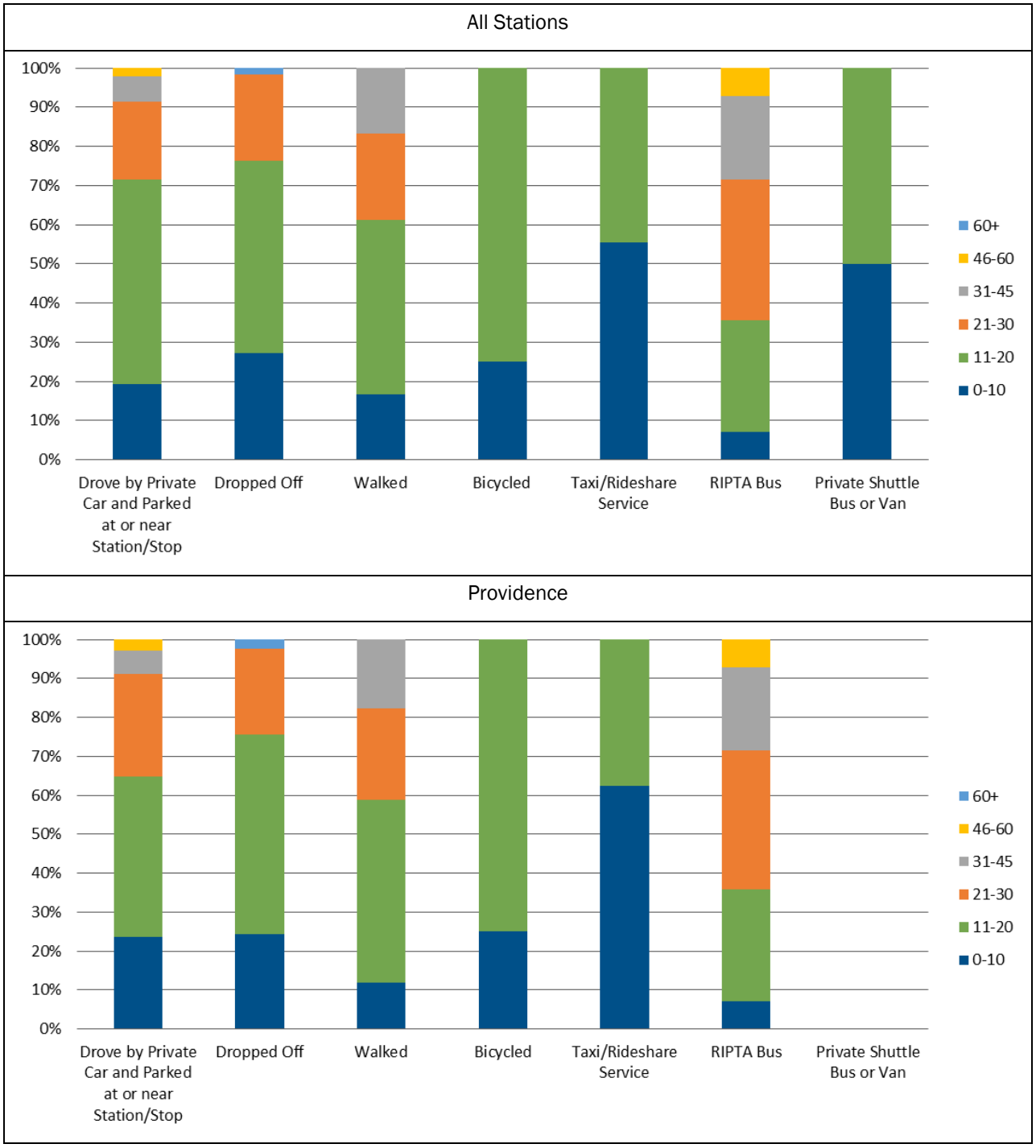


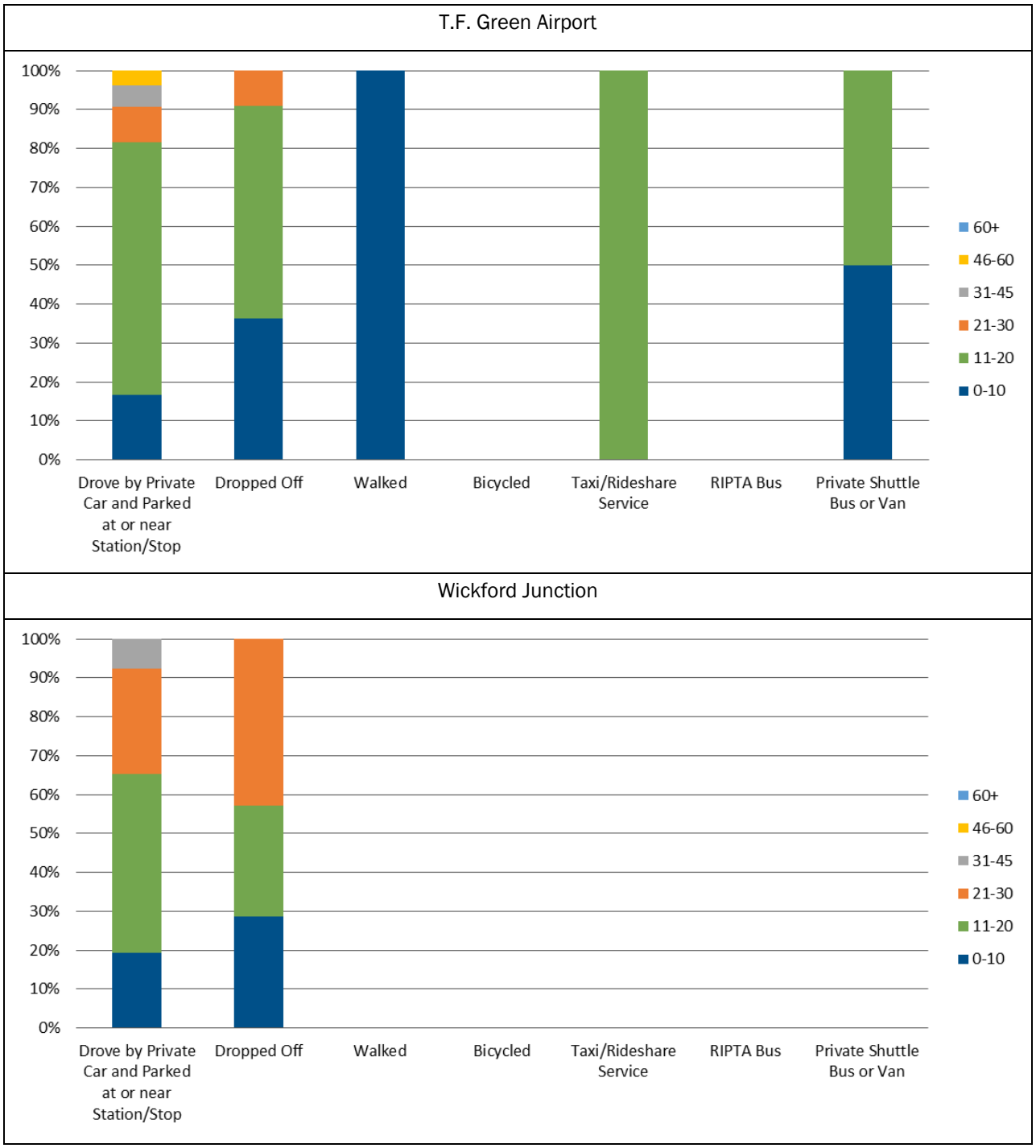
For the Rhode Island segment as a whole, over 90% of those surveyed indicated that their journey to the station took no more than 30 minutes and nearly three quarters stated that it took no more than 20 minutes. As seen in Figure 23, station ingress times between 11 and 20 minutes were the most common (50%), followed by travel times no greater than 10 minutes (22%). Long ingress trips (i.e., those taking more than 30 minutes) were relatively uncommon (8%) and the majority of those trips took no more than 45 minutes (6%). Overall, passengers who biked or took a taxi, rideshare, or shuttle to a rail station had the shortest first-mile trips, with all passengers traveling by these modes reporting trips under 20 minutes.

As seen in Figure 24, the ingress time distribution for Providence Station is similar to that of the Rhode Island segment as a whole, with just over 90% of boarding passengers stating that their journey took

no more than 30 minutes; however, the proportion of passengers with an ingress time between 21 and 30 minutes is relatively larger than for the RI segment overall.

Figure 24. Ingress Time Distributions by Boarding Mode





The only ingress trip that took longer than an hour was recorded at Providence Station and this facility also captured two of the four records for journeys taking between 46 and 60 minutes.

As approximately 19% of all MBTA ingress trips to Providence Station involve a vehicular journey less than or equal to 10 minutes in length, there exists a real opportunity to shift a substantial proportion of these vehicular ingress trips to the station to active modes (i.e., walking and biking). Initiating this transition towards greater reliance on walking and biking will necessarily require greater levels of

investment towards improving multimodal access (i.e., projects focused on enhancing sidewalks, curb ramps, on-street bicycle lanes, and separated bikeways).

Ingress times at T.F. Green Airport and Wickford Junction were, on average, lower than those recoded for Providence Station. Given the higher densities surrounding Providence Station, this result is likely to be a function of the mode choice of passengers at the outlying stations who tended to choose personal vehicles as the primary means of arriving at the station, as seen in Figure 24. 93% of boarding passengers at both stations stated that their ingress trip took no more than 30 minutes. While 3% of the trips to T.F. Green Airport took between 46 and 60 minutes, none of the respondents at Wickford Junction reported an ingress time greater than 45 minutes.

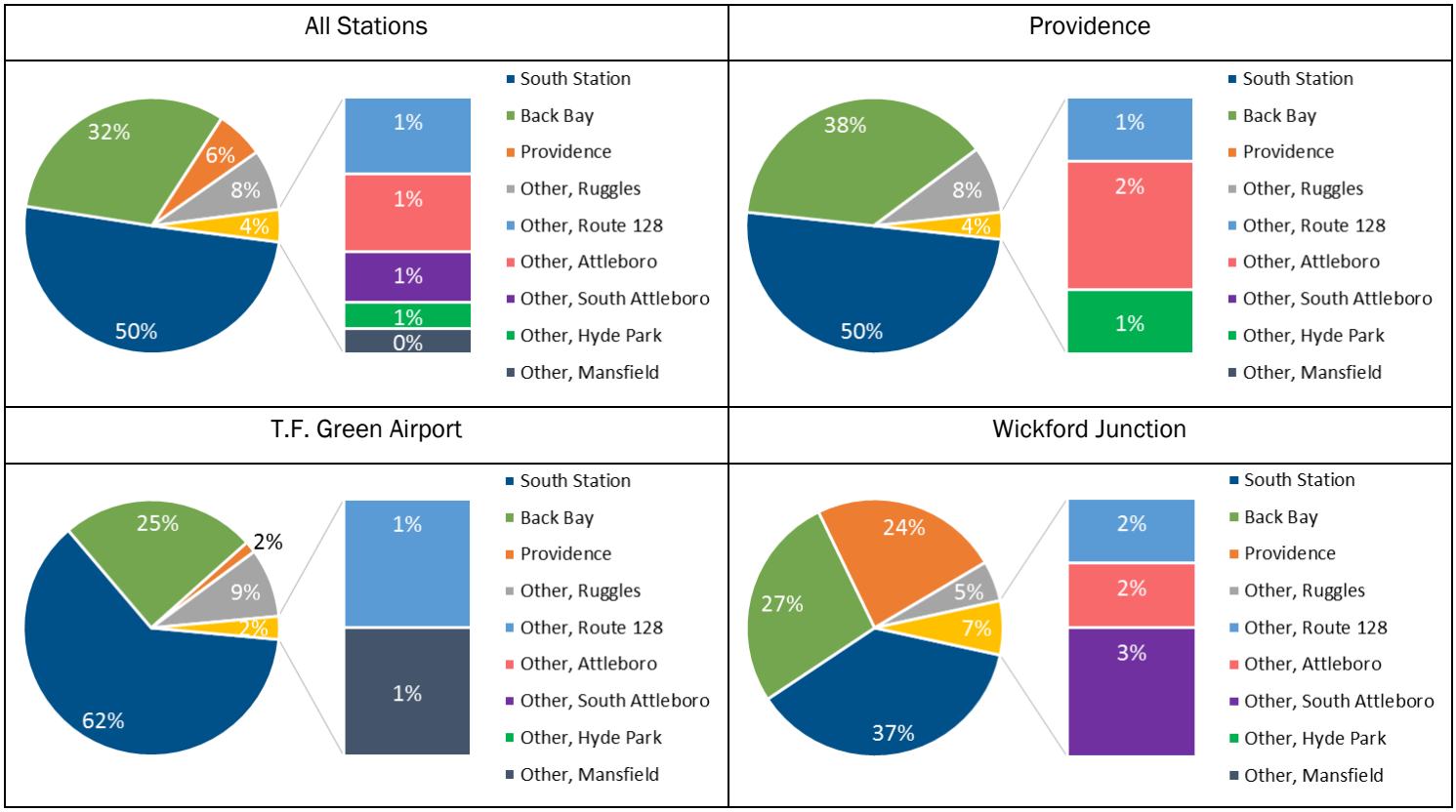
5.3.2 Destination Information

This section summarizes answers to Questions 8-12 of the on-board passenger survey which inquired about the passenger's destination information for the one-way trip reported.

5.3.2.1 Alighting Station

"At which Commuter Rail station will you get off <u>this</u> train?"

Figure 25. Alighting Station



As seen in Figure 25, 90% of Inbound AM Peak passengers surveyed along the Rhode Island segment stated that they were alighting at an MBTA Commuter Rail Station located inside of Massachusetts' Route 128. Train terminals within Route 128 that are also serviced by Amtrak accounted for over 80%, led by South Station (50%) and followed by Back Bay (32%). Ruggles, which is located near Boston's Longwood Medical Center (Boston Children's Hospital, Beth Israel Deaconess, and others) and several

institutions of higher learning (Harvard Medical School, Northeastern University, Massachusetts College of Art and Design and the Wentworth Institute of Technology), served as the alighting station for 8% of passengers. Providence Station was the fourth most common destination (6%). Minor destinations (1%) reported include cities within southeastern Massachusetts (Attleboro, South Attleboro and Mansfield) and Hyde Park.

The distribution for Providence Station was quite similar to that of the line as a whole, with 50% of passengers alighting at South Station, 38% getting off at Back Bay, and 8% stopping at Ruggles. Route 128 and Mansfield accounted for 1% of alighting passengers each. Two passengers reported that they would alight at Attleboro (2%).

Unlike the other stations and the segment as a whole, 62% of boarding passengers at T.F. Green Airport were en route to South Station, followed by 25% alighting at Back Bay. Ruggles constituted 9% of destinations at T.F. Green Airport while local passengers alighting at Providence accounted for 2%. Minor destinations from T.F. Green Airport included Route 128 and Mansfield with 1% each.

Alighting stations for passengers coming from Wickford Junction were more evenly distributed than those who boarded at the other two stations. South Station (37%) and Back Bay (27%) played relatively modest roles. Local trips from Wickford Junction to Providence Station represented 24% of the Inbound AM Peak passengers surveyed. Other alighting stations reported include Ruggles (5%), South Attleboro (3%), Route 128 (2%), and Attleboro (2%).

A series of maps showing the relative distribution of Inbound AM Peak passengers' final destinations, aggregated by ZIP code, by boarding station is provided on the following four pages. Figure 26 provides aggregated destination results for those boarding along the Rhode Island segment of the Providence/Stoughton Line while Figure 27 through Figure 29 display the destinations for those boarding at Providence Station, T.F. Green Airport, and Wickford Junction.

