Rhode Island Public Transit Authority Mobility Zone Assessment

Prepared for Rhode Island Public Transit Authority

Prepared by AECOM

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1 Mobility-on-Demand Executive Summary

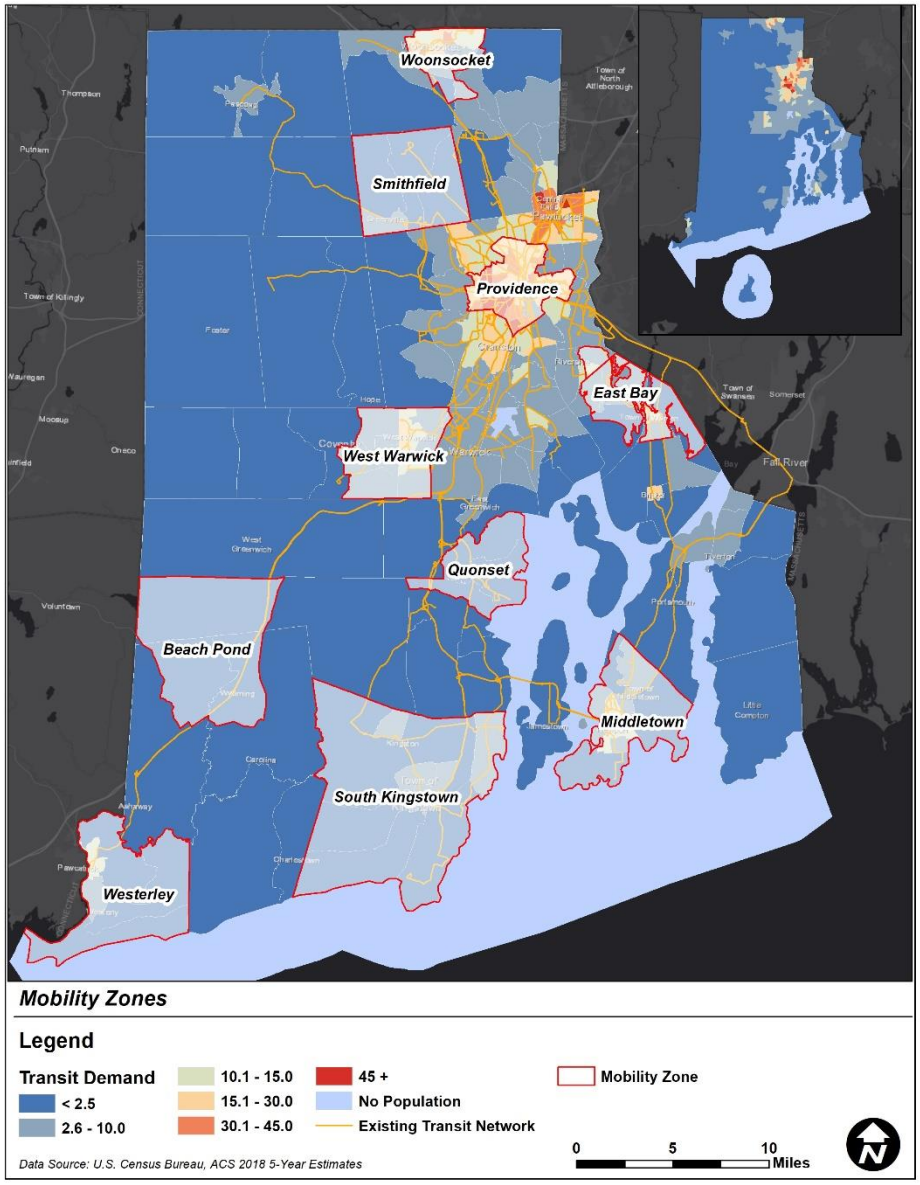
In Transit Forward RI 2040, the Rhode Island Public Transportation Authority (RIPTA) statewide Transit Master Plan, Mobility on Demand (MOD) was identified as a potential mobility solution for the state. MOD is the ability to leverage technologies, including real-time data, trip planning, and mobility wallet, to better apprise users of mode choices and improve their transportation experience. RIPTA was particularly interested in exploring microtransit, a general public on-demand service that serves a designated area and typically is summoned via a smartphone app, one of the potential MOD solutions, as a possibility to augment the existing fixed route transit service network and address equity concerns associated with identified "transit deserts" across the state.

The pilot design process started with a comprehensive statewide "Universal Screening," which took demographics, socioeconomics, employment, presence of trip generators, and travel patterns into consideration. This resulted in a diverse set of use cases for a wide range of geographic candidate microtransit zones, referred to below as "Mobility Zones." Where pre-existing RIPTA Flex Zones were present, they were converted to Mobility Zones for this exercise.

Once the candidate Mobility Zones from the "Universal Screening" process were identified, the AECOM-developed Sustainable Systems Integration Model (SSIM) analysis tool was used to quantify the performance potential of each candidate Mobility Zone in order to narrow the list based on the proposed criteria and metrics. The SSIM process analyzed each zone using the criteria selected as part of the "Universal Screening" process and assigning a weighted value based on the factors that best met the goals of the MOD project. Each candidate Mobility Zone received a final score, based on the weighted value of each metric, to represent its implementation potential for on-demand transit services.

RIPTA conducted a study of ten different potential zones for Mobility-on-Demand (MOD) service. Of the ten original zones, seven were chosen for closer examination and potential MOD service design. The potential pilot zones are presented on Figure 1-1. Based on the detailed analysis of the seven zones, three were recommended for pilot MOD service. Below is a summary of the findings.

Figure 1-1: Ten Zones Considered for Pilot MOD Service



1.1 Zones Recommended for Further Analysis as Pilot Zones

The three zones recommended for further analysis for pilot service, the West Warwick Zone, Westerly Zone, and Woonsocket Zone, represent different potential use cases. The West Warwick Zone is located just outside of Providence and has a large commercial area; the Westerly Zone is a smaller population center in a more rural part of the state; and the Woonsocket Zone is a more centrally located zone with a diverse population.

Table 1-1: Key Statistics - Zones Recommended for Pilot Service

Recommended Zones	West Warwick	Westerly	Woonsocket
Current Ridership (Pick-ups in FY19)	22,471	20,392	52,078
% of Trips In-Zone	39.9%	89.9%	89.5%
Latent In-Zone Demand (Trips/Weekday)	98	81	156
Recommended Span of Service	7 AM - 4 PM, M - F	7 AM - 4 PM, M - F	6 AM - 6 PM, M - F
Estimated Maximum Annual Cost of MOD Service Recommendations	$833,320	$833,320	$1,499,976

1.1.1 West Warwick Zone

The West Warwick Zone is recommended for an MOD pilot because it includes a major commercial corridor located along Route 2, population centers in West Warwick and Coventry, and a planned multimodal hub at the Community College of Rhode Island (CCRI) – Knight Campus. Currently the primary regional transfer point for fixed route service is at Warwick Mall, which is also a major employer and shopping location. MOD service oriented toward in-zone trips and first-mile/last-mile service to the Warwick Mall (or, when operational, the CCRI hub) is recommended.

1.1.2 Westerly Zone

The Westerly Zone shows evidence that a pilot MOD service could be successful. There is already a successful Flex Service operating in the zone, providing deviated fixed route service, which suggests that riders in Westerly may be primed for using an on-demand service. Westerly also has a high proportion of trips occurring in-zone, suggesting strong in-zone trip demand.

1.1.3 Woonsocket Zone

The Woonsocket Zone has a robust transit market and a diverse population, making it a strong candidate for an MOD pilot. It has the second-highest proportion of people of color and limited-English proficiency residents of all the zones analyzed. RIPTA has plans to increase service between Woonsocket and Providence along the Route 54, which provides an opportunity for first-mile/last-mile service via MOD. The existing Flex Service is also unique as it already provides general public demand response service, providing a quick turnaround option to fold it into a more robust app-enabled on-demand service (MOD).

1.2 Potential Pilot Zones

Two additional zones also showed some potential for an MOD pilot service, though both have potential drawbacks. The Middletown Zone runs the risk of siphoning ridership from fixed route service and the South Kingstown Zone has a large low-density section that may be challenging to serve.

Table 1-2: Key Statistics - Zones for Potential Pilot Service

Potential Zones	Middletown	South Kingstown
Current Ridership (Pick-ups in FY19)	22,254	22,408
% of Trips In-Zone	74.5%	83.9%
Latent In-Zone Demand (Trips/Weekday)	134	92
Recommended Span of Service	7 AM - 4 PM, M - F	7 AM - 5 PM, M - F
Estimated Maximum Annual Cost of MOD Service Recommendations*	$1,166,648	$999,984

1.2.1 Middletown Zone

The Middletown Zone is comprised of the communities of Middletown and Newport. It has a robust fixed route transit market, which indicates some opportunity for introducing a new complementary MOD service. However, given the extensive fixed route service, there is also the potential for an MOD service to pull ridership from fixed route trips. Therefore, MOD service (if piloted) should be monitored closely to understand the impacts to travel patterns, as it may not be a desirable outcome to shift riders from fixed route service to an MOD service.

1.2.2 South Kingstown Zone

The South Kingstown Zone is home to the University of Rhode Island but is otherwise comprised of a low-density suburban/rural area. There may be opportunity to better connect these outlying areas in the zone (which currently have no transit service) with the university or the main population center of Narragansett. However, there is a risk that service targeting these outlying areas would have low ridership and high operating costs due to long travel distances and thin demand.

1.3 Mobility Zones Analyzed but Not Recommended for Pilot Service

Finally, two other zones were analyzed but not recommended for pilot service: East Bay and Smithfield. These two zones share several characteristics. The East Bay and Smithfield Zones are both lower-density suburban communities with a strong orientation toward Providence, as indicated by the low proportion of in-zone trip demand. Furthermore, in-zone trip demand in both instances could be served by slack capacity in the Americans with Disability Act (ADA) paratransit system. Therefore, it is not recommended to pilot new MOD service in these zones.

Table 1-3: Key Statistics - Zones Not Recommended for Pilot Service

Not Recommended Zones	East Bay	Smithfield
Current Ridership (Pick-ups in FY19)	10,294	11,789
% of Trips In-Zone	6.2%	14.5%
Latent In-Zone Demand (Trips/Weekday)	7	5
Recommended Span of Service	N/A	N/A
Estimated Maximum Annual Cost of MOD Service Recommendations*	$0	$0

1.3.1 East Bay Zone

East Bay is comprised of the communities of East Providence, Barrington, and Warren. While East Providence has several fixed routes, Barrington and Warren have low levels of public transportation service. Travel demand is also low relative to the other zones, and the vast majority (95%) of travel demand is for cross-zone service. An MOD pilot service runs a strong risk of low ridership.

1.3.2 Smithfield Zone

The Smithfield Zone is comprised of the Town of Smithfield, a lower-density community to the northwest of Providence. The majority of trip demand (85%) is for cross-zone service, indicating that a pilot service focusing on in-zone MOD would have limited ridership. That, combined with the low-density composition of the service area, suggests that a pilot MOD service would have low ridership and high trip costs, and is therefore not recommended.

Potential technology platforms to pilot MOD service were also identified and analyzed. An overview in the report compares and contrasts various platforms. This review serves as a first step to identify technology platforms that meet the goals of the MOD program. The next step will be to further research these platforms to determine the interoperability with RIPTA's current technology that can be seamlessly integrated to allow for trips to be booked and paid with one-call or one-click by the user.

1.4 Next Steps

This study not only identified three zones recommended for pilot MOD service, but also outlined the metrics that can measure the success of the pilot as well as the technologies available to aid with implementation. Recommended next steps include the following:

1. **Procure Technology** – It is recommended to issue a Request for Information (RFI) for an MOD smart phone application. In keeping with the service design findings, there are opportunities for using slack time in the demand response system to perform on-demand trips within the proposed zones. However, this would require a smart phone application that customers could use to request rides. An RFI would allow RIPTA to identify the opportunities and capabilities such an application would have and would set the stage for issuing a Request for Proposals (RFP) to procure a technology vendor.
2. **Coordinate with Local Stakeholders** – RIPTA should coordinate with local stakeholders in the recommended potential pilot zones. Stakeholders could include local elected officials, human service organization staff and clients, or major employers. This coordination could take the form of phone calls, meetings, or online surveys. This will help to confirm the proposed service design and assist with raising awareness about the MOD service once it is launched.
3. **Confirm Internal Logistics** – RIPTA should develop its own internal logistics for operating the proposed MOD service. This should include establishing the budget for the new service, assigning drivers and vehicles, integrating IT elements, discussions with the marketing team, and confirming other internal resources necessary for the successful piloting of the service.

RIPTA's interest in MOD is a timely exploration of new technology to expand the mobility of the state's residents, particularly in underserved regions or times of day. This study lays the foundation for implementing pilot service and evaluating the service's success and could lead to permanent implementation of a new mode of public transportation service in the Ocean State.

2 Introduction

In Transit Forward RI 2040, the Rhode Island Public Transportation Authority (RIPTA) statewide Transit Master Plan, Mobility on Demand (MOD) was identified as a potential mobility solution for the state. MOD is the ability to leverage technologies, including real-time data, trip planning, and mobility wallet, to better apprise users of mode choices and improve their transportation experience. RIPTA was particularly interested in exploring microtransit, a general public on-demand service that serves a designated area and typically is summoned via a smartphone app, one of the potential MOD solutions, as a possibility to augment the existing fixed route transit service network and address equity concerns associated with identified "transit deserts" across the state.

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Once the candidate Mobility Zones from the "Universal Screening" process were identified, the AECOM-developed Sustainable Systems Integration Model (SSIM) analysis tool was used to quantify the performance potential of each candidate Mobility Zone in order to narrow the list based on the proposed criteria and metrics. Each candidate Mobility Zone received a final score to represent its implementation potential for on-demand transit service.

Once the Mobility Zones were finalized, the AECOM team coordinated with RIPTA to define operational elements and service structures for the proposed Mobility Zones. Below is a detailed overview of the technical analysis undertaken in order to develop the proposed Mobility Zones and service structures.

3 Mobility Zone Assessment

This section provides an overview of the Mobility Zone identification process, including data inputs and the analytical approach to selecting and refining the zones most suited for a MOD pilot project.

3.1 Zone Identification Process

The zone identification process consisted of three steps as shown in Figure 3-1. In the first step, a Transit Propensity Analysis was conducted in lieu of a travel demand forecast. This initial analysis took demographic and socioeconomic metrics into consideration and assigned individual transit propensity factors to these metrics as shown in Table 3-1. The transit propensity score was calculated for all census tracts in the state and consisted of an origin score and destination score. The destination score was primarily employment-related information while the origin score took other factors such as population density, minority density, and density of seniors into consideration.

The second step was to overlay the existing fixed route transit service network, Flex Service boundaries, fixed route service coverage, and trip generators throughout the states. Based on pre-existing transit resources and the Transit Propensity Analysis, multiple areas were identified as potential Mobility Zones. The Mobility Zones were refined based on Traffic Analysis Zone (TAZ) boundaries, major roadways, and natural dividers such as rivers and creeks.