(Remainder of page is intentionally blank)

Figure 26. Inbound AM Peak Passenger Destinations by ZIP Code – All Stations

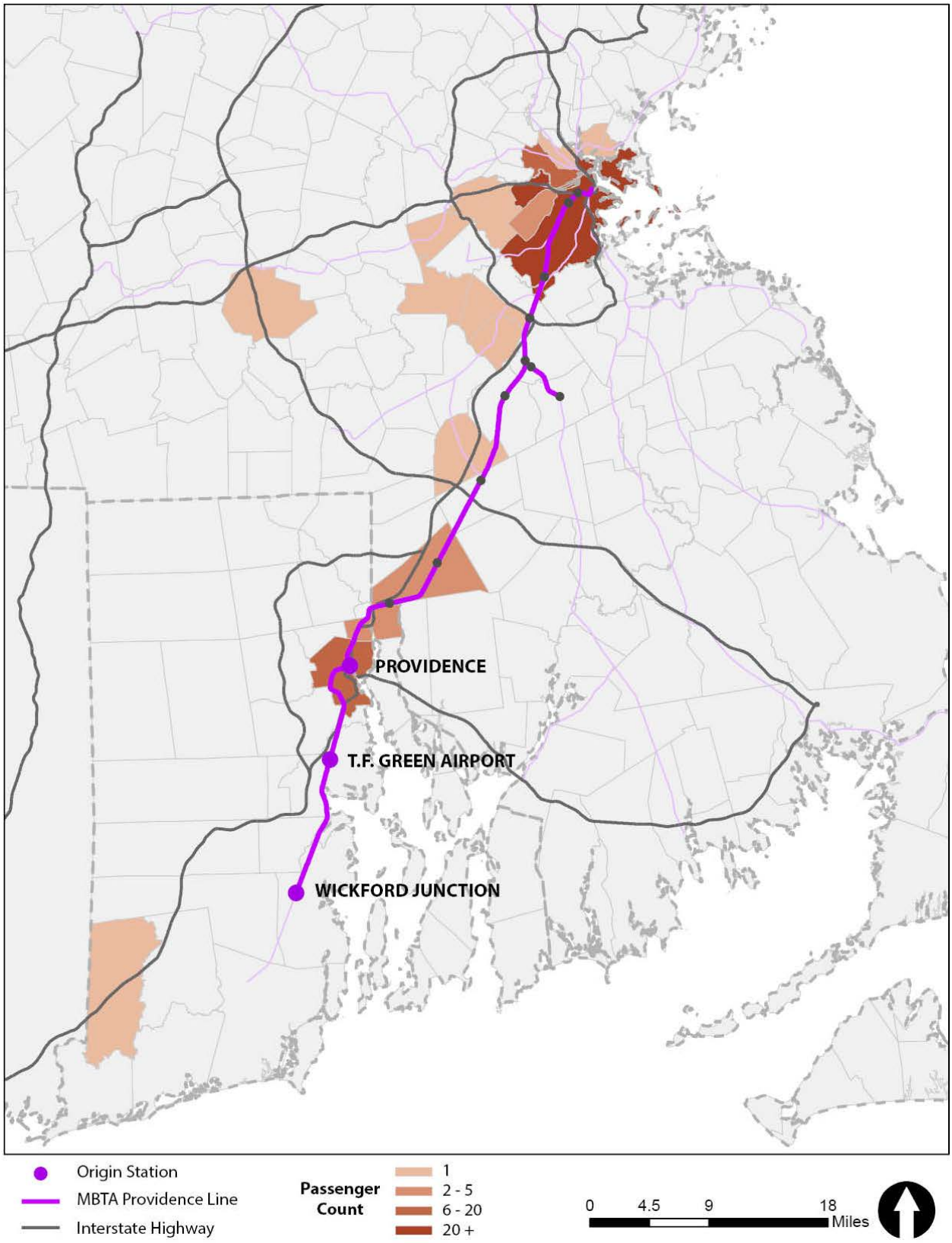


Figure 27. Inbound AM Peak Passenger Destinations by ZIP Code – Providence Station

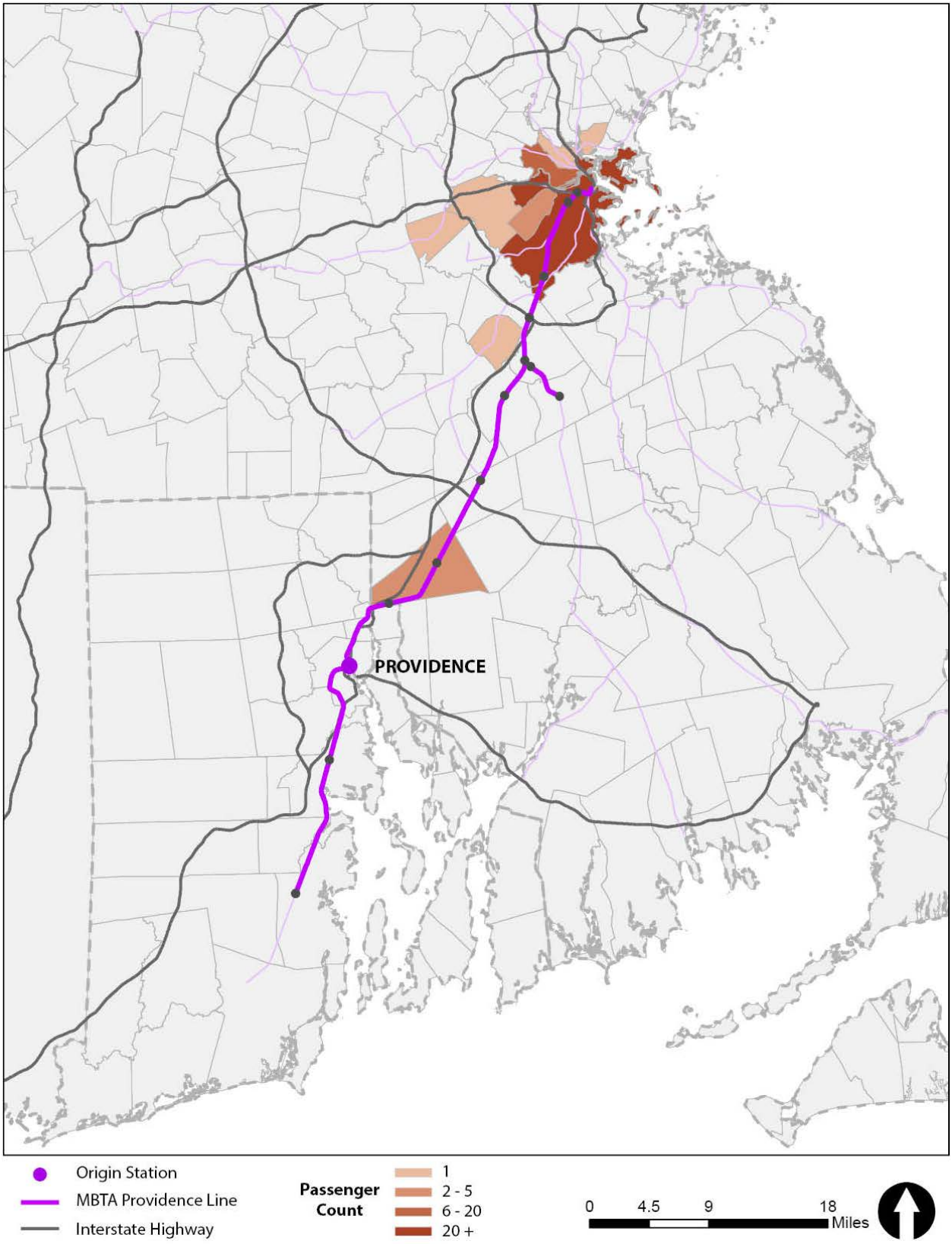


Figure 28. Inbound AM Peak Passenger Destinations by ZIP Code – T.F. Green Airport

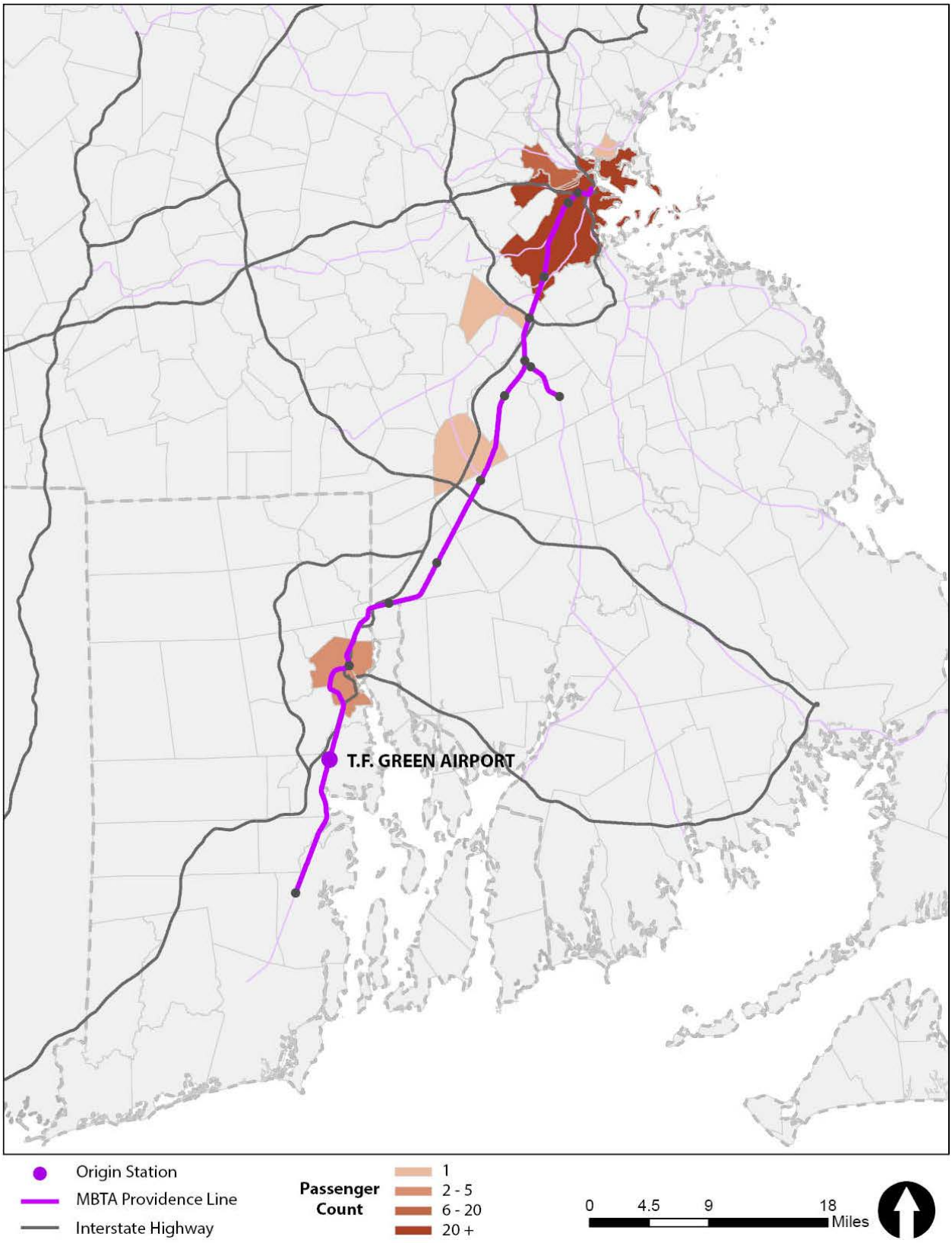
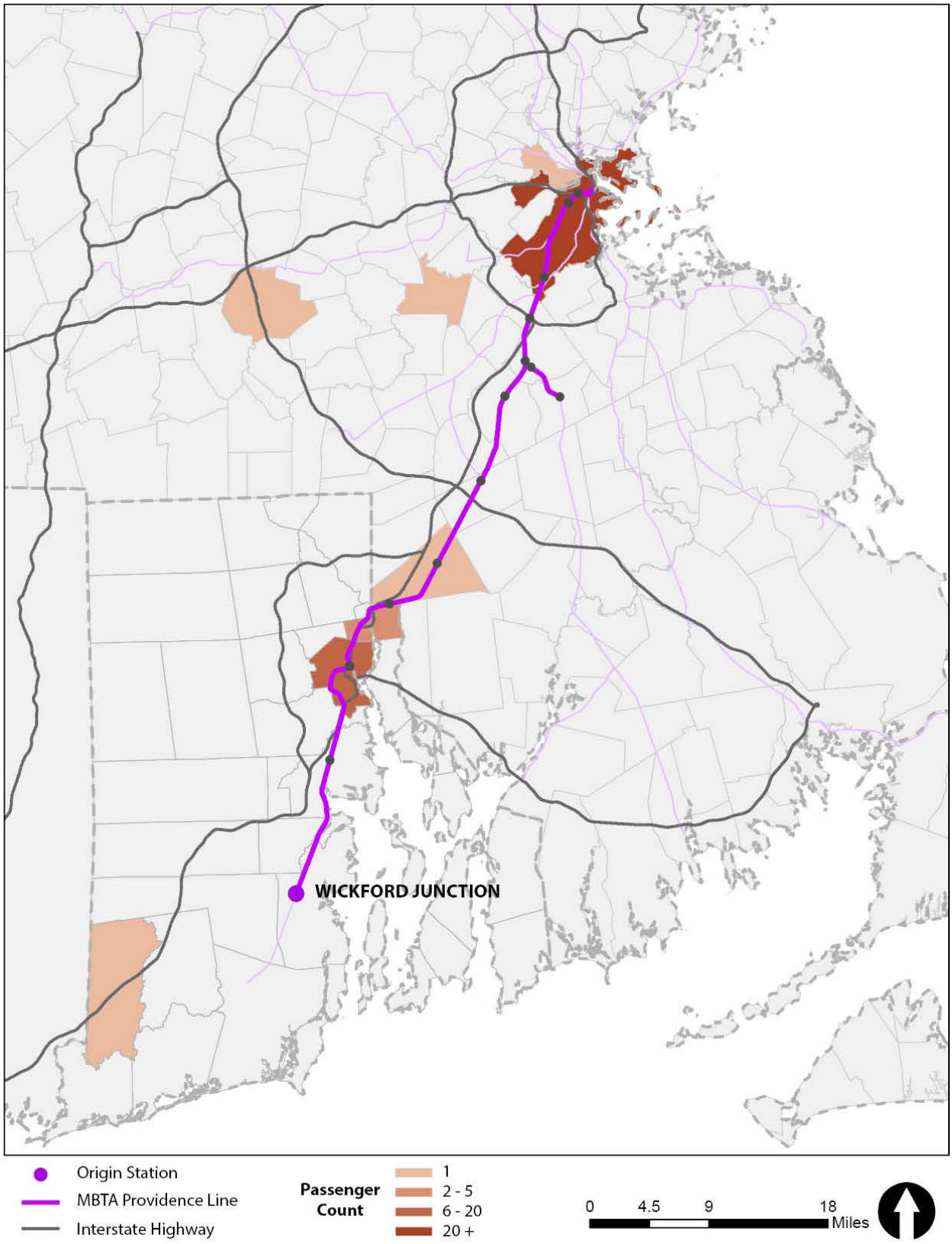


Figure 29. Inbound AM Peak Passenger Destinations by ZIP Code - Wickford Junction



5.3.2.2 Egress Mode

"How will you reach your FINAL DESTINATION from the end Commuter Rail station you reported above?"

Figure 30. Egress Mode by Alighting Station

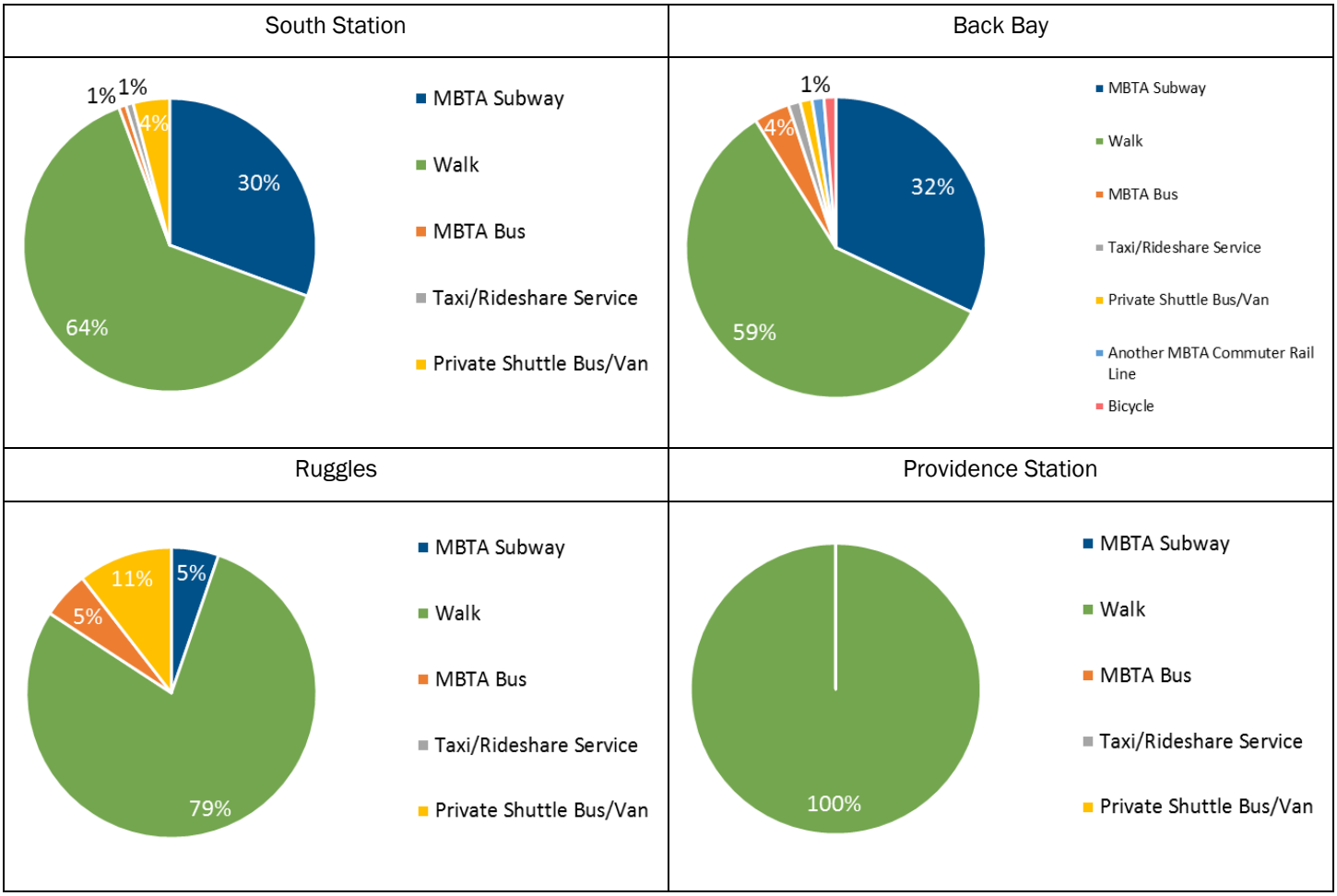


Figure 30 presents the egress mode distributions for the top four alighting stations. At South Station the majority of alighting passengers reported that they walked to reach their final destination (64%), followed by 30% who reported taking the MBTA subway to connect to their destination. Private shuttles served 4% of alighting passengers at South Station while taxi/rideshare and MBTA bus service each carried the remaining 1%.