Figure 3-1: Mobility Zone Selection Diagram

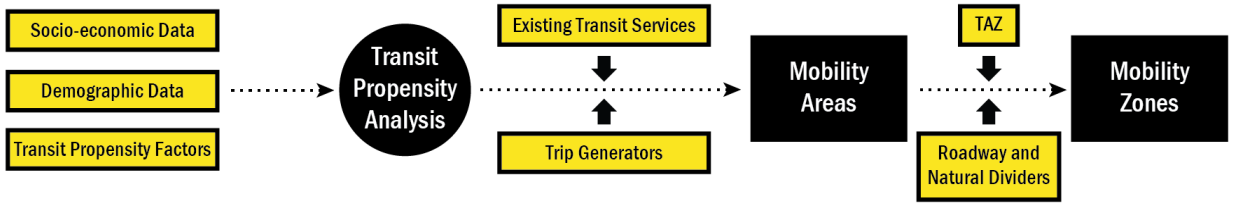
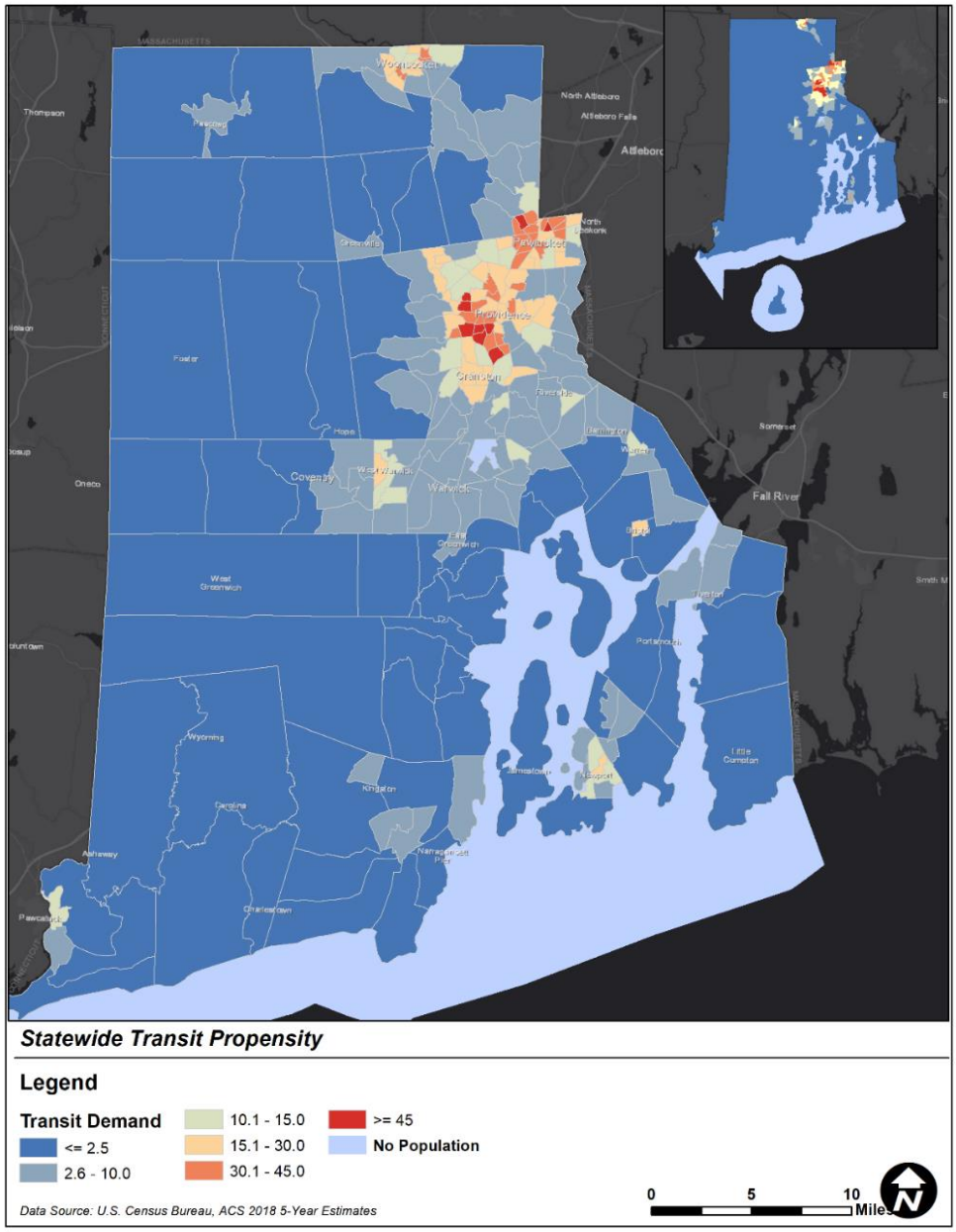


Table 3-1: Transit Propensity Metrics and Factors

Demographic Metric	Transit Propensity Factor
Black or African American (Non-Hispanic)	2
Asian (Non-Hispanic)	1.24
Hispanic	1.75
White (Non-Hispanic)	0.63
Other Race (Non-Hispanic)	2.01
Zero-Vehicle Households	6.18
One-Vehicle Households	1.27
Households with Two or More Vehicles	0.55
Households with Income <$25,000	1.42
Households with Income between $25,000 and $35,000	0.97
Households with Income >$35,000	0.69
Native-Born Citizen	0.87
Foreign-Born Citizen	1.49

Figure 3-2 presents the Transit Propensity Score at census-tract-level across the state. While most of the existing transit demand is in the Providence area, some other hot spots include the Woonsocket, West Warwick, Middletown/Newport, Bristol, and Westerly. Census tracts with a score of more than 15 have moderate or higher transit propensity/demand.

Figure 3-2: Statewide Transit Propensity Score Analysis by Census Tract



The trip generators, shown in Figure 3-3, are documented in the Transit Master Plan. They were classified into the following nine categories:

- Town Halls
- Schools

- Libraries
- Grocery Stores
- Employment Institutions
- Recreation Centers
- Nursing Homes & Assisted Living Facilities
- Rail and Ferry Stops
- Airports

Figure 3-3: State-wide Transit Trip Generators

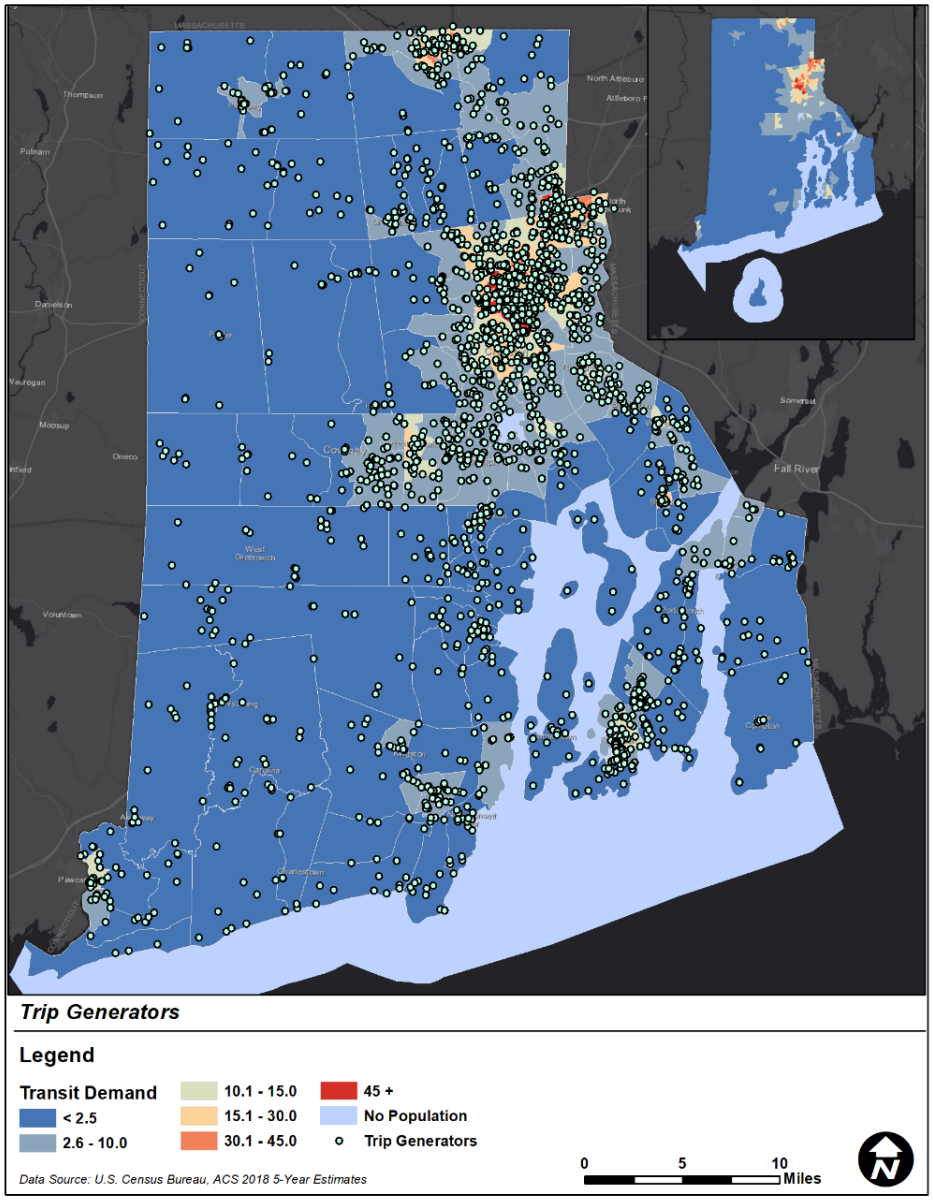
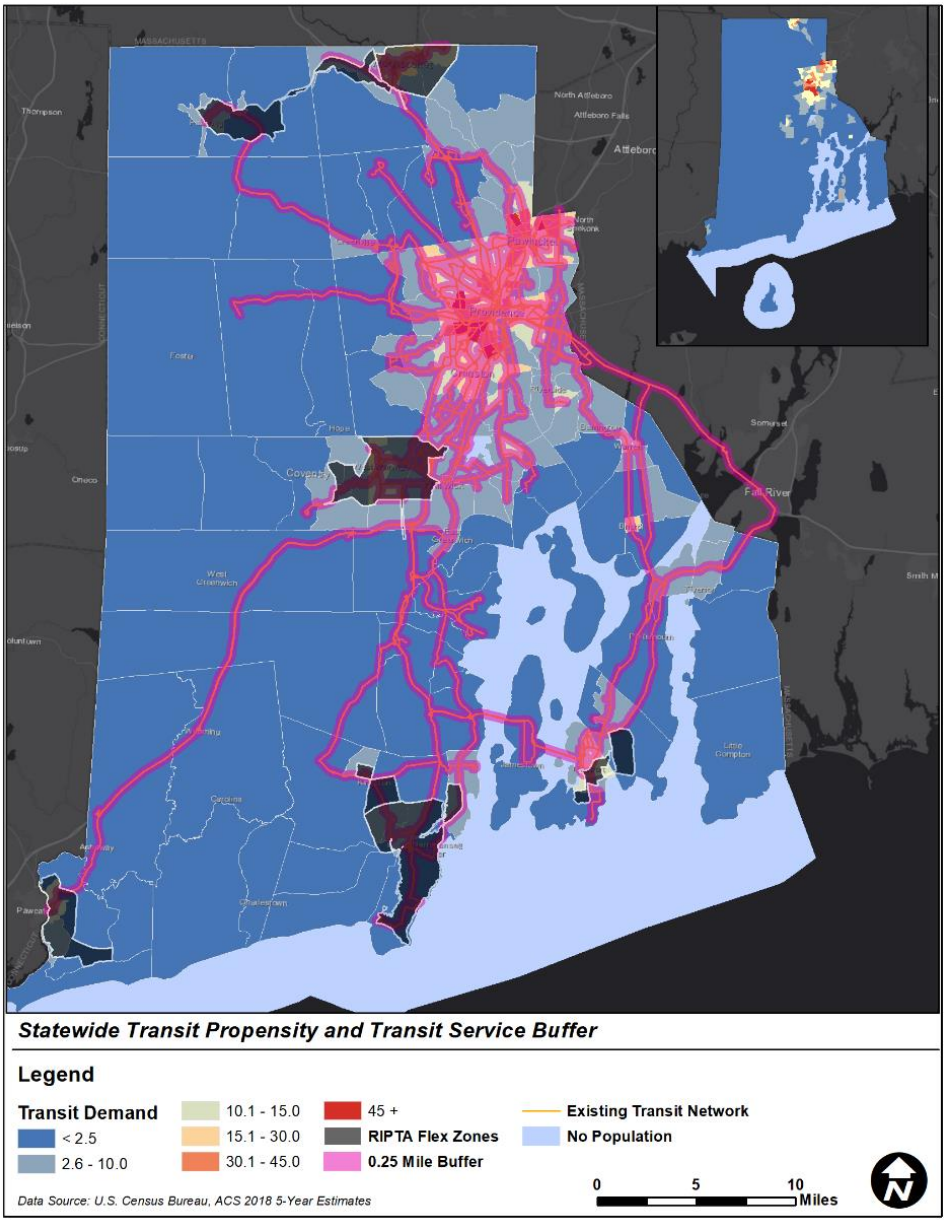