Back Bay had a modal split similar to South Station, as 59% of alighters reported walking to their final destination and 32% transferred to the MBTA subway. It should be noted that Back Bay was the only top alighting station where respondents reported using a bicycle (4%) and a different MBTA Commuter Rail line (1%).

Given the proximity of major medical facilities and educational institutions, 79% of those alighting at Ruggles completed the rest of their trip on foot. In addition to the large proportion of walkers, Ruggles modal split is notable in that 11% of alighters reported using a private shuttle and 5% reported transferring to an MBTA bus.

All Inbound AM Peak passengers who alighted at Providence Station reported walking to their final destination.

5.3.2.3 Egress Duration

"About how long will it take you to reach your FINAL DESTINATION from the end Commuter Rail station your reported in Question 8?"

Figure 31. Egress Duration by Alighting Station

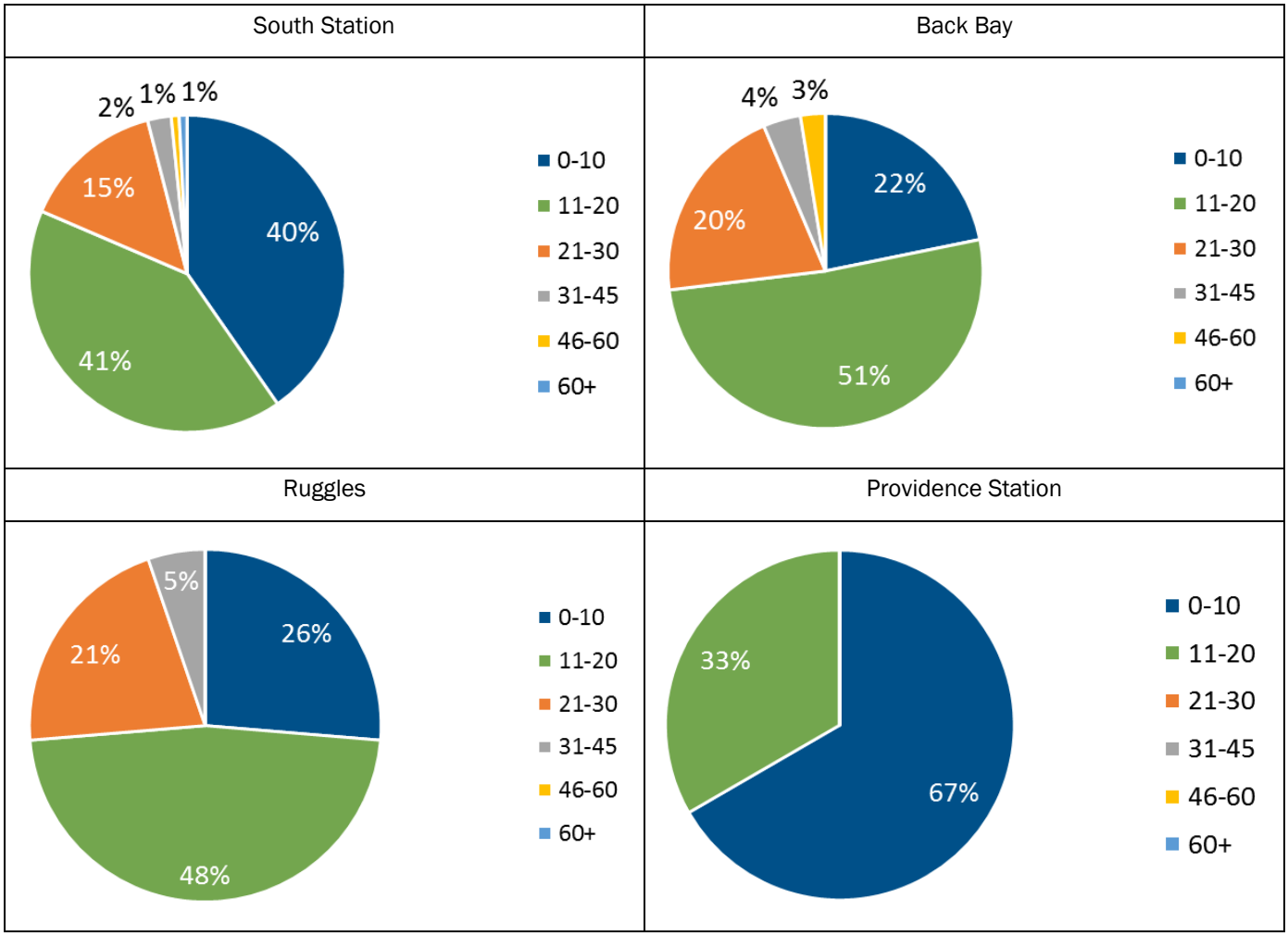
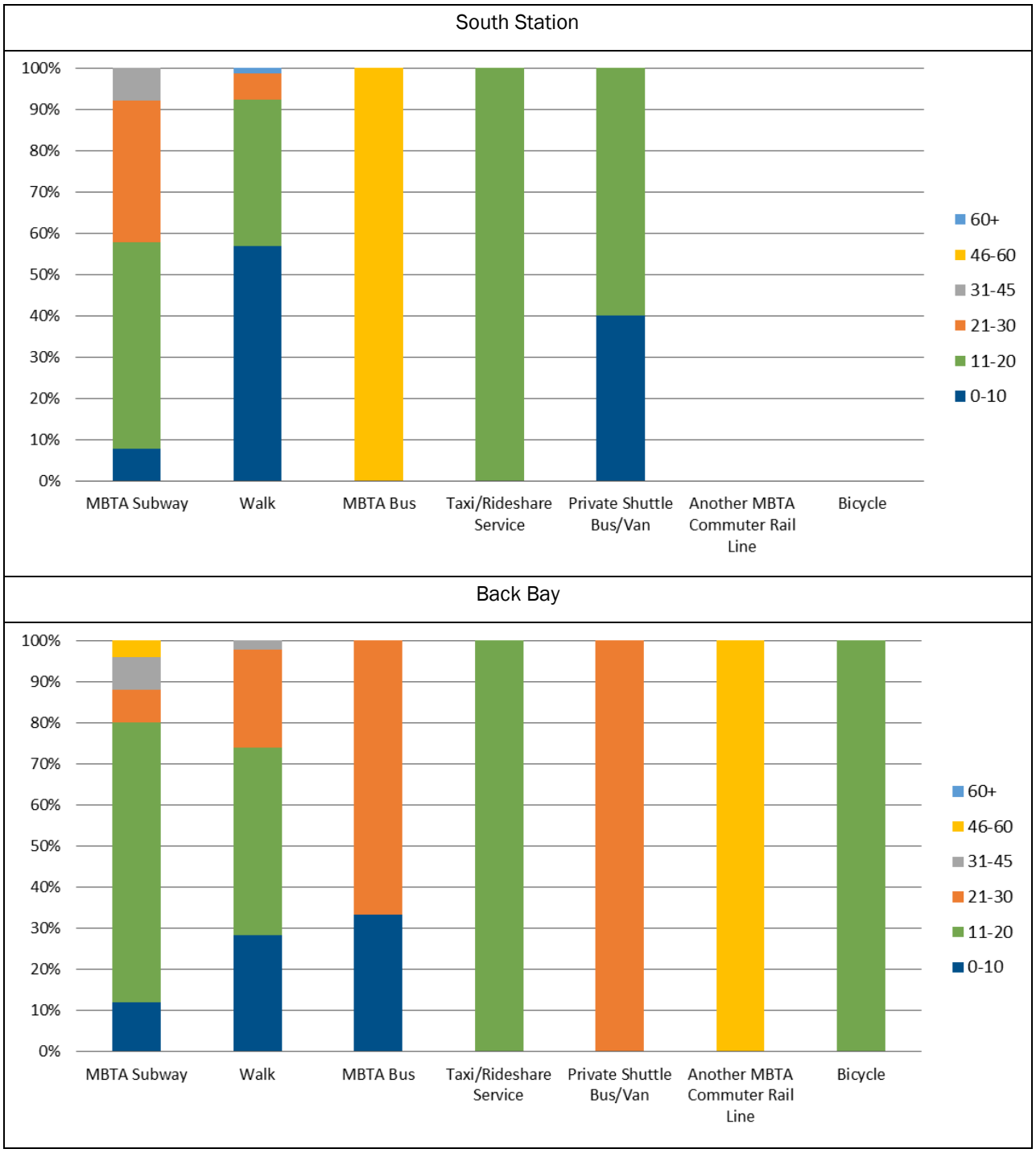
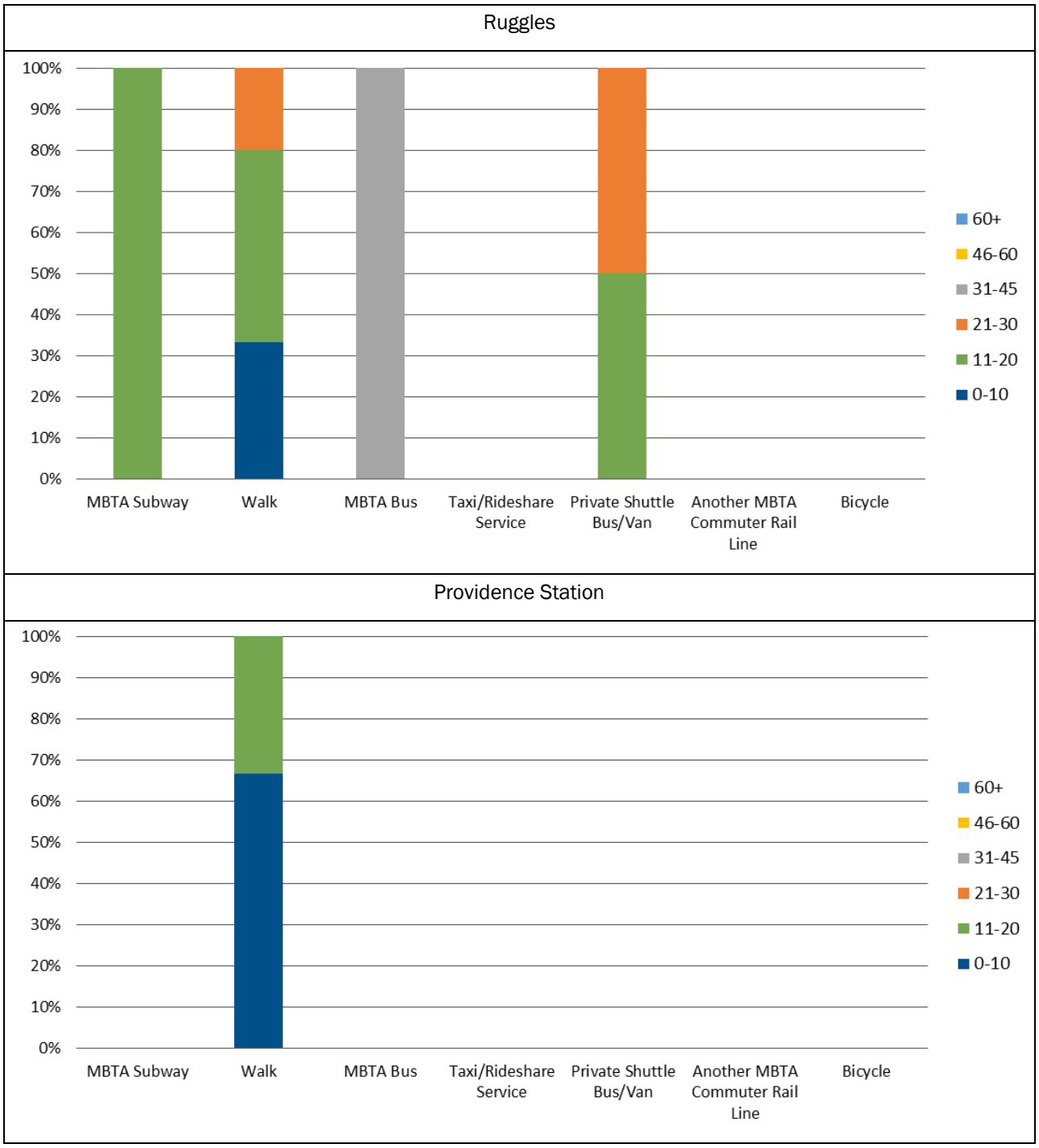


Figure 31 shows the distribution of egress times from the top four alighting stations reported by Inbound AM Peak passengers. At South Station 96% of egress trips to final destinations were reported as taking no longer than 30 minutes and 81% of egress trips took no more than 20 minutes. Out of the top four alighting stations, South Station was the only facility that included records for egress trips longer than one hour. Figure 32 displays the distribution of egress times at each of the top four alighting stations based on the alighting mode that was reported. As seen in the figure, the clustering of long haul trips at South Station is more a function of the wide range of long-distance connections that are offered at South Station than Boston's built environment.

Figure 32. Egress Time Distribution by Alighting Mode





93% of egress trips from Back Bay were completed within 30 minutes and 73% took no longer than 20 minutes. Although Back Bay did not have any egress trips reported as taking longer than 60 minutes, 4% of egress trips were reported as having taken between 31 and 45 minutes and 3% took between 46 and 60 minutes.

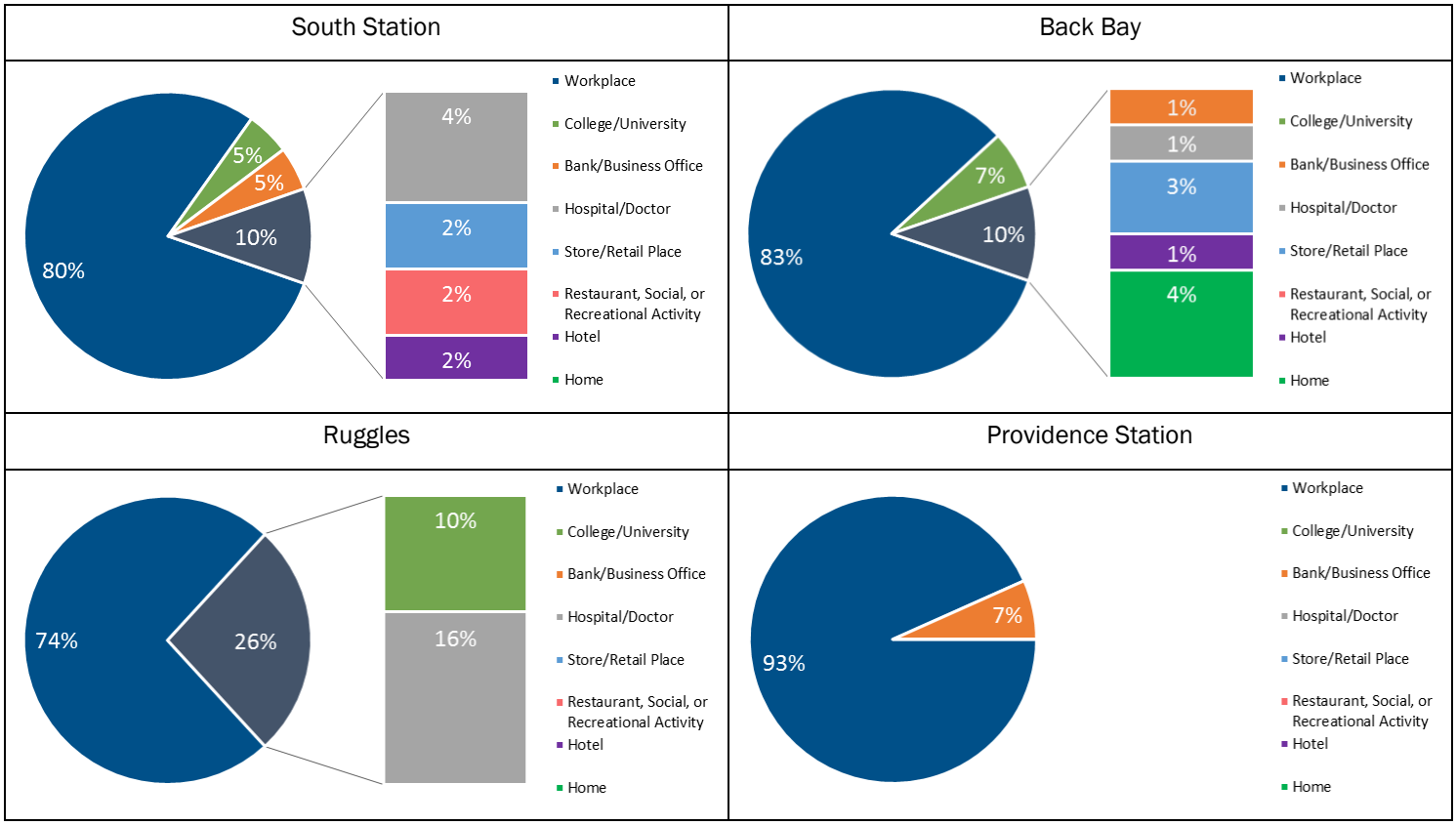
At Ruggles 95% of egress trips to final destinations were completed in no more than 30 minutes and 74% of egress trips took no longer than 20 minutes. Aside from Providence Station, passengers alighting at Ruggles had the lowest average travel time to their final destinations.

As 100% of respondents reported walking as their egress mode, egress times at Providence Station are, as expected, the lowest of the top four stations. Two thirds of passengers alighting in Providence reached their final destination in no more than 10 minutes and the other third reported that it took them no longer than 20 minutes to complete their trip.

5.3.2.4 Destination Place Type

"What type of place is the FINAL DESTINATION of your current one-way trip?"

Figure 33. Destination Place Type by Alighting Station



As seen in Figure 33, the majority of Inbound AM Peak passengers at each of the top four alighting stations were en route to their place of work. Passengers alighting at South Station and Back Bay reported a variety of destination place types while those alighting at Ruggles and Providence Station were going to a limited set of places. Aside from Providence Station, egress trips to a college or university were either the second or third most popular destination place type.

At South Station egress trips to a college or university and those to banks or business offices each accounted for 5% of the trips from the station. 4% of passengers alighting at South Station were traveling a medical office while retail establishments, recreational activities, and hotels each accounted for 2% of the egress trips from South Station.

While 83% of alighting passengers at Back Bay traveled to their workplace, 7% continued to a college or university. Other notable destinations reached from Back Bay include place of residence (4%) and retail establishments (3%).

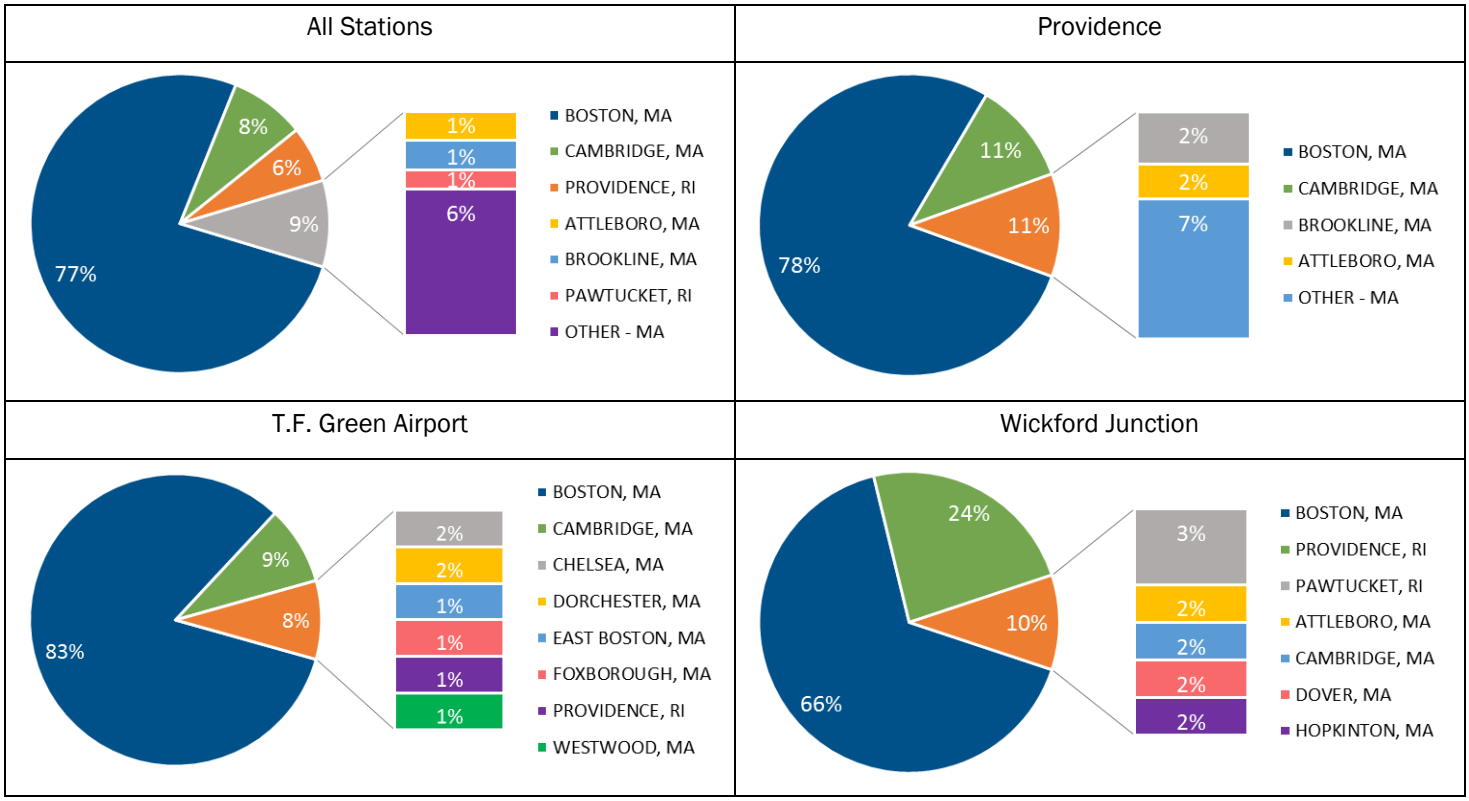
Workplace was the final destination for 74% of alighting passengers at Ruggles. As Ruggles is quite proximate to the Longwood Medical Center and several higher learning institutions, all other passengers were either headed to a medical facility (16%) or a college or university (10%).

Aside from the 93% of alighting passengers at Providence Station who were destined for their place of work, the remaining 7% of alighting passengers were en route to a bank or business office.

5.3.2.5 Destination Location

"Please tell us the nearest intersection or landmark of the one-way trip FINAL DESTINATION you checked above:"

Figure 34. Destination Place by City



To understand where passengers from each of the stations surveyed are ultimately traveling to, Figure 34 shows the distribution of destination cities by boarding station. For the Rhode Island segment as a whole, 77% of Inbound AM Peak passengers were destined for Boston, followed by 8% en route to Cambridge, and 6% completing local trips from T.F. Green Airport or Wickford Junction to Providence.

At Providence Station 90% of those who boarded were headed to Boston (78%) or the adjacent cities of Cambridge (11%) or Brookline (2%). Destinations in Attleboro generated 2% of the trips surveyed at Providence Station while other destinations within Massachusetts accounted for the remaining 7% of those who boarded in Providence.

83% of those who boarded at T.F. Green Airport were headed to Boston, along with 9% en route to Cambridge. The neighboring districts of Chelsea and Dorchester each accounted for 2% of the destinations. Less common destinations (1%) that were reported by passengers boarding at T.F. Green Airport included East Boston, Foxborough, Westwood, and Providence.

Given that it is the station located furthest away from Boston, passengers boarding at Wickford Junction, as expected, had relatively less demand for trips to the regional center (66% as opposed to around 80%) than those that boarded at T.F. Green Airport or Providence Station. Local trips to Providence Station accounted for 24% of all boardings surveyed at Wickford Junction. Of the three stations surveyed, passengers at Wickford Junction were most likely to use MBTA Commuter Rail service to reach local activity centers in Pawtucket and Attleboro.

The vast majority of in-state commuter rail passenger trips to Providence Station end at the zip code containing the train station (02903; 79%). This is not the case in Boston, which is the top destination for Rhode Island commuter rail passengers and has many zip codes containing popular neighborhoods and destinations. The top zip codes for those alighting at South Station are in the nearby Financial District and Waterfront (02110; 20%), Seaport (02210; 20%), Chinatown (02111; 16%), Cambridge's Harvard Square/Alewife neighborhoods (02138; 7%), and the West End (02114; 7%). The western portion of Kendall Square/MIT in Cambridge (02139) followed with 5%.

The top zip codes for passengers alighting at Back Bay Station were its namesake neighborhood (02116; 28%), the Longwood/Huntington Ave. area (02115; 15%), the West End (02114; 13%), the Fenway/Commonwealth Ave. area (02215; 8%), and the South End (02118; 8%). Three of these zip codes – Longwood, Fenway, and the South End – are geographically closer to the Ruggles Commuter Rail station than to Back Bay, especially for Rhode Island riders coming from the South. As these zip codes comprise over 30% of Rhode Island-based trips alighting at Back Bay Station, this represents a significant number of passengers who "double-back" south and west after alighting at Back Bay. This is probably because the Providence Line has limited service to Ruggles and the existing service is not well-aligned with passengers' schedules. As discussed in Section 5.3.5 of this report, survey takers' requests to expand service between Rhode Island and Ruggles supports this notion.

There is currently inadequate infrastructure at Ruggles Station to accommodate additional train service, but MBTA's ongoing Ruggles Station Platform Project will add a new platform to accommodate additional service. Given the popularity of destinations near Ruggles Station among Rhode Island-based MBTA Commuter Rail riders, RIDOT should advocate for expanded service to Ruggles once the project is complete, which MBTA expects to be in 2018.[8]

Rhode Island-based commuter rail passengers who do alight at Ruggles typically have final destinations in a concentrated area. The majority, 67%, have final destinations in the Longwood/Huntington Ave. area (02115) followed by Roxbury (02120; 17%).

[8] MBTA. Accessed: July 31, 2017. http://www.mbta.com/about_the_mbta/t_projects/default.asp?id=25059

5.3.3 Commuter Rail Use Information

This section, which is continued on the following page, discusses responses to Questions 7, 13-14, and 24 of the on-board passenger survey which solicited input from passengers regarding how and why they typically use MBTA Commuter Rail services.

(Remainder of page is intentionally blank)

5.3.3.1 Fare Type

"What type of fare did you use to pay for this train trip?"

Figure 35. Fare Type by Boarding Station

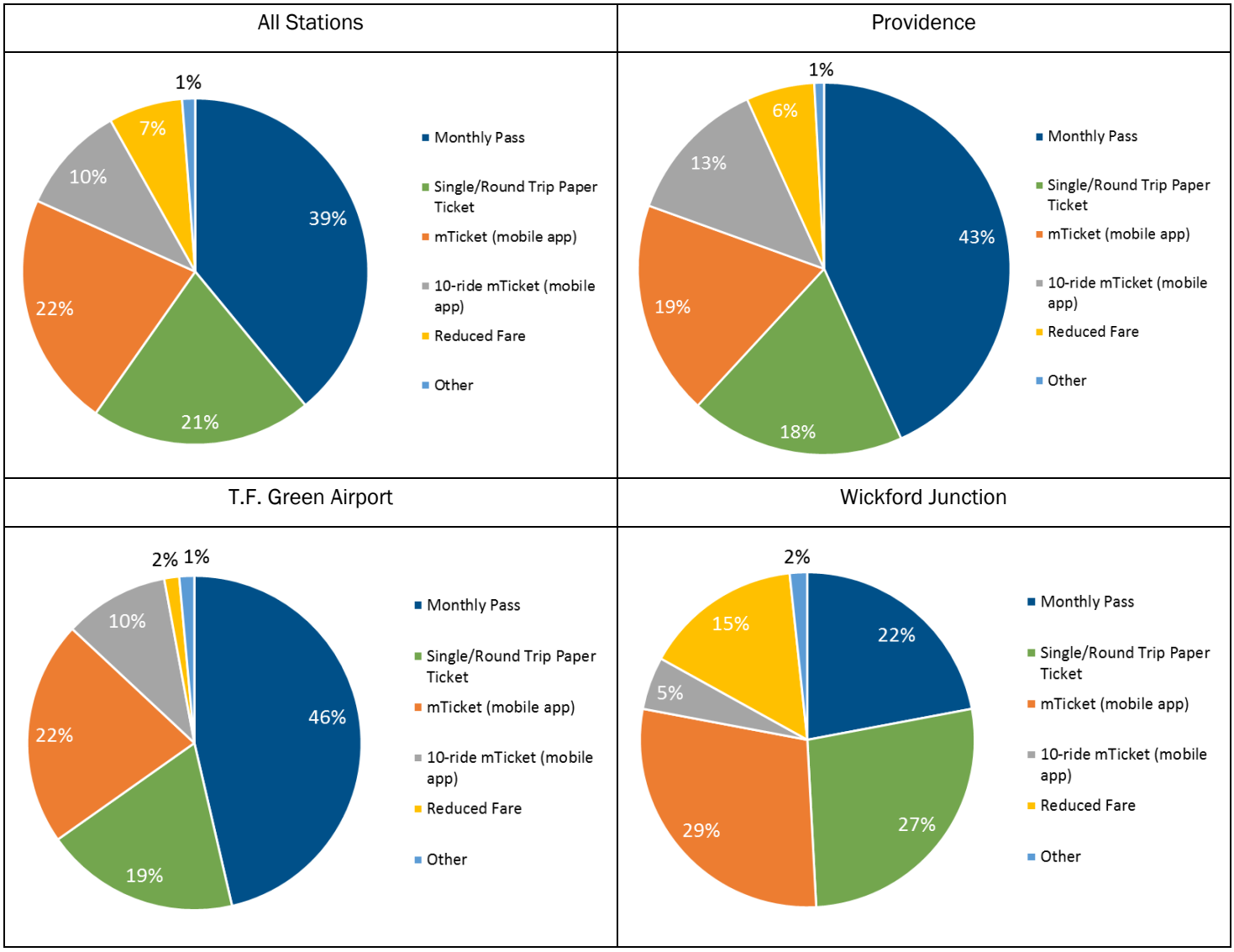


Figure 35 presents the proportion of fare products used by passengers. For the Rhode Island segment as a whole, the plurality of passengers (39%) paid their fare via a monthly Commuter Rail pass. Other popular options included cash-based paper tickets (21%), single fares purchased via the MBTA mTicket mobile phone application (22%), and 10-ride passes purchased via the mTicket application. Patrons using reduced fare products (i.e., seniors, persons with disabilities, and public school students) accounted for 7% of the line's total. The Other category reflects passengers who rode for free because they were either blind, visually impaired, or active military personnel.