Figure 3-4 presents RIPTA's existing transit services, including fixed route transit lines and Flex Zones. In addition to these two services, RIPTA offers ADA paratransit service within ¾ of a mile of its fixed route service for those unable to use the fixed route service.

Figure 3-4: RIPTA Existing Transit Services



Factors that indicated a certain area was a good candidate to be a Mobility Zone included:

- Would serve a variety of use cases
- Has a high or medium transit propensity
- Has a reasonable number of transit generators
- Would serve local trips and connections to routes
- Currently has Flex Zones
- Has employment growth areas
- Could expand the span of service

Based on these factors, the project team developed the preliminary zones described below.

3.2 Preliminary Zones

This section presents the selected preliminary Mobility Zone candidates. Figure 3-5 shows the boundaries and geographic distribution of the potential Mobility Zones overlaid on top of existing transit resources. Table 3-2 summarizes some of the basic information of each zone such as the size, population, employment, transit demand/propensity, existing transit coverage, trip generators, and unique service considerations. Zone-level discussions are detailed below. Besides the zones that were analyzed for the preliminary zones, an additional zone was added for service design later in the study, East Bay.

Figure 3-5: RIPTA Existing Transit Services and Potential Zones

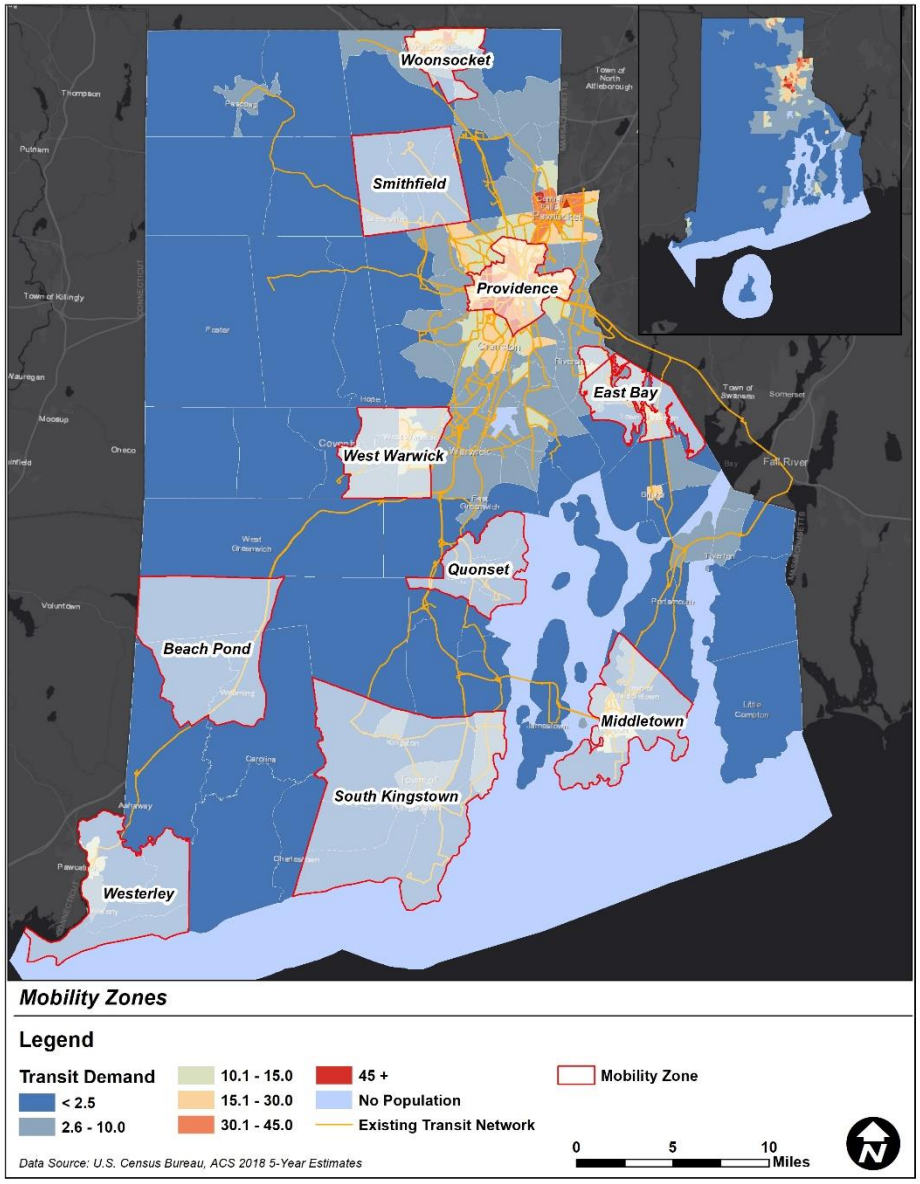


Table 3-2: Preliminary Mobility Zone Profiles Summary

Zone Name	Acreage	Population	Employment	Transit Demand	Transit Coverage	Trip Generators	Choice Consideration
Providence	9,820	156,590	126,949	28.3	95.7%	301	Demand-Response, Future Demand
Woonsocket	6,480	63,258	51,551	13.2	35.9%	65	Flex Zone, Demand-Response, Future Demand
West Warwick	13,691	52,481	44,096	6.1	32.9%	78	Flex Zone, Demand-Response, Future Demand
Middletown	17,383	39,937	34,384	3.8	27.1%	142	Flex Zone, Demand-Response, Future Demand
Smithfield	17,660	21,483	18,770	1.8	22.7%	55	Inducing Transit Demand, Strengthening Existing Transit Routes
Westerly	21,954	22,428	19,078	1.6	4.4%	48	Flex Zone, Airport Connection, Inducing Transit Demand, Strengthening Existing Transit Routes
Quonset	11,417	11,312	9,316	1.5	32.5%	31	Airport Connection, Inducing Transit Demand, Strengthening Existing Transit Routes
South Kingstown	52,775	45,970	40,725	1.2	19.8%	130	Flex Zone, Inducing Transit Demand, Strengthening Existing Transit Routes
Beach Pond	29,153	6,887	5,794	0.4	9.1%	38	Inducing Transit Demand, Strengthening Existing Transit Routes

3.2.1 Providence

Providence stands out as the zone with the highest number of jobs and residents of the candidate Mobility Zones (Figure 3-6). It is almost fully covered by the existing fixed route transit network. The Providence Zone is served by 45 bus routes with service being offered on some routes as early as 4:41 AM and as late as 2:19 AM on weekdays (Table 3-3). The bus routes in this zone are amongst the busiest and most frequent services in the RIPTA system. This zone was selected to augment existing transit service, and the mobility service in this zone should primarily feed the existing transit options and serve as a span enhancement.