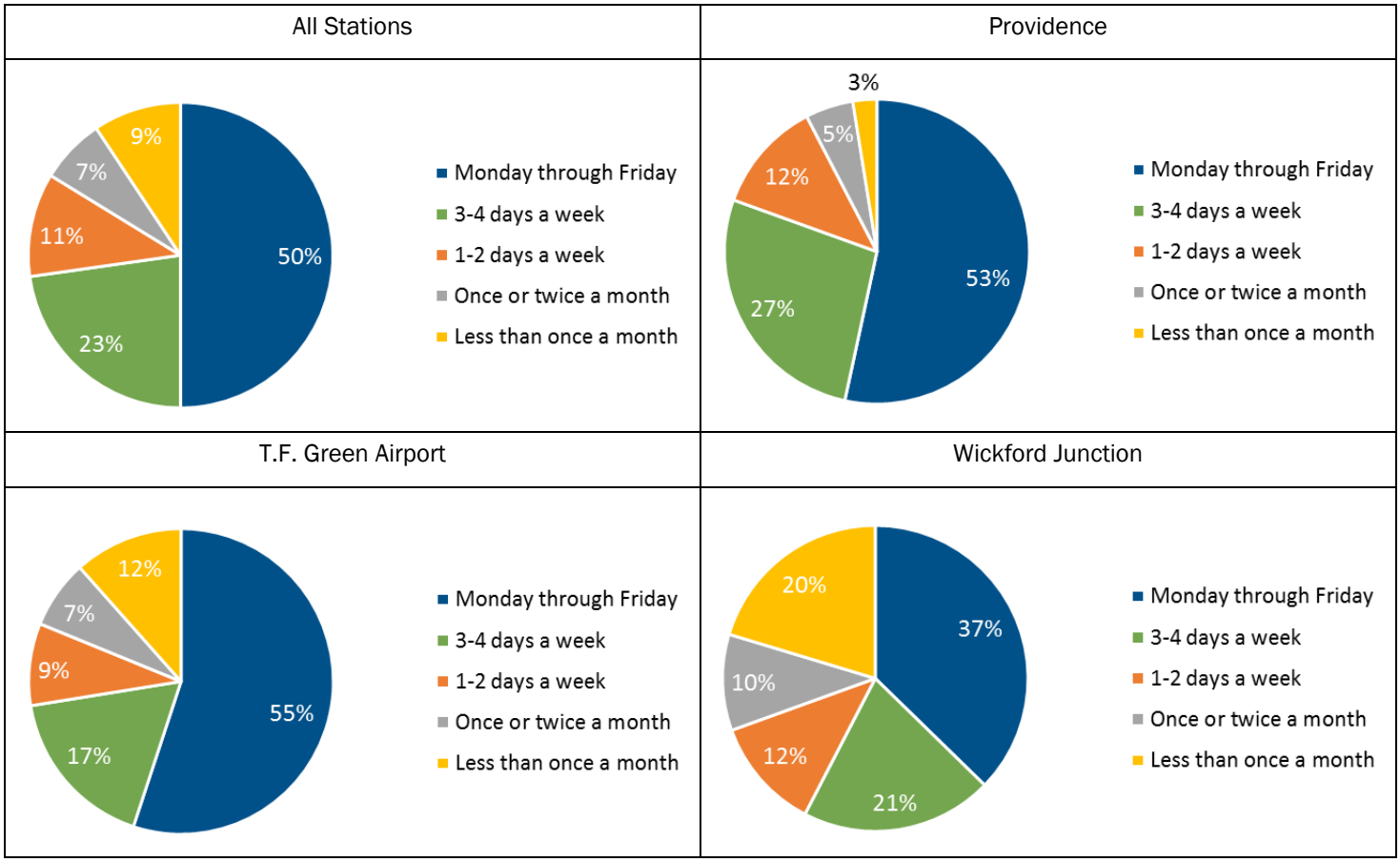
The distributions for Providence Station and T.F. Green Airport are quite similar to the distribution for the Rhode Island segment; however, there are relatively fewer reduced fare passengers at T.F. Green

Airport. The distribution at Wickford Junction is unique in that 15% of the respondents traveling Inbound during the AM Peak stated that they were using a reduced fare.

5.3.3.2 Weekday Frequency

"On WEEKDAYS only, how often do you typically ride Commuter Rail?"

Figure 36. Weekday Commuter Rail Use Frequency by Boarding Station



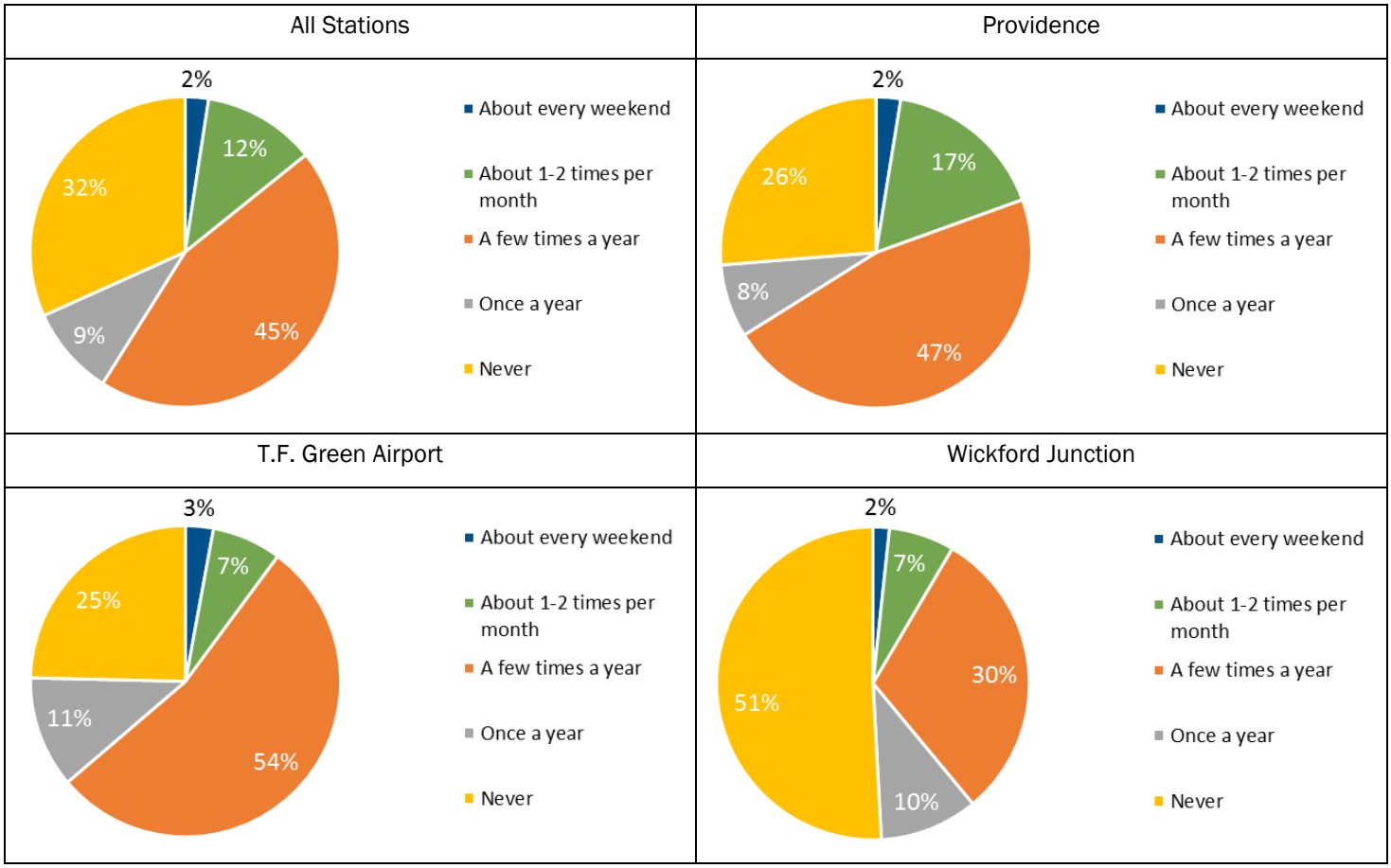
Across the Rhode Island segment of the Providence/Stoughton Line 84% of Inbound AM Peak passengers responded that they use the MBTA Commuter Rail weekday service at least once a week, including 50% who use it on a routine basis (i.e., Monday through Friday) and another 23% who use it three to four days a week. As seen in Figure 36, occasional riders (i.e., those that use the service no more than once or twice a month) accounted for 19% of respondents, with 7% stating they use the service once or twice a month and 12% responding that they use it less than once a month.

In terms of frequent use of the weekday service, Providence Station has the largest proportion of passengers using the service at least three days a week (80%), despite T.F. Green Airport having a slightly higher proportion of daily users (53%). Wickford Junction had the highest proportion of occasional riders (30%) while this user type accounted for only 8% of Inbound AM Peak passengers at the more frequently served Providence Station.

5.3.3.3 Weekend Frequency

"Do you use Commuter Rail on Saturdays and Sundays?"

Figure 37. Weekend Commuter Rail Use Frequency by Boarding Station



As seen in Figure 37, 86% of the Inbound AM Peak passengers surveyed along the Rhode Island segment of the Providence/Stoughton Line reported using the MBTA Commuter Rail weekend service less than once a month while only 2% stated that they use it about every weekend. The majority of passengers use the service a few times a year (45%) and the second most common response was that the weekday passengers never use the weekend service (32%). Of those who reported using the weekday service on a monthly basis, the majority take the train one or two times a month (12% overall).

Comparing the responses by boarding station, it becomes evident that passengers boarding Inbound AM Peak trains at stations which currently lack weekend service (i.e., Wickford Junction and T.F. Green Airport) are approximately half as likely to use weekend service on a monthly basis. Monthly use at Providence Station constituted 19% of respondents while monthly use was reported as 10% and 9% for T.F. Green Airport and Wickford Junction passengers, respectively. It is interesting to note that, while both stations are not currently served, passengers surveyed at T.F. Green Airport reported never using weekend service at a rate equal to half that of those surveyed at Wickford Junction. This relationship suggests that, given the shorter distance between Providence and T.F. Green Airport relative to the distance between Providence and Wickford Junction, respondents at T.F. Green Airport

are willing to travel to Providence Station to make use of the service while those located further south around Wickford Junction either forego weekend trips that could have otherwise been completed via weekend MBTA Commuter Rail service or, more likely, complete the trip using a different mode.

5.3.3.4 Reasons for Using Commuter Rail

"What are your main reasons for using Commuter Rail? (please check all that apply)"

Figure 38 compares the distribution of Inbound AM Peak weekday passengers' reasons for using MBTA Commuter Rail service across the Rhode Island segment and each of the three boarding stations. Figure 39 provides proportions for each potential reason for the line as a whole as well as at each station. Overall, avoiding driving/traffic was the most popular reason for using the service (25%), followed by its convenience (17%), the ability for passengers to avoid parking at their final destination (16%), and the ability for passengers to read or complete work while on-board (15%).

Approximately 2% of all respondents stated that they use the MBTA Commuter Rail to reach their destination because it is the only option available to them. Given that one-way fares to each of the stations surveyed increased by $1.00 just months prior to deployment of the survey, it makes sense that relatively few passengers responded that they take commuter rail because it is less expensive than other choices (6%).

The distribution of reasons for using commuter rail was remarkably similar when compared across the three stations, with no major deviations observed from the overall pattern of the line as a whole.

Figure 38. Distribution of Reasons for Using Commuter Rail by Boarding Station

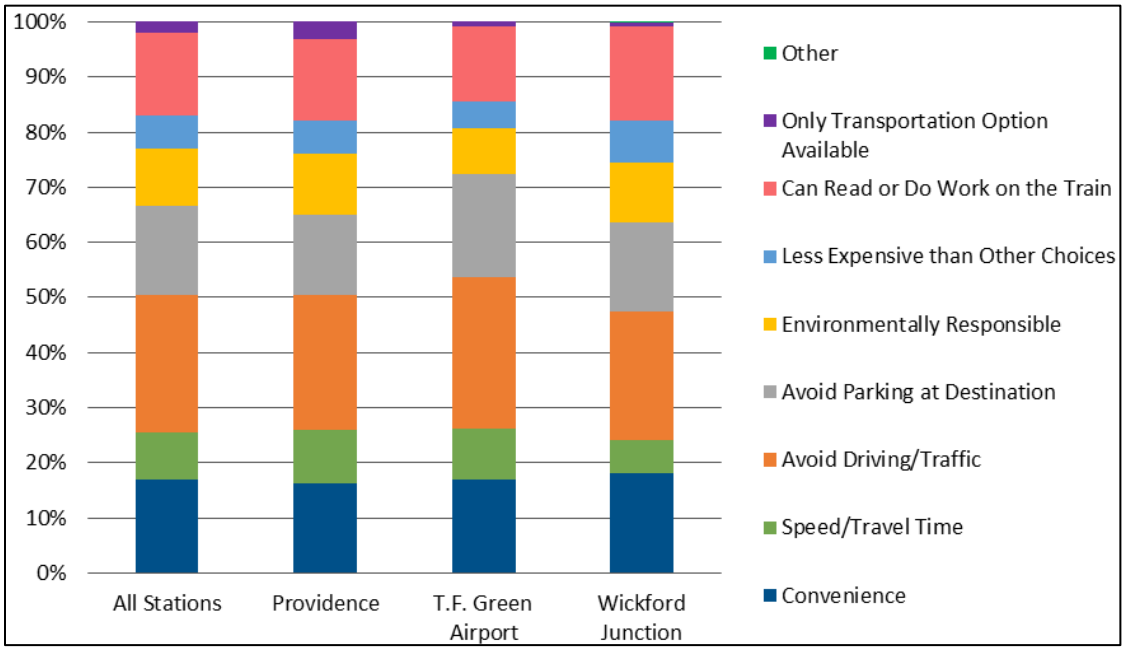
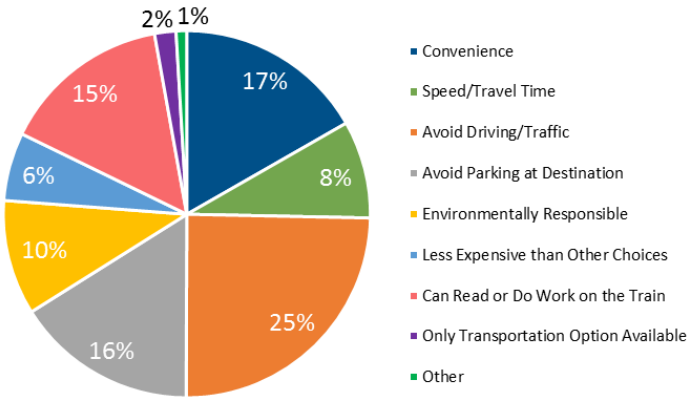
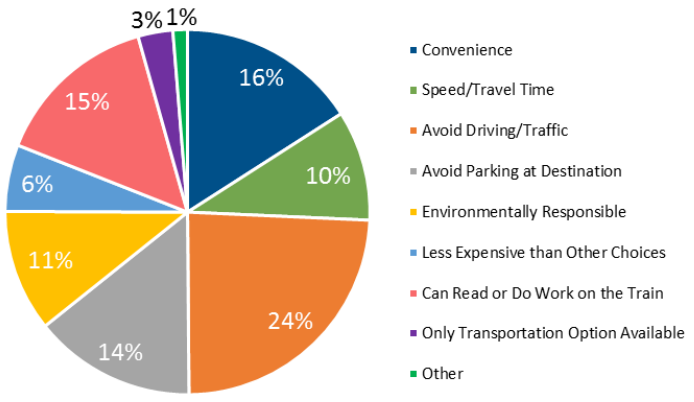


Figure 39. Reasons for Using Commuter Rail by Boarding Station

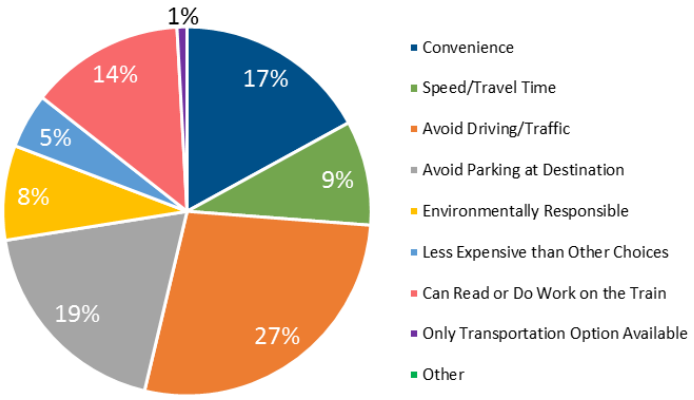
All Stations



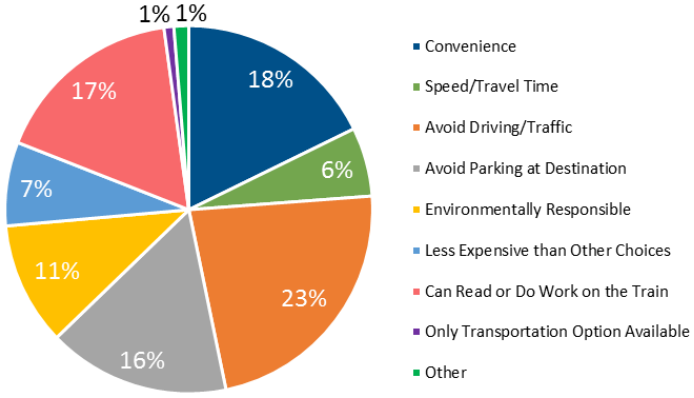
Providence



T.F. Green Airport



Wickford Junction



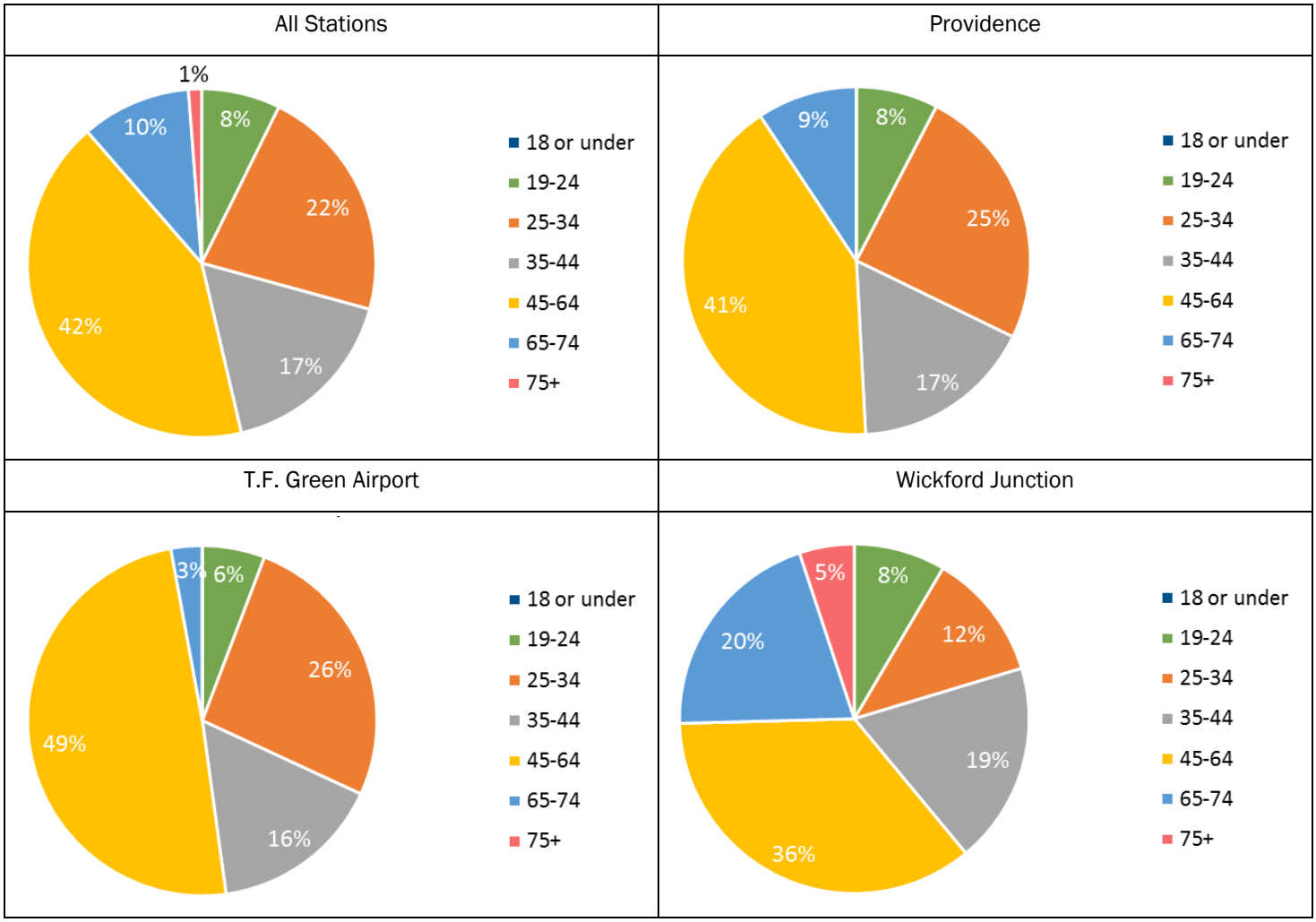
5.3.4 Demographic Information

This section, which is continued on the following page, reviews answers to Questions 15-23 of the on-board passenger survey which solicited input from passengers regarding how and why they typically use MBTA Commuter Rail services.

5.3.4.1 Age

"What is your age?"

Figure 40. Age by Boarding Station



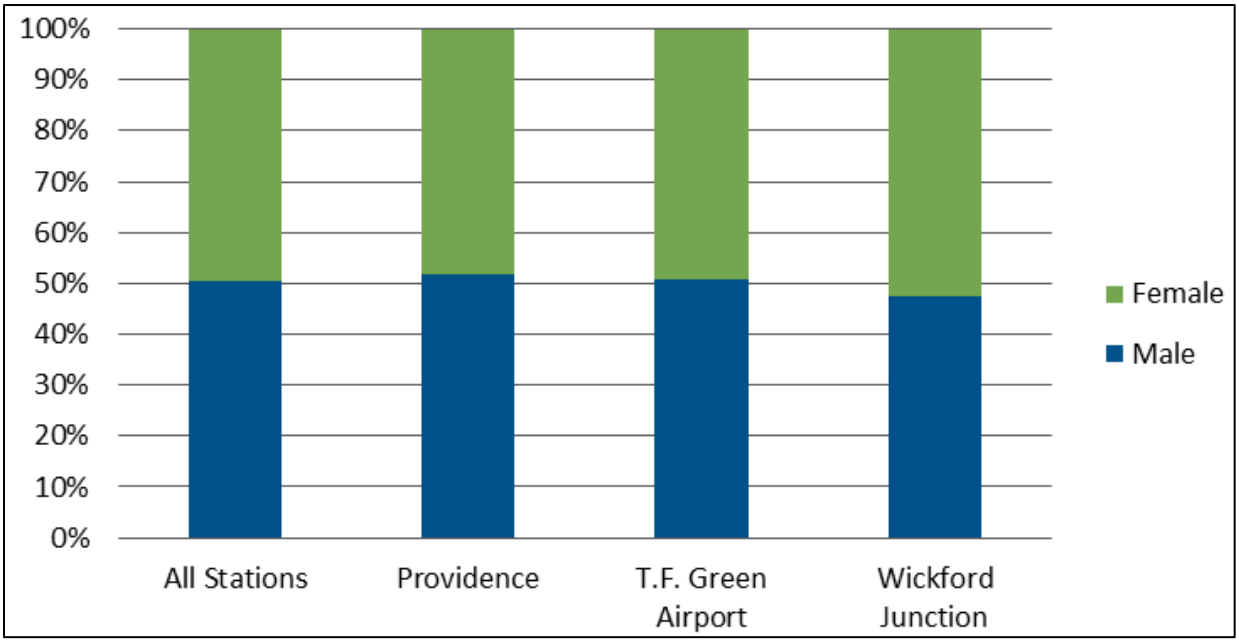
In terms of respondent age, 81% of all respondents reported were between the ages of 25 and 64. The most common age cohort for the Rhode Island segment of the line were those whose age ranged from 45 to 64 (42%), followed by young adults between the ages of 25 and 34 (22%), and 35 to 44 year olds (17%). Senior ridership accounted for 11% while those between the ages of 19 and 24 represented 8% of respondents.

As seen in Figure 40, Wickford Junction had the highest proportion of seniors (25%) while T.F. Green Airport had only 3%. It is interesting to note that passengers of college age (i.e., the 19-24 cohort) were as likely to have boarded at Wickford Junction as Providence Station (8%). Based on age, ridership composition is the most varied at Wickford Junction.

5.3.4.2 Gender

"How do you identify by gender?"

Figure 41. Gender by Boarding Station



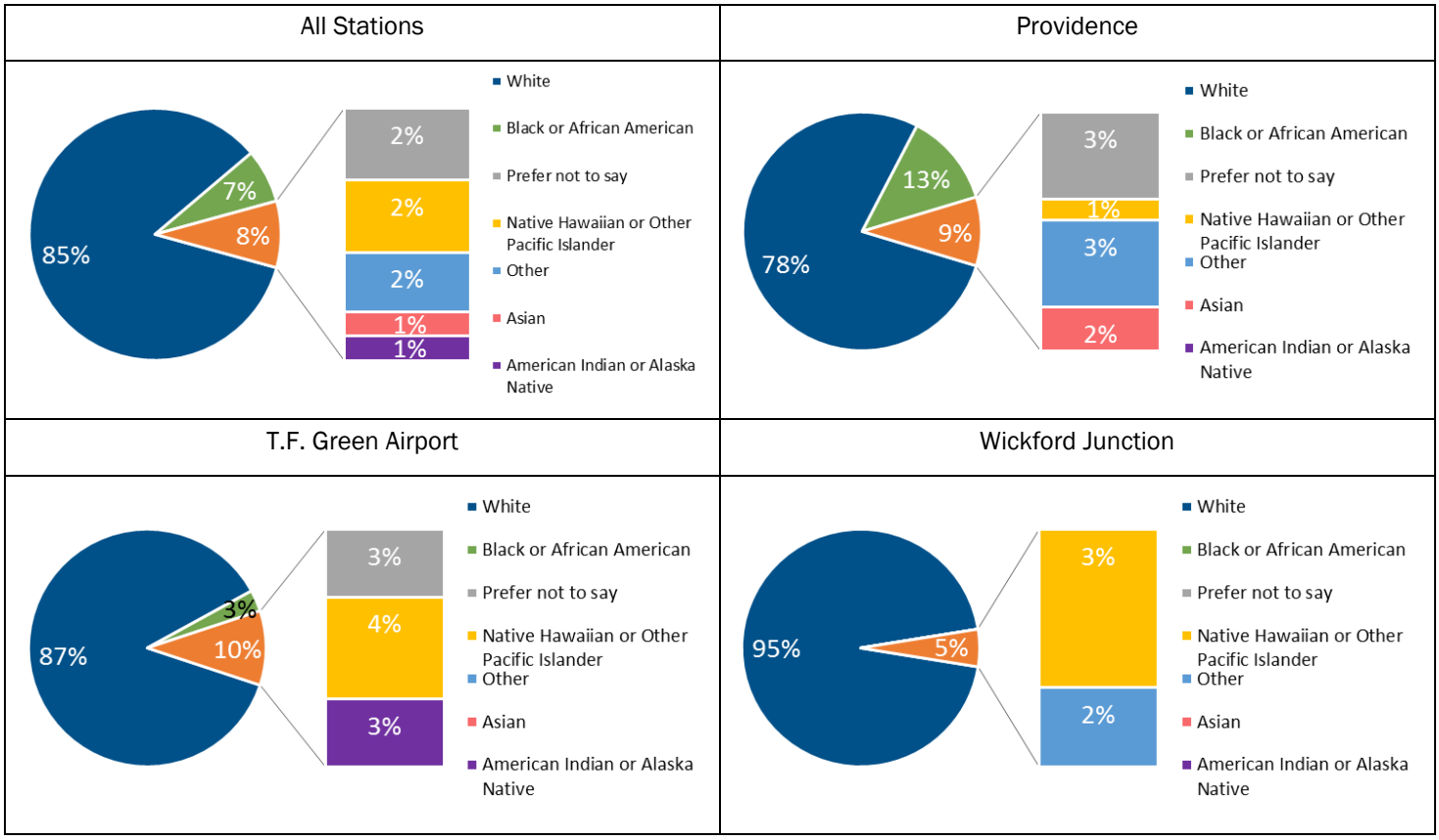
For the Rhode Island segment as a whole, the proportion of males to females using Inbound AM Peak MBTA Commuter Rail service was nearly one-to-one. As seen in Figure 41, male representation was highest at Providence Station (52%) while the largest proportion of females was reported at Wickford Junction (53%).

(Remainder of page is intentionally blank)

5.3.4.3 Race

"How do you self-identify by race? (please check all that apply)"

Figure 42. Race by Boarding Station



Overall 85% of the Inbound AM Peak passengers surveyed stated that they were White, with the second most frequent response being Black or African-American (7%). Other racial minorities represented include Native Hawaiian or Other Pacific Islander (2%), Other (2%), Asian (1%), and American Indian or Alaska Native (1%). Passengers reluctant to self-identify their race accounted for 2% of the total responses. It is interesting to note that Native Hawaiian or Other Pacific Islander representation was higher at T.F. Green Airport (4%) and Wickford Junction (3%) than Providence Station (1%).

As seen in Figure 42, the most heavily urbanized environment (i.e., Providence Station) was, as expected, also the most racially diverse with 19% of respondents self-identifying as non-White and 3% refusing to provide race information. Similarly, the most suburban environment sampled (i.e., Wickford Junction) had the fewest non-White respondents (5%). It should be noted that T.F. Green Airport was the only boarding station at which those surveyed stated that they were American Indian or Alaska Native (3%).

A comparison of the racial characteristics of Inbound AM Peak passengers who responded to the survey with those of the Rhode Island population as a whole is provided in Table 17. Based on the most recent five-year averages from the Census' American Community Survey, coupled with an imputation of racial characteristics via removal of those not responding (i.e., Prefer Not to Say), the

racial composition of the population surveyed was relatively aligned with the racial composition of the State of Rhode Island as a whole.

Table 17. Comparison of Survey Respondents Racial Characteristics with Statewide Averages

RACE	% SURVEYED	% SURVEYED (EXCLUDING NON-RESPONSE)	5-YEAR ACS STATEWIDE AVERAGES [9]
White	84.6%	86.7%	81.1%
Black or African American	6.9%	7.1%	6.5%
Native Hawaiian or Other Pacific Islander	2.4%	2.5%	0.0%
Other	2.0%	2.1%	5.8%
Asian	0.8%	0.8%	3.2%
American Indian or Alaska Native	0.8%	0.8%	0.5%
Two or More Races	0.0%	0.0%	2.8%
Prefer Not to Say	2.4%	N/A	N/A
TOTAL	**100.0%**	**100.0%**	**100.0%**

5.3.4.4 Hispanic Status

"Are you Hispanic/Latino/Latina?"

Table 18. Hispanic Status by Boarding Station

HISPANIC STATUS	ALL STATIONS		PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
	Count	% of Riders	Count	% of Riders	Count	% of Riders	Count	% of Riders
Yes	13	5.3%	12	10.2%	1	1.4%	0	0.0%
No	233	94.7%	106	89.8%	68	98.6%	59	100.0%
TOTAL	**246**	**100.0%**	**118**	**100.0%**	**69**	**100.0%**	**59**	**100.0%**

As seen in Table 18, approximately 5% of all Inbound AM Peak weekday passengers identified themselves as Hispanic/Latino/Latina. Providence Station had the highest representation of Hispanic/Latino/Latina with 10% while T.F. Green Airport had 1%. None of the respondents at Wickford Junction identified as Hispanic/Latino/Latina.

[9] US Census Bureau. 2011-2015 American Community Survey 5-Year Estimates.

5.3.4.5 Limited English Proficiency (LEP)

"Are you generally able to understand basic directions spoken or written in English?"

Table 19. Limited English Proficiency Populations by Boarding Station

LIMITED ENGLISH PROFICIENCY	ALL STATIONS		PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
	Count	% of Riders	Count	% of Riders	Count	% of Riders	Count	% of Riders
Always	243	98.8%	115	97.5%	69	100.0%	59	100.0%
Often	3	1.2%	3	2.5%	0	0.0%	0	0.0%
Sometimes	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Never	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Prefer not to say	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL	**246**	**100.0%**	**118**	**100.0%**	**69**	**100.0%**	**59**	**100.0%**

Individuals with Limited English Proficiency (LEP) are those who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English. For the Rhode Island segment of the Providence/Stoughton Line, only 1% of Inbound AM Peak weekday passengers stated that they were not always able to understand basic directions spoken or written in English. However, as seen in Table 19, all respondents within this group reported that they were often able to understand basic directions spoken or written in English.

5.3.4.6 Preferred Language

"In what language do you prefer to receive information about riding Commuter Rail?"