Figure 3-6: Providence Zone Profile

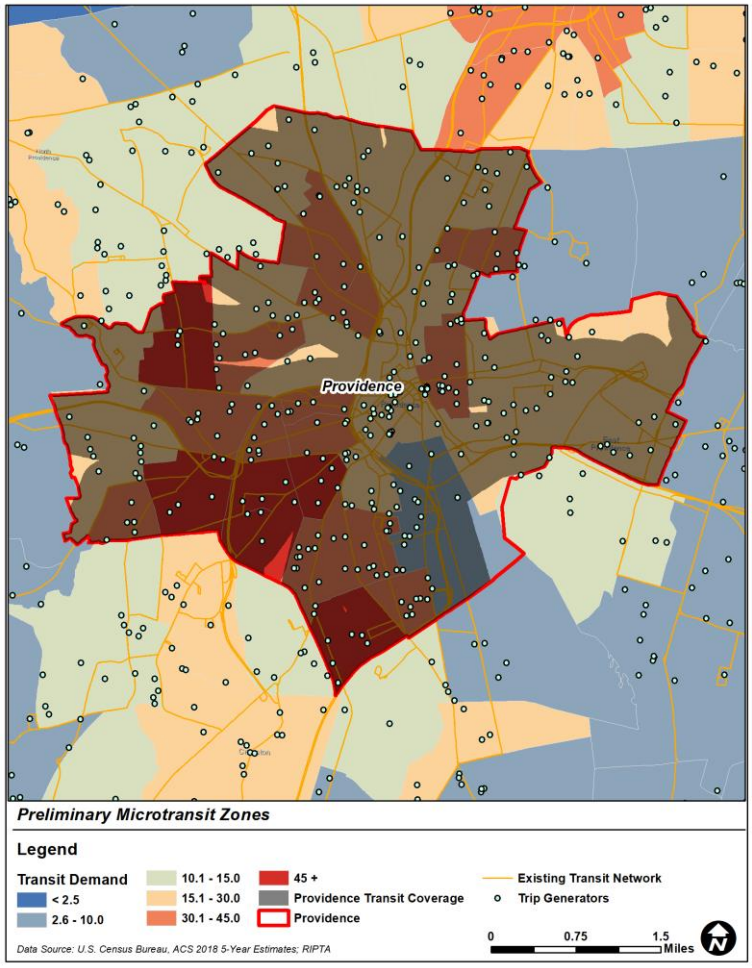
Zone Name: Providence	Profile Statistics	
	**Acreage**	9,819.5
	Population	156,590
	Employment	126,949
	Transit Demand	28.3
	Transit Coverage	95.7%
	Trip Generators	301

Table 3-3: Providence Existing Services

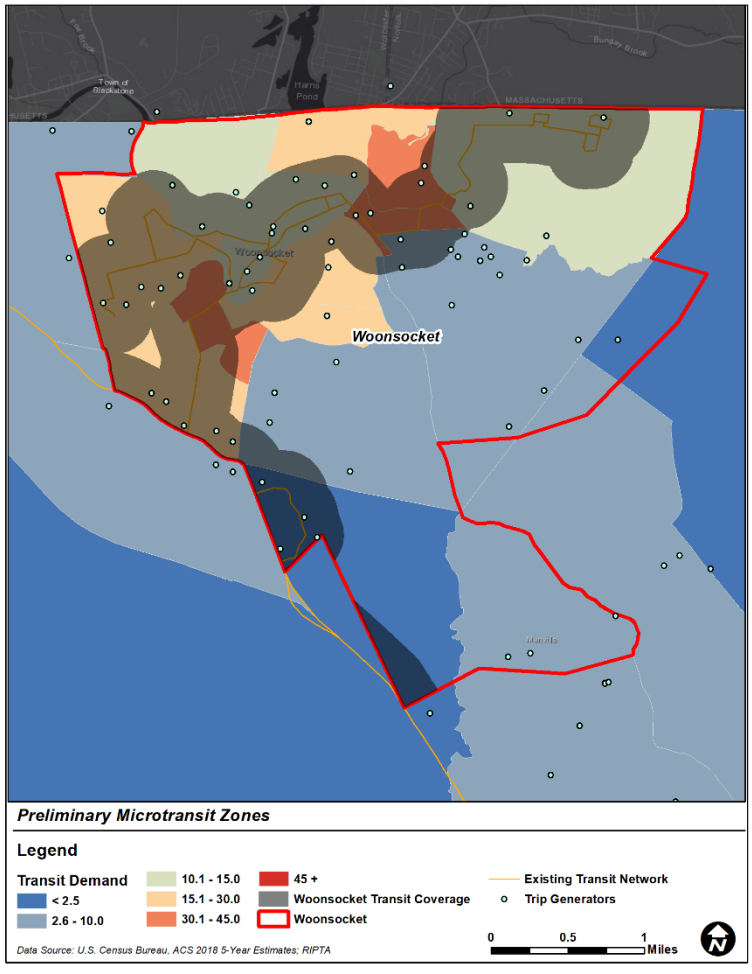
Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
R-Line	4:55 AM	1:08 AM	10	10	5:12 AM	1:07 AM	15	6:30 AM	12:17 AM	15
1	5:47 AM	12:02 AM	20	20	6:41 AM	10:30 PM	42	6:46 AM	9:15 PM	40
3	5:03 AM	10:03 PM	40	40	6:16 AM	9:07 PM	70	7:18 AM	8:12 PM	100
4	5:19 AM	10:45 PM	40	40	6:50 AM	8:31 PM	70	6:25 AM	7:26 PM	100
6	6:16 AM	9:41 PM	60	30	8:25 AM	5:42 PM	60	9:25 AM	4:21 PM	60
8x	6:00 AM	6:26 PM	30							
9x	6:46 AM	6:32 PM	30							
10x	7:10 AM	5:44 PM	1 trip							
12x	6:44 AM	6:20 PM	30							
14	4:50 AM	8:28 PM	14	57	8:22 AM	8:01 PM	94			
17	5:57 AM	10:42 PM	5	30	6:09 AM	10:43 PM	50	7:47 AM	7:57 PM	50
18	6:16 AM	8:07 PM	30	60	7:05 AM	7:42 PM	60			
19	5:42 AM	11:41 PM	15	30	6:43 AM	11:44 PM	50	7:24 AM	8:17 PM	50
20	4:41 AM	10:16 PM	15	15	5:57 AM	10:58 PM	30	5:30 AM	9:42 PM	45
21	5:10 AM	10:59 PM	30	30	6:01 AM	11:30 PM	30	7:00 AM	9:54 PM	50
22	5:49 AM	10:39 PM	30	30	6:05 AM	8:05 PM	45	6:05 AM	6:46 PM	45
24L	5:53 AM	8:05 PM	60							
27	5:32 AM	11:56 PM	12	20	5:53 AM	11:59 PM	38	7:25 AM	9:30 PM	50
28	5:47 AM	10:22 PM	20	20	6:20 AM	10:09 PM	38	7:54 AM	7:58 PM	50
30	5:06 AM	9:39 PM	40	40	6:27 AM	7:31 PM	40	7:30 AM	9:18 PM	40
31	5:40 AM	11:38 PM	15	15	5:57 AM	10:42 PM	18	6:44 AM	8:58 PM	20
32	5:50 AM	7:35 PM	60	60						
33	5:10 AM	11:18 PM	30	30	6:22 AM	11:01 PM	40	6:50 AM	8:33 PM	60
34	5:09 AM	10:15 PM	40	40	6:42 AM	10:20 PM	40	7:16 AM	8:07 PM	60
35	5:08 AM	6:40 PM	55	45	7:00 AM	7:32 PM	90	7:28 AM	7:00 PM	90
40	6:45 AM	8:00 PM	60	60						
49	8:45 AM	4:13 PM	46							
50	5:32 AM	1:44 AM	15	20	6:50 AM	11:35 PM	30	7:02 AM	9:06 PM	45
51	5:21 AM	10:50 PM	20	30	6:16 AM	10:43 PM	30	6:51 AM	10:17 PM	60
54	5:19 AM	1:10 AM	30	30	6:38 AM	12:26 AM	50	6:25 AM	11:45 PM	60
55	5:15 AM	1:26 AM	30	30	6:34 AM	11:14 PM	30	7:54 AM	7:44 PM	45
56	5:34 AM	11:29 PM	12	15	6:00 AM	10:47 PM	18	6:57 AM	8:38 PM	20
57	5:36 AM	10:54 PM	15	30	6:35 AM	9:54 PM	30	8:25 AM	7:55 PM	30
58	5:43 AM	8:30 PM	60	60	6:30 AM	8:13 PM	60			
59x	6:30 AM	5:55 PM	30							
60	4:46 AM	2:19 AM	15	30	5:45 AM	1:37 AM	30	6:30 AM	11:59 PM	45
61x	6:19 AM	6:16 PM	30							
62	5:56 AM	7:39 PM	60	60						
65	6:30 AM	6:23 PM	15							
66	5:33 AM	12:53 AM	60	60	7:07 AM	11:56 PM	60	8:13 AM	11:50 PM	60
72	5:08 AM	11:55 PM	20	20	6:17 AM	10:41 PM	30	6:53 AM	8:45 PM	30
78	5:41 AM	11:03 PM	45	45	6:35 AM	10:45 PM	45	7:00 AM	8:12 PM	90
92	5:42 AM	10:52 PM	20	20	6:23 AM	11:05 PM	30	8:52 AM	7:02 PM	30
95x	5:37 AM	6:22 PM	30							
QX	4:45 AM	4:56 PM	34							