Table 20. Preferred Language by Boarding Station

PREFERRED LANGUAGE	ALL STATIONS		PROVIDENCE		T.F. GREEN AIRPORT		WICKFORD JUNCTION	
	Count	% of Riders	Count	% of Riders	Count	% of Riders	Count	% of Riders
English	243	98.8%	115	97.5%	69	100.0%	59	100.0%
Spanish	2	0.8%	2	1.7%	0	0.0%	0	0.0%
English & Spanish	1	0.4%	1	0.8%	0	0.0%	0	0.0%
TOTAL	**246**	**100.0%**	**118**	**100.0%**	**69**	**100.0%**	**59**	**100.0%**

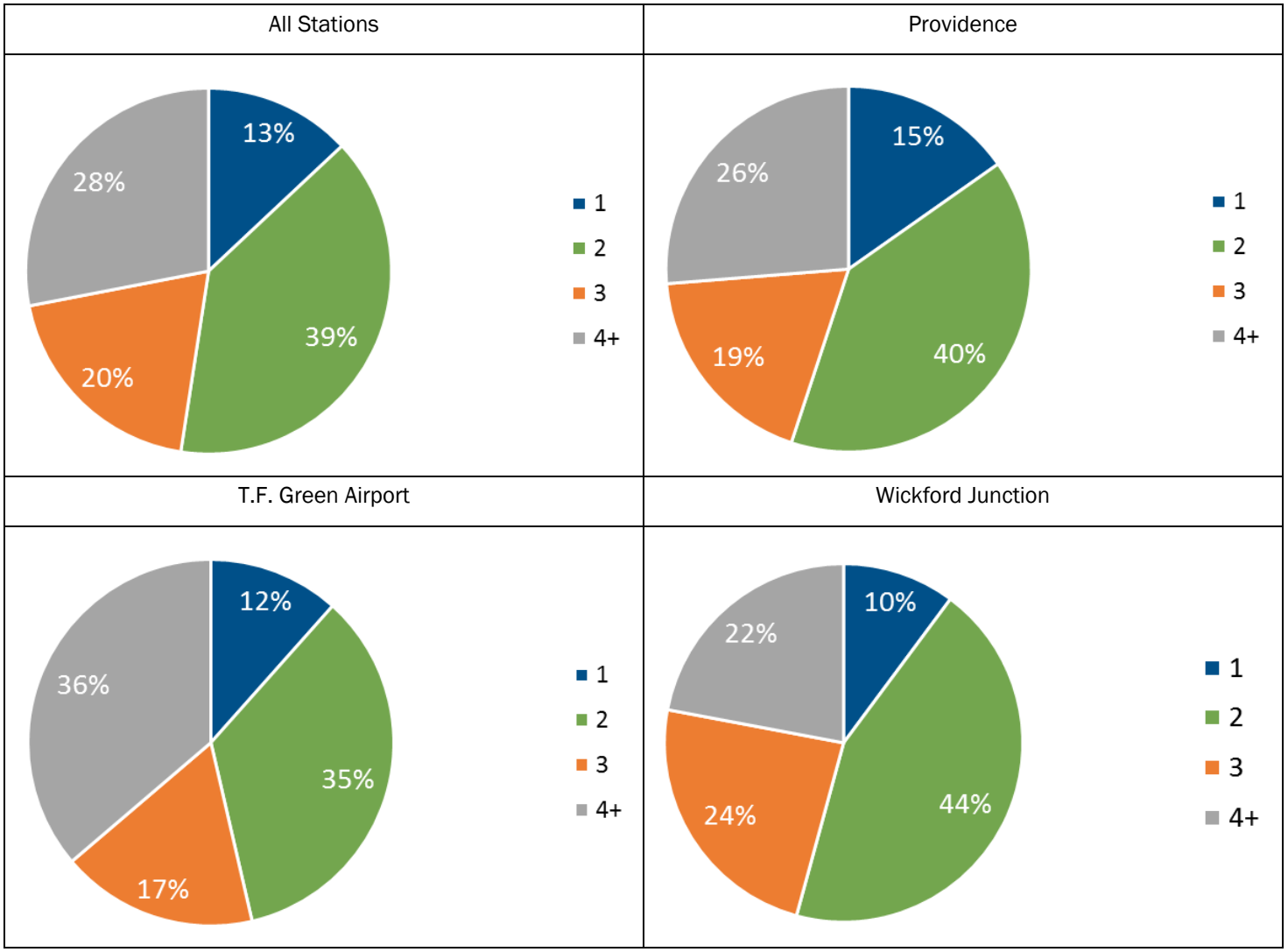
As seen in Table 20, nearly 99% of those surveyed reported a preference to receive information about riding MBTA Commuter Rail in English. All three respondents who stated that they would prefer information in a language other than English were boarding the train at Providence Station and accounted for nearly 3% of Inbound AM Peak weekday passengers surveyed at the station. Of the three

respondents, two preferred information to be transmitted to them in Spanish only while one preferred to receive materials in both English and Spanish.

5.3.4.7 Household Size

"How many people are in your household (including yourself)?"

Figure 43. Household Size by Boarding Station



On the line as a whole, 87% of respondents surveyed stated that they share a household with at least one other person while 13% reported living by themselves. As seen in Figure 43, the most common response was a two-person household (39%), followed by a four-person household (28%), and a three-person household (20%). The household size distribution for Providence Station was remarkably similar to that of the Rhode Island segment except there was a slightly higher representation of single households and a relatively lower representation of four-person households. T.F. Green Airport had the highest proportion of four-person households (36%) while Wickford Junction had the lowest proportion of one-person households (10%).

5.3.4.8 Household Income

"What is your annual combined household income (before taxes)"?

Figure 44. Distribution of Household Income by Boarding Station

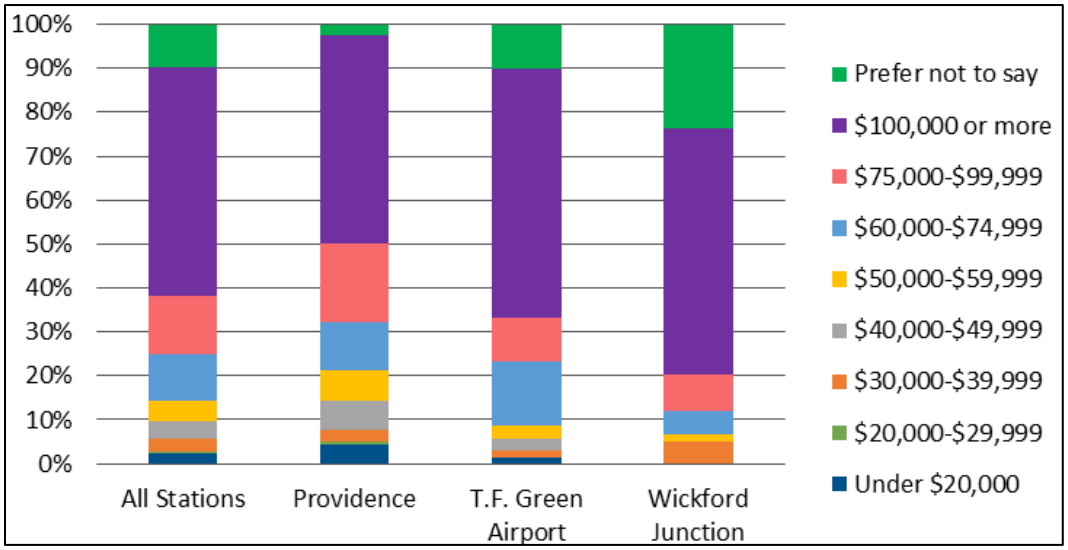


Figure 45. Household Income by Boarding Station

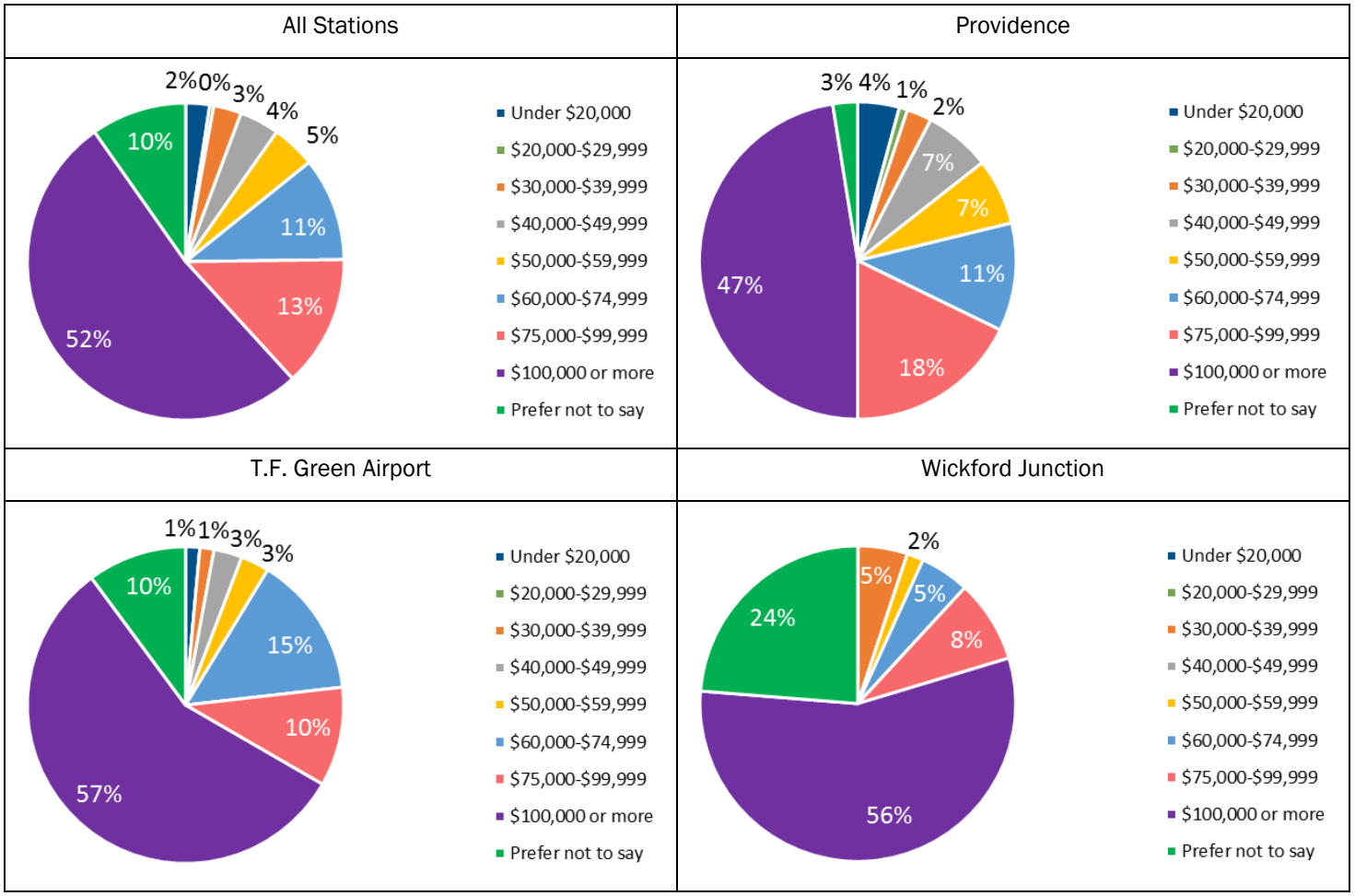
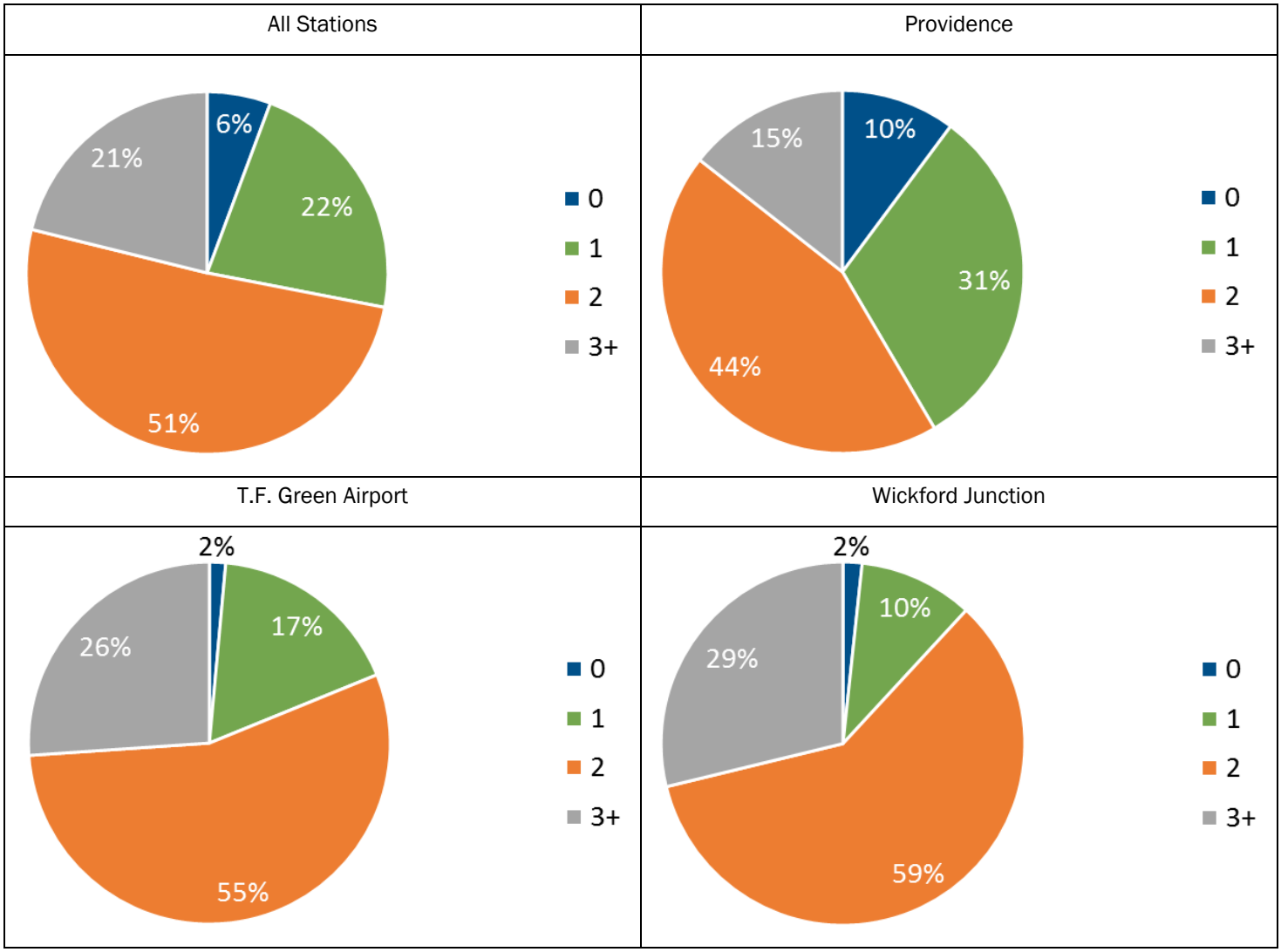


Figure 44 compares the relative share of each household income bracket for the Rhode Island segment of the Providence/Stoughton Line, as well as each of the three boarding stations surveyed, while Figure 45 reports the proportions of each household income bracket. Approximately two thirds of Inbound AM Peak weekday passengers surveyed along the Rhode Island segment of the line reported that their household earns at least $75,000 and high wage households (i.e., those earning at least $100,000 annually) accounted for 52% of overall ridership. While high income households were relatively less common at Providence Station than T.F. Green Airport (57%) and Wickford Junction (57%), they, nevertheless, accounted for 47% of the responses in Providence. Passengers living in low-income households (i.e., those with annual incomes less than $50,000) constituted 9% of all respondents and Providence Station had the highest proportion of low-income households (14%). As is common in passenger surveys, household income was the most frequently refused question that was included in the survey instrument.

5.3.4.9 Household Usable Vehicles

"How many usable vehicles are in your household?"

Figure 46. Household Vehicles Available by Boarding Station



Of the Inbound AM Peak weekday passengers boarding in Rhode Island, 94% responded that they had at least one usable (i.e., it reliably starts and is capable of safe operation) vehicle within their household. The most common response for the line as a whole was two usable vehicles (51%), followed by one usable vehicle (22%) and three usable vehicles (21%). Thus, the majority of passengers using the Inbound AM Peak weekday service routinely have the ability to complete their trip using a different mode. As seen in Figure 46, Providence Station had the highest proportion of zero-vehicle households (10%) while only 2% of respondents at Wickford Junction and T.F. Green Airport were members of a zero-vehicle household. This result is likely more a function of differences in the built environment and population density surrounding the stations, as well as access to frequent transit service, than the household income levels of those boarding the trains. Wickford Junction had the greatest proportion of households with three or more usable vehicles (29%), followed closely by T.F. Green Airport (26%), while only 15% of those surveyed at Providence Station stated that their household had at least three usable vehicles.

5.3.5 Open-Ended Responses

The final prompt of the on-board passenger survey was an open-ended response box that asked participants for their comments and suggestions. Each open-ended response was reviewed and each element within a given response was classified into one of 26 general categories to produce a total of 216 comments and suggestions collected across the three MBTA Commuter Rail stations in Rhode Island. Table 21 provides a ranked list of the most frequent comments and suggestions collected along the Rhode Island segment of the Providence/Stoughton Line, as well as rankings for each category at the individual stations.