3.2.2 Woonsocket

The existing transit network covers 36% of Woonsocket and has high transit demand (Figure 3-7). The Woonsocket zone is served by four RIPTA bus routes: two local routes, one express route, and one Flex Service. Service on the two local routes is every 30 to 40 minutes all day between 5:19 AM and 1:10 AM on weekdays, with more limited weekend service. MOD options in this zone should be primarily feeder service, with some in-zone service to serve the trip generators on the border of the mobility zone. The mobility service in this zone will be an augmentation and restructuring of the existing Flex Zone service.

Figure 3-7: Woonsocket Zone Profile

Zone Name: Woonsocket



Profile Statistics

Acreage	6,479.8
Population	63,258
Employment	51,551
Transit Demand	13.2
Transit Coverage	35.9%
Trip Generators	65

Table 3-4: Woonsocket Existing Services

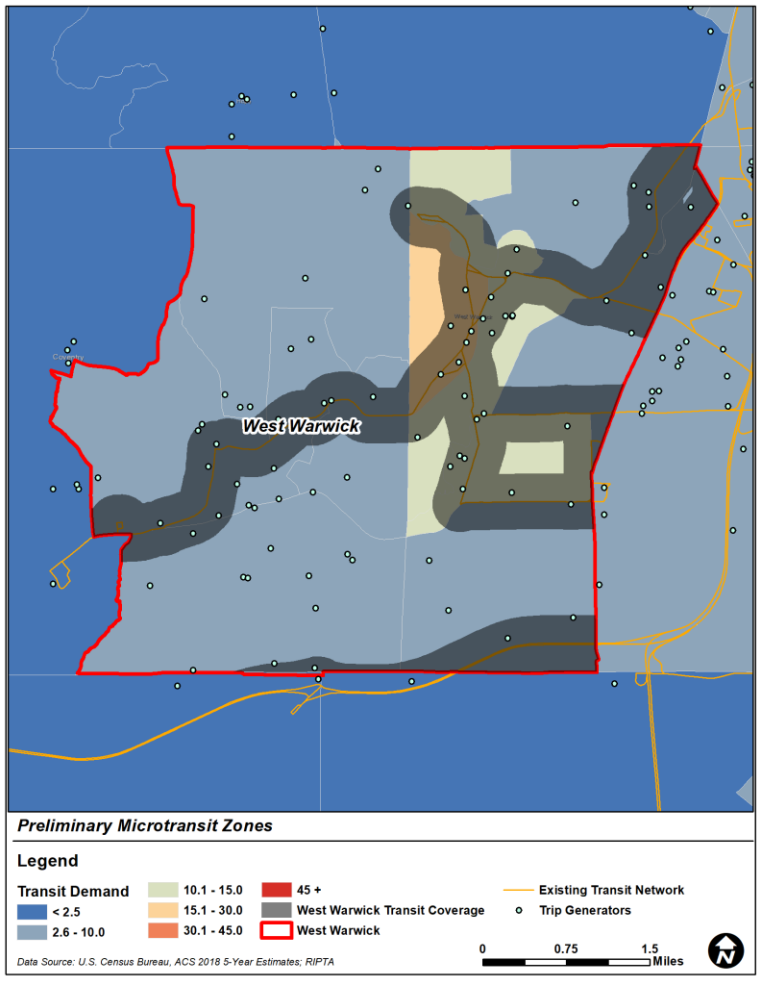
Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
54	5:19 AM	1:10 AM	30	30	6:38 AM	12:26 AM	50	6:25 AM	11:45 PM	60
59x	6:30 AM	5:55 PM	30							
87	5:40 AM	9:30 PM	40	30	6:40 AM	9:58 PM	75	6:40 AM	9:54 PM	75
281	6:00 AM	6:30 PM			6:38 AM	12:26 AM	50			

3.2.3 West Warwick

Approximately 33% of West Warwick is covered by the existing transit network and has moderate transit demand. The West Warwick zone is served by four RIPTA bus routes: two local routes, one express route, and one Flex Service. Service on the two local routes is every 50 to 100 minutes all day between 5:00 AM and 8:00 PM on weekdays. Service operates on a more limited basis on the weekend. Trip generators are small in volume and spread throughout the zone (Table 3-5). The service in this zone should be a mix of feeder service and door-to-door service (Figure 3-8). The mobility service in this zone will be based on the existing Flex Zone service.

Figure 3-8: West Warwick Zone Profile

Zone Name: West Warwick



Profile Statistics	
Acreage	13,690.6
Population	52,481
Employment	44,096
Transit Demand	6.1
Transit Coverage	32.9%
Trip Generators	78

Table 3-5: West Warwick Existing Services

Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
12x	6:44 AM	8:28 AM	30							
13	5:00 AM	7:52 PM	50	50	5:40 AM	9:14 PM	100	7:20 AM	7:35 PM	100
29	5:40 AM	6:50 PM	100	90			90			
242	6:15 AM	6:30 PM								

3.2.4 Middletown

The existing transit network covers 27% of the zone and serves moderate transit demand. Middletown is served by seven RIPTA transit services, one of them being a Flex Service. Service in this zone has a long span, with one route, Route 60, starting as early as 4:46 AM and ending at 2:19 AM on weekdays, with more limited service levels on weekends (Table 3-6). Middletown has a large number of trip generators, most of which are along the existing transit lines (Figure 3-9). The service in this zone should be a mix of feeder service and in-zone service. The MOD in this zone will be based on the existing Flex Zone service.

Figure 3-9: Middletown Zone Profile

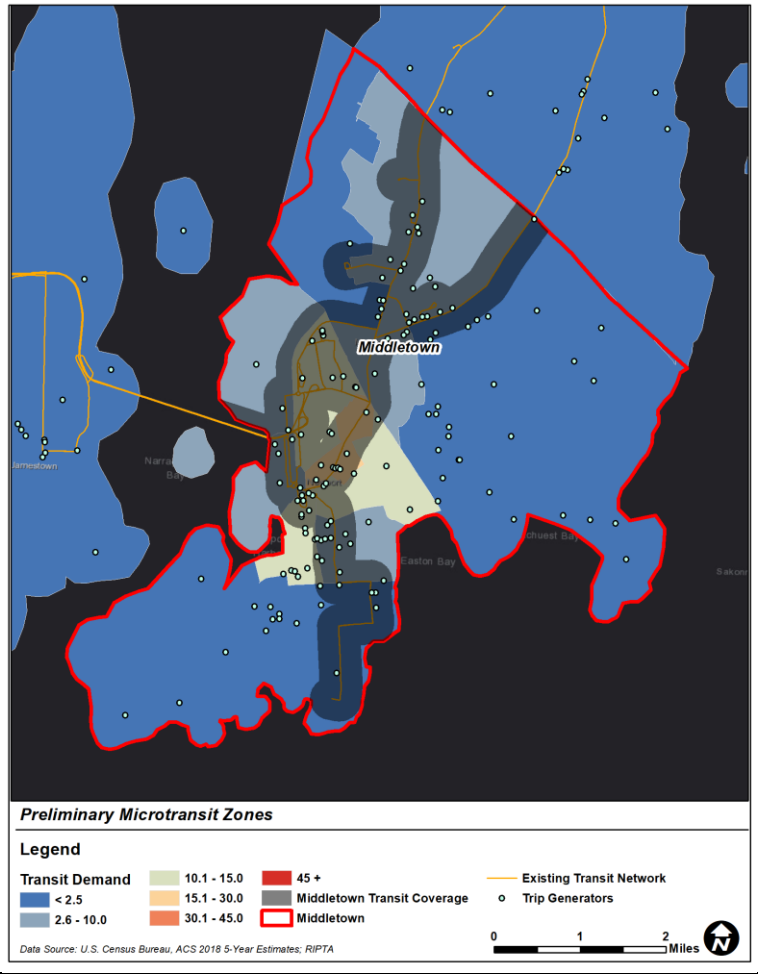
Zone Name: Middletown	Profile Statistics	
	**Acreage**	17,383.4
	Population	39,937
	Employment	34,384
	Transit Demand	3.8
	Transit Coverage	27.1%
	Trip Generators	142

Table 3-6: Middletown Existing Services

Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
14	4:50 AM	8:28 PM	14	57	8:22 AM	8:01 PM	94			
24L	5:53 AM	8:05 PM	60							
60	4:46 AM	2:19 AM	15	30	5:45 AM	1:37 AM	30	6:30 AM	11:59 PM	45
63	6:55 AM	9:05 PM	30	30	7:45 AM	8:21 PM	49	10:15 AM	6:43 PM	85
64	6:20 AM	6:23 PM	70	80	9:55 AM	6:26 PM	135			
67	7:30 AM	8:15 PM	30	30	8:30 AM	7:20 PM	30	9:30 AM	8:15 PM	30
231	6:45 AM	5:12 PM			8:45 AM	4:45 PM				

3.2.5 Smithfield

The existing transit service covers approximately 23% of the Smithfield Zone and the transit demand of this zone is limited. Fixed route service is comprised of two local routes and an express route serving the zone. Local service operates between 5:32 AM and 1:44 AM on weekdays with more limited service available on weekends (Table 3-7). Trip generators are small in volume and spread throughout the zone (Figure 3-10). The MOD in this zone should be primarily in-zone service to trip generators and should have a goal of generating new transit demand.

Figure 3-10: Smithfield Zone Profile

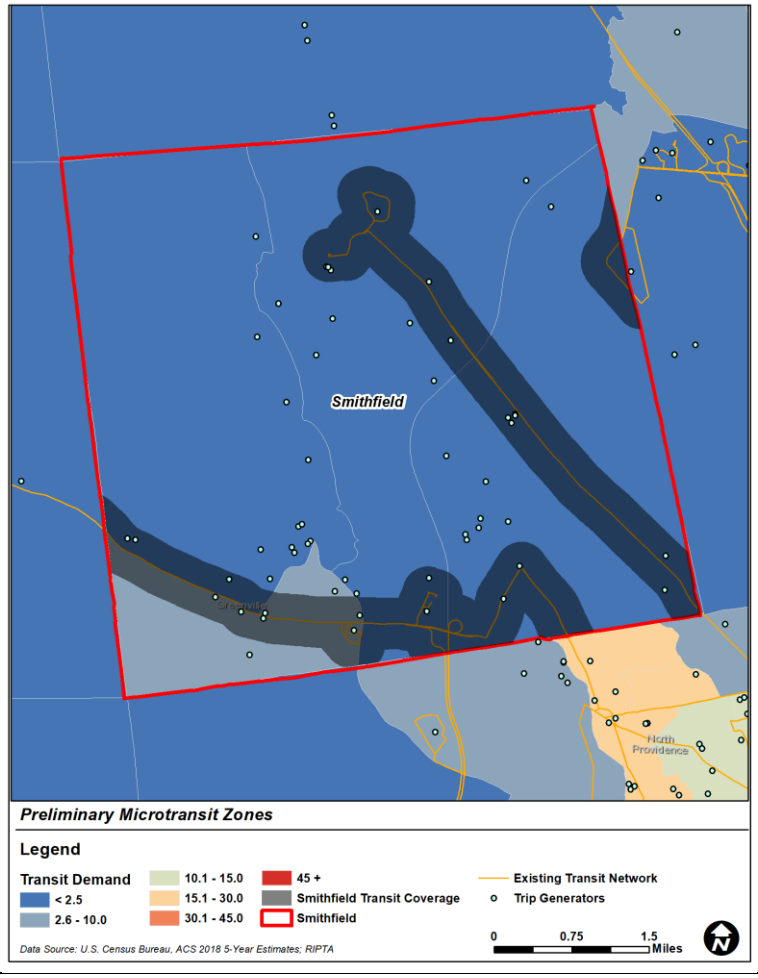
Zone Name: Smithfield	Profile Statistics	
	**Acreage**	17,660.3
	Population	21,483
	Employment	18,770
	Transit Demand	1.8
	Transit Coverage	22.7%
	Trip Generators	55

Table 3-7: Smithfield Existing Services

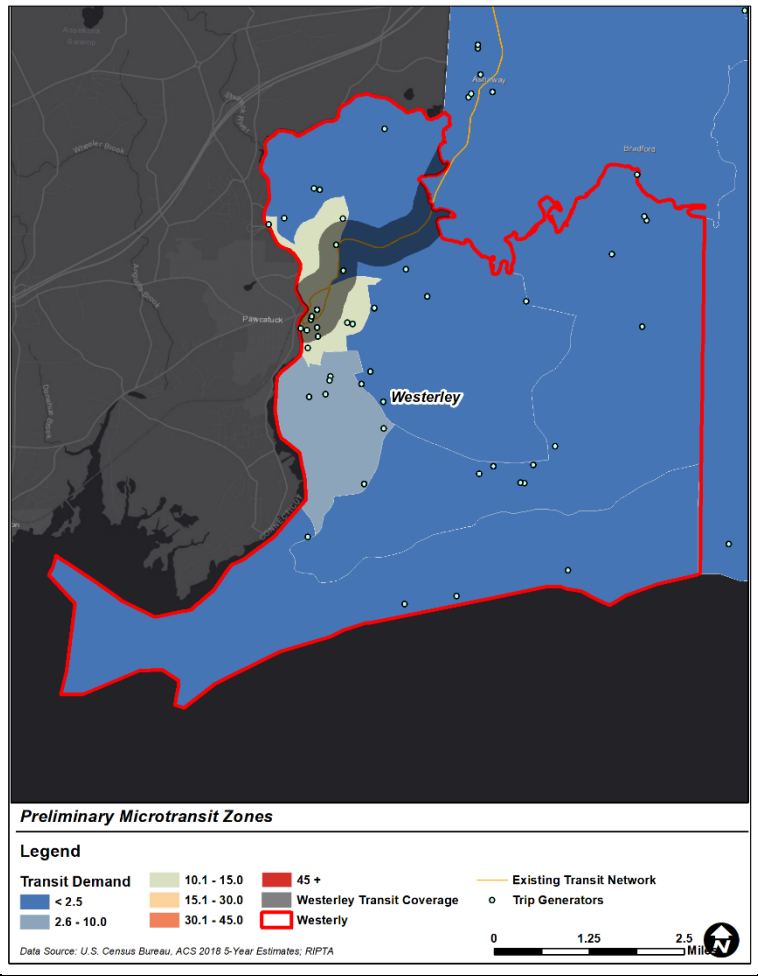
Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
9x	6:46 AM	6:32 PM	30							
50	5:32 AM	1:44 AM	15	20	6:50 AM	11:35 PM	30	7:02 AM	9:06 PM	45
58	5:43 AM	8:30 PM	60	60	6:30 AM	8:13 PM	60			

3.2.6 Westerly

Westerly has little existing transit network coverage, and that which does exist focuses on the downtown area. RIPTA transit service is limited to one express route, one rural fixed route that operates only on Thursdays, and one Flex Service. Transit service in this zone is only available on weekdays (Table 3-8). There are relatively few trip generators, with most of them along existing transit lines (Figure 3-11). The service in this zone should be primarily in-zone service with a goal of generating new transit demand, as well as feeder services to the Westerly Airport and the downtown Westerly transit network. The MOD service in this zone will be based on the existing Flex Zone service.