Table 21. Comments and Suggestions Received from Inbound AM Peak Passenger

OVERALL RANK	COMMENT/SUGGESTION	% ALL RESPONSES	COUNT	PVD RANK	TFG RANK	WFJ RANK
1	More Trains Needed – Weekend	11.6%	25	15	2	1
2	More Trains Needed – Generally	10.2%	22	4	1	4
3	I Like the Commuter Rail Service	6.5%	14	15	12	2
4	Improve Service – Generally	6.0%	13	10	7	3
5	Add a Stop at a Particular Station	5.6%	12	3	6	10
6	Introduce Express Trains to/from Providence and Boston	5.1%	11	4	7	7
7	More Trains Needed – Midday	4.6%	10	10	3	16
7	More Trains Needed – PM Peak	4.6%	10	22	3	7
7	Service is Becoming Too Expensive	4.6%	10	4	7	10
7	Wi-Fi Complaints	4.6%	10	1	20	7
7	Service Window Gaps	4.6%	10	10	5	10
12	Trains Too Crowded – Open More Cars	4.2%	9	2	12	16

OVERALL RANK	COMMENT/SUGGESTION	% ALL RESPONSES	COUNT	PVD RANK	TFG RANK	WFJ RANK
13	Additional Amenities	3.2%	7	4	12	16
14	More Trains Needed – AM Peak	2.8%	6	22	7	10
14	Announcement & Passenger Information Complaints	2.8%	6	15	11	10
14	Introduce Quiet Car	2.8%	6	15	17	6
14	Conductors & Staff – Positive Feedback	2.8%	6	15	20	4
18	Cleanliness – Trains	2.3%	5	4	20	16
18	Need More Parking at Providence Station	2.3%	5	4	20	16
20	Add a New Commuter Rail Station in Rhode Island	1.9%	4	10	20	10
20	Improve Transit Connections to Commuter Rail Stations	1.9%	4	15	12	16
22	Introduce Additional Fare Options	1.4%	3	10	20	16
22	Adjust Arrival/Departure Time of a Specific Train	1.4%	3	22	12	16
24	Cleanliness – Providence Station Restroom	0.9%	2	15	20	16
24	Need Greater Police Presence / Passenger Conduct Issues	0.9%	2	22	17	16
26	Conductors & Staff – Negative Feedback	0.5%	1	26	17	16
	TOTAL	**100.0%**	**216**			

The top six responses accounted for 45% of all comments and suggestions provided by Inbound AM Peak weekday passengers in Rhode Island. The top ranked comment overall (More Trains – Weekend) was that nearly 12% of all Inbound AM Peak weekday passengers wish to see increased frequency on weekends. 23 of the 25 comments within the top category were related to passengers boarding south of Providence Station wanting the MBTA to extend some, if not all, of its existing weekend trains that serve Providence Station further southward to terminate at Wickford Junction. Extension of weekend service southward was the most frequent comment from those boarding at Wickford Junction and the second most frequent comment for those at T.F. Green Airport. Within this category there were also two responses from passengers at Providence Station who stated that they would like the MBTA to introduce additional weekend outbound trains during the PM Peak so that they have more opportunities to return back to Providence from Boston on weekend trips.

The second most frequent comment overall (More Trains – Generally) received 10% of all responses and ranked among the top four categories at each of three stations. Responses at Providence Station suggested simply adding more service while responses at T.F. Green Airport and Wickford Junction primarily focused on extending some of the existing trains that terminate at Providence Station further southward.

Over 6% of all respondents stated that they value the service that the MBTA and RIDOT provide along the Providence/Stoughton Line, making it the third most frequent comment received. As this category had the second highest ranking at Wickford Junction, passengers there appear to still appreciate RIDOT's decision to extend commuter rail service to South County.

Overall 6% of respondents provided details on service issues they experience on a regular basis (Improve Service – Generally), making it the fourth most frequent comment category. The majority of the responses within this category pertained to routine mechanical failures along the line which compromise the reliability of the service and generate delays for passengers who are already undertaking relatively long commutes. Aside from the reliability aspect, virtually all passengers who commented in this category at T.F. Green Airport and Wickford Junction suggested to eliminate the 10 minute Inbound AM Peak layover at Providence Station that is built into the schedules for the 802, 806, 808, and 814.

The fifth most frequent comment (Add a Stop at a Particular Station) garnered nearly 6% of all responses; however, 25% of these responses pertained to support for adding an Amtrak stop at T.F. Green Airport. Of the comments related to MBTA service changes, most comments originated from riders at Providence Station (3rd highest ranking at station) who want to have more opportunities for alighting at Ruggles during the AM Peak period, with some suggesting that Ruggles be served by every Inbound AM Peak train. Other suggestions included adding an Outbound PM Peak stop at Route 128 on either the 825 or the 827, introducing daily service to Gillette Stadium, extending the MBTA service further southward to the existing Amtrak station at Kingston, and providing additional alighting opportunities at Hyde Park during the PM Peak service period.

Introducing a true Express service (i.e., no intervening stops between termini) between Boston and Providence Station accounted for 5% of all responses received. The majority of respondents in this category, including those boarding at T.F. Green Airport and Wickford Junction, simply stated that they want Express service between Providence and Boston while others suggested Express service between South Station and Providence Station, with local stops at T.F. Green Airport and Wickford Junction as well. One respondent suggested introducing a weekend Express route serving Wickford Junction, T.F. Green Airport, Providence Station, Attleboro, Route 128, Back Bay, and South Station.

In addition to these overall comments, all of which were ranked within the top four for passengers boarding at T.F. Green Airport and Wickford Junction, other highly ranked comments at Providence Station mainly pertained to amenities and passenger comfort. Aside from the top ranked response at Providence Station (10% of passengers complained about the on-board Wi-Fi service), the second most frequent response was that the MBTA needs to open more cars on its trainsets or introduce a higher proportion of bi-level coaches to its trainsets on the Providence/Stoughton Line to reduce crowding and provide Rhode Islanders with an opportunity to sit down, with one passenger going so far as to suggest that the Outbound 825 often feels like a "cattle car".

Comments that tied for the fourth most frequent responses at Providence Station included: Express service to Boston, commuter rail is becoming too expensive given the level of service provided, trains need to be cleaned more frequently, additional on-board amenities (like more charging outlets, tables, lighting, and trash cans), and more parking opportunities near Providence Station.

(Remainder of page is intentionally blank)

6 Conclusions

This chapter provides a summary of key insights related to weekday and weekend ridership as observed during the quarterly and bi-annual counts, as well as a discussion of major themes derived from an analysis of MBTA Inbound AM Peak weekday riders' responses to the September 2016 on-board survey. It should be noted that RIDOT will continue to conduct quarterly weekday and bi-annual weekend ridership counts through April 2018 (i.e., the end of state FY 2018).

6.1 Weekday Passenger Counts

Since the quarterly weekday ridership counts began in July 2015, total activities along the Rhode Island segment of the MBTA's Providence/Stoughton Commuter Rail Line have increased by 12%. This observed increase was likely a function of the introduction of seven additional weekday trains serving Providence Station in July 2016, as Providence experienced a 16% growth in activities while passenger traffic at T.F. Green Airport rose by 2% and boardings and alightings at Wickford Junction decreased by 4%. Approximately 80% of all activities observed along the Rhode Island segment took place at Providence Station while T.F. Green Airport and Wickford Junction both accounted for roughly 10% of boardings and alightings.

Temporal distributions of weekday ridership along the Rhode Island segment were consistent with traditional patterns of commuter rail ridership, with the AM Peak period containing the most activity (35%), followed by the PM Peak (33%) based on observations from FY 2016 and FY 2017. On average, the Midday service period garnered approximately 23% of all activities while the Late Night service period housed the remaining 9% of boardings and alightings. It should be noted that boardings and alightings across the line as a whole increased for every service period in which at least one additional train serving Providence was added in May 2016 (11% AM Peak with one new train, 33% Midday with four additional trains, and 23% Late Night with two more trains) while a 2% decrease in total activities was observed during the PM Peak, the only period for which service levels at Providence Station remained constant throughout this effort.

In terms of temporal distributions across the Rhode Island stations, a steady stream of activities was observed at Providence, with just over one third of FY 2017 activities occurring outside of the AM and PM Peak service periods. On the other hand, the AM and PM Peak service periods dominated activities at T.F. Green Airport, with off-peak activities accounting for only 16% of boardings and alightings in FY 2017. Midday activities at Wickford Junction were proportional to the share of activities observed during the same service period at Providence Station. Late Night activities south of Providence Station were relatively uncommon, as the service period only constituted 2% of total activities in FY 2017 for both T.F. Green Airport and Wickford Junction.

As is common for commuter rail systems, AM Peak boardings were heavily concentrated in the Inbound direction while Outbound alightings accounted for the majority of passenger traffic during the PM Peak. In terms of the extent to which weekday commuter rail service was used by those boarding in Rhode Island to travel to other destinations within Rhode Island, internal trips constituted 2.2% of all trip-level activities along the Rhode Island segment of the line in FY 2016 and 2.7% of trips in FY 2017. As expected, 95% of the internal trips observed in FY 2017 had a trip end at Providence Station.

In terms of passenger preferences for different service types, Inbound AM Peak passengers prefer Express trains, likely because of the reduced travel time prior to the start of the work day, while Outbound PM Peak passengers prefer Semi-Express trains most likely due to the convenient arrival and departure times. The Inbound AM Peak 808, which departs Providence Station at 7:15 AM and arrives to South Station at 8:16 AM, consistently had the highest outgoing passenger load crossing into Massachusetts (typically at least 325 passengers) while the Outbound 825 Express, which departs South Station at 5:40 PM and arrives to Providence Station at 6:43 PM, secured four of the top five incoming passenger loads crossing into Rhode Island (usually at least 275 passengers).

Based on a price elasticity analysis between weekday MBTA Commuter Rail ridership and gasoline prices, the cost of a one-way fare, and the total number of daily trains serving a station, it appears that changes to service frequency have a stronger influence than increases in the cost of fuel and/or fares.

6.2 Weekend Passenger Counts

Total activities at Providence Station for Saturday and Sunday increased by 7% and 2%, respectively, since the bi-annual weekend ridership counts began in October 2015. Since neither the frequency of service nor the arrival/departure times for weekend service changed between FY 2016 and FY 2017, this increase was most likely a function of passengers who would have otherwise taken a personal vehicle to complete weekend trips opting instead to take the commuter rail in response to gradual increases in the cost of gasoline. In FY 2017, the average activity levels for Saturday and Sunday equate to 65% and 50% of average weekday activities. However, weekend activities within the Midday and Late Night service periods were quite comparable to the observed weekday activity levels during those periods.

In terms of temporal distributions for Saturday ridership, the Midday service period, on average, constituted nearly 45% of all activities, followed by the PM Peak with approximately 30%, and Late Night with roughly 15%. As there were only three trains operating during the traditional AM Peak, a modest contribution of 10% was reasonable. Large percentage increases in Saturday ridership between FY 2016 and FY 2017 were observed during the AM Peak (21%) and PM Peak service periods. In FY 2017, 70% of Inbound boardings from Providence Station en route to Boston were concentrated in the AM Peak (21%) and Midday (49%) service periods while 57% of Outbound alightings coming from Massachusetts to Providence Station occurred during the PM Peak (38%) and Late Night (19%) service periods.

Similar to the distribution observed for Saturday, the Midday service period accounted for 50% of all Sunday activities, followed by the PM Peak with approximately 35%, and the Late Night near 15%. As the first two Saturday trains do not operate on Sunday, there was an absence of service during the AM Peak period on Sunday. Growth in Sunday ridership between FY 2016 and FY 2017 was mainly due to increases in activities during the Late Night (13%) and PM Peak (5%) service periods. In FY 2017, 52% of Inbound boardings from Providence Station took place within the Midday service period whereas 58% of Outbound alightings coming back into Rhode Island fell within the PM Peak (37%) and Late Night (21%) service periods.

As weekend service is not provided south of Providence Station, internal trips aboard commuter rail were not possible.

The most tightly packed weekend Inbound trains heading into Massachusetts were observed to occur during the Midday service period, followed by the PM Peak. Sunday had 65% of the high load weekend trains and this was likely a function of the MBTA operating eight fewer trains on Sunday than Saturday. The Inbound 1806 and 2806 (departs Providence Station at 11:20 AM, arrives to South Station at 12:30 PM) accounted for five of the top seven trains and tended to carry well over 165 passengers from Rhode Island into Massachusetts.

In the Outbound direction, the trains carrying the highest loads of passengers from Massachusetts into Rhode Island were observed to occur during the PM Peak service period, followed by the Midday. As opposed to the Inbound direction, the split of high load trains was relatively even between Saturday and Sunday. The Outbound 1811 and 2811 (departs South Station at 4:35 PM, arrives to Providence at 5:40 PM) claimed 35% of the top 20 spots and tended to carry well over 150 passengers across the state line.

Based on a price elasticity analysis between weekend MBTA Commuter Rail ridership and gasoline prices and the cost of a one-way fare, it appears that, in addition to providing weekday commuters with access between Providence and Boston, MBTA Commuter Rail service at Providence Station also functions as a competitive substitute to driving a personal vehicle for discretionary trips on the weekend.

6.3 On-Board Passenger Survey

Based on the number of "wholly valid" responses collected from Inbound AM Peak weekday passengers, the results of the on-board passenger survey for the Rhode Island segment, as well as at individual stations, can be confidently generalized with a margin of error less than 10%.

In terms of getting to their boarding station, 92% of Inbound AM Peak passengers boarding along the Rhode Island segment of the Providence/Stoughton Line were at their residence prior to arriving at their boarding station. The majority of passengers surveyed originated within the State of Rhode Island (98%), with Providence (32%), Warwick (20%), North Kingstown (8%), East Greenwich (5%), and Cranston (4%) being the most common origin cities. Over 90% of those surveyed indicated that their journey to the station took no more than 30 minutes and nearly three quarters stated that it took no more than 20 minutes.

Based on the responses to the ingress mode question, there is a heavy reliance on the use of personal vehicles en route to the stations, with 57% having driven a private vehicle and parked at or near a station and 24% that were dropped off. Active transportation modes were the third most popular option, with walking accounting for 7% of origin trips and biking nearly 2%. Transit use accounted for 6% of arrivals at boarding stations. Finally, private, for-hire vehicles accounted for only 5% of arrivals, with taxi/rideshare contributing 4% and private shuttles constituting 1% of all station arrivals.

90% of those surveyed along the Rhode Island segment stated that they were alighting at a station within Route 128, with South Station (50%) leading, followed by Back Bay (32%) and Ruggles (8%). 6% of all respondents responded that they would be alighting at Providence Station.

In terms of the proportion of passengers who frequently use MBTA Commuter Rail, 84% of Inbound AM Peak passengers responded that they use the service on weekdays at least once a week, including 50% who use it every weekday and another 23% who use it three to four days a week. 86% of those surveyed reported using the service on the weekend less than once a month while only 2% stated that

they use it about every weekend. When prompted to explain why they choose commuter rail, over 40% of passengers replied, in some form or another, that taking the service allows them to avoid the hassles of driving (25% selected "avoid driving/traffic" and 16% said "avoid parking at final destination") while the convenience of the service accounted for another 32% of responses (17% chose "convenience" and another 15% selected "can read or do work on the train"). Only 2% of all respondents stated that they use the MBTA Commuter Rail to reach their destination because it is the only option available to them.

The majority of passengers (39%) paid their fare via a monthly Commuter Rail pass and other popular payment options included cash-based paper tickets (21%), single fares purchased via the mTicket application (22%), and 10-ride mTicket passes.

In terms of demographic composition, the majority of passengers surveyed were of working age (19-64). Ridership on MBTA Commuter Rail appears to have a slightly higher proportion of non-minorities and high earning households, especially at stations south of Providence.

Aside from the multiple choice questions, responses to the open-ended comment box also shed some light as to what passengers desire from the service. The most frequent comment received was that the MBTA should extend weekend service to T.F. Green Airport and Wickford Junction, followed by the general suggestion to add more train service. Many passengers elaborated on reliability issues they experience on a regular basis which generate delays for passengers who are already undertaking relatively long commutes. There was substantial support from those boarding at T.F. Green Airport and Wickford Junction to eliminate the 10 minute Inbound AM Peak layover at Providence Station that is built into the schedules for the 802, 806, 808, and 814. As expected, suggestions for introducing a true Express service (i.e., no intervening stops between termini) between Boston and Providence Station constituted one of the more popular responses.

Additionally, many of the riders at Providence Station stated that they would like to see more opportunities for alighting at Ruggles during the AM Peak period. Finally, the second most frequent response from those boarding at Providence Station was that the MBTA needs to open more cars on its trainsets or introduce a higher proportion of bi-level coaches to its trainsets on the Providence/Stoughton Line to reduce crowding and provide Rhode Islanders with an opportunity to sit down.

Overall, the distribution of answers at Providence Station and T.F. Green Airport were remarkably similar to the distribution observed for the Rhode Island segment as a whole. However, for many questions the distribution of responses at Wickford Junction was markedly distinct, as observed by the deviations summarized below.

- Origin Place Type: higher share of passengers who began their trip to the station from Another Person's Home
- Origin Location: most varied distribution of the stations with large representation from coastal communities
- Ingress Mode: no representation of active transportation, transit, or taxi/rideshare use
- Alighting Station: 24% of trips from the station terminated at Providence Station and 5% ended at stations in southern Massachusetts (Attleboro and South Attleboro)
- Fare Type: lowest utilization of monthly passes (22%)
- Weekday Use: lowest share of routine users (58% use service at least three times per week)

- Weekend Use: highest share of passengers who have never boarded weekend service (51%)
- Age: highest proportion of seniors (25% were 65+)
- Race: least diverse (95% self-identified as White)
- Household Usable Vehicles: highest proportions of multi-vehicle households (88% had two or more usable vehicles)

Given these variations in passenger characteristics relative to the other two stations, some of the principles and strategies used to increase ridership in more urban settings like Providence Station or T.F. Green Airport may not realize the same degree of success when applied to the more suburban context of Wickford Junction. However, some strategies, such as increasing frequency and having transit-supportive development, particularly residential, will likely be effective at all three stations. Thus, any attempt to grow ridership at Wickford Junction should also rely on the use of supplemental strategies that are uniquely tailored to suit the demographic composition and land use characteristics of South County.

(Remainder of page is intentionally blank)