Figure 3-11: Westerly Zone Profile

Zone Name: Westerly



Profile Statistics

Acreage	21,953.7
Population	22,428
Employment	19,078
Transit Demand	1.6
Transit Coverage	4.4%
Trip Generators	48

Table 3-8: Westerly Existing Services

Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
95x	5:37 AM	6:22 PM	30							
204	6:00 AM	6:30 PM								
301	9:00 AM	1:47 PM								

3.2.7 Quonset

The existing transit network covers 32.5% of Quonset and demand is limited. The small number of trip generators are sprinkled throughout the zone (Figure 3-12). RIPTA provides service on five routes within this zone operating between 4:45 AM and 12:53 AM on weekdays. Only two routes operate on Saturdays and one route operates on Sundays (Table 3-9). The service in this zone should be primarily in-zone service with a goal of generating new transit demand, as well as feeder services to the Quonset Airport.

Figure 3-12: Quonset Zone Profile

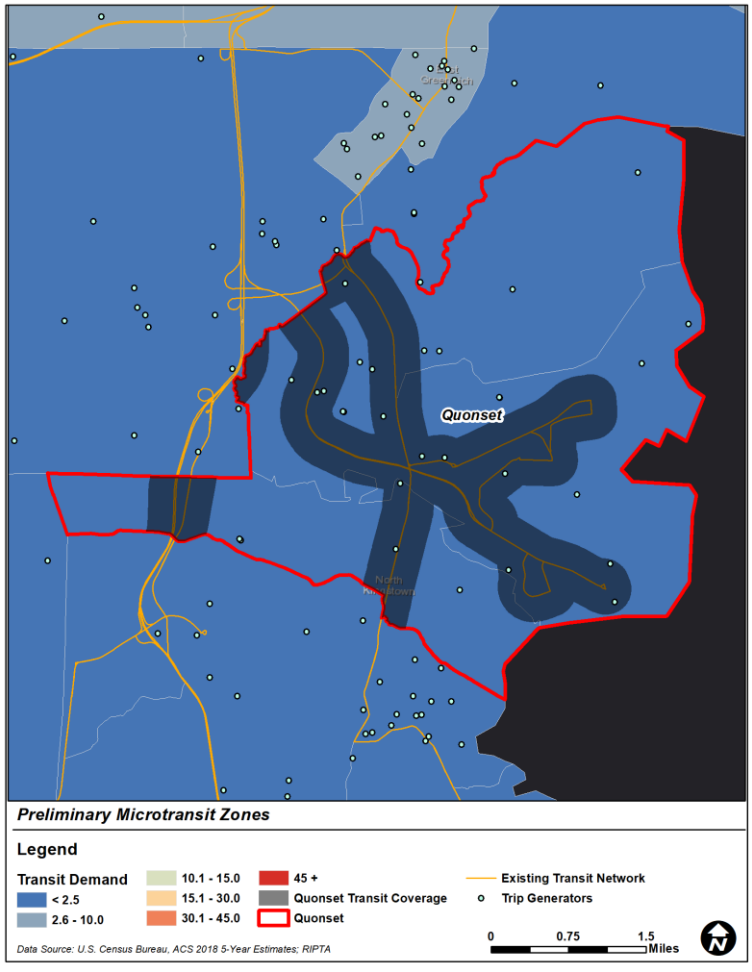
Zone Name: Quonset	Profile Statistics	
	**Acreage**	11,416.5
	Population	11,312
	Employment	9,316
	Transit Demand	1.5
	Transit Coverage	32.5%
	Trip Generators	31

Table 3-9: Quonset Existing Services

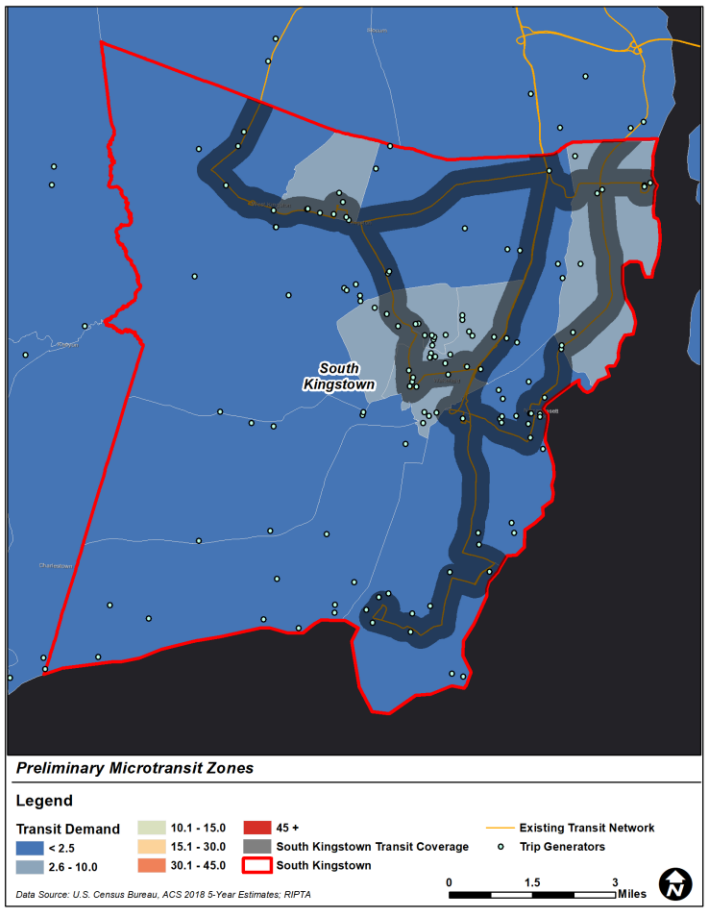
Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
14	4:50 AM	8:28 PM	14	57	8:22 AM	8:01 PM	94			
62	5:56 AM	7:39 PM	60	60						
65	6:30 AM	6:23 PM	15							
66	5:33 AM	12:53 AM	60	60	7:07 AM	11:56 PM	60	8:13 AM	11:50 PM	60
QX	4:45 AM	4:56 PM	34							

3.2.8 South Kingstown

South Kingstown is the largest zone by area among all candidate Mobility Zones. The existing transit network covers 20% of the zone and transit demand is limited. RIPTA operates four fixed routes and two Flex Services in this zone. Service operates between 6:30 AM and 12:53 AM on weekdays with more limited service levels on weekends (Table 3-10). The zone has a large volume of trip generators, most of which are along the existing transit lines (Figure 3-13). The service in this zone should be primarily feeder services to existing transit stops and some in-zone service to trip generators outside of the existing transit coverage area, with a goal of generating new transit demand. The mobility service in this zone will be based on the existing Flex Zone services.

Figure 3-13: South Kingstown Zone Profile

Zone Name: South Kingstown



Profile Statistics	
Acreage	52,774.5
Population	45,970
Employment	40,725
Transit Demand	1.2
Transit Coverage	19.8%
Trip Generators	130

Table 3-10: South Kingstown Existing Services

Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
62	5:56 AM	7:39 PM	60	60						
64	6:20 AM	6:23 PM	70	80	9:55 AM	6:26 PM	135			
65	6:30 AM	6:23 PM	15							
66	5:33 AM	12:53 AM	60	60	7:07 AM	11:56 PM	60	8:13 AM	11:50 PM	60
203	5:45 AM	6:30 PM								
210	8:00 AM	5:00 PM			10:00 AM	5:00 PM		10:00 AM	5:00 PM	

3.2.9 Beach Pond

Beach Pond has only 9% of the zone covered by the existing transit network with very little transit demand. Beach Pond is served by an express bus operating during weekdays and a rural route that operates only on Thursdays (Table 3-11). Trip generators are small in number and located either near the Village of Wyoming or in the northern half of the zone dominated by recreational and agricultural areas (Figure 3-14). MOD in this zone should be primarily in-zone service aimed at generating new transit demand and feeder service to the existing Westerly Express.

Figure 3-14: Beach Pond Zone Profile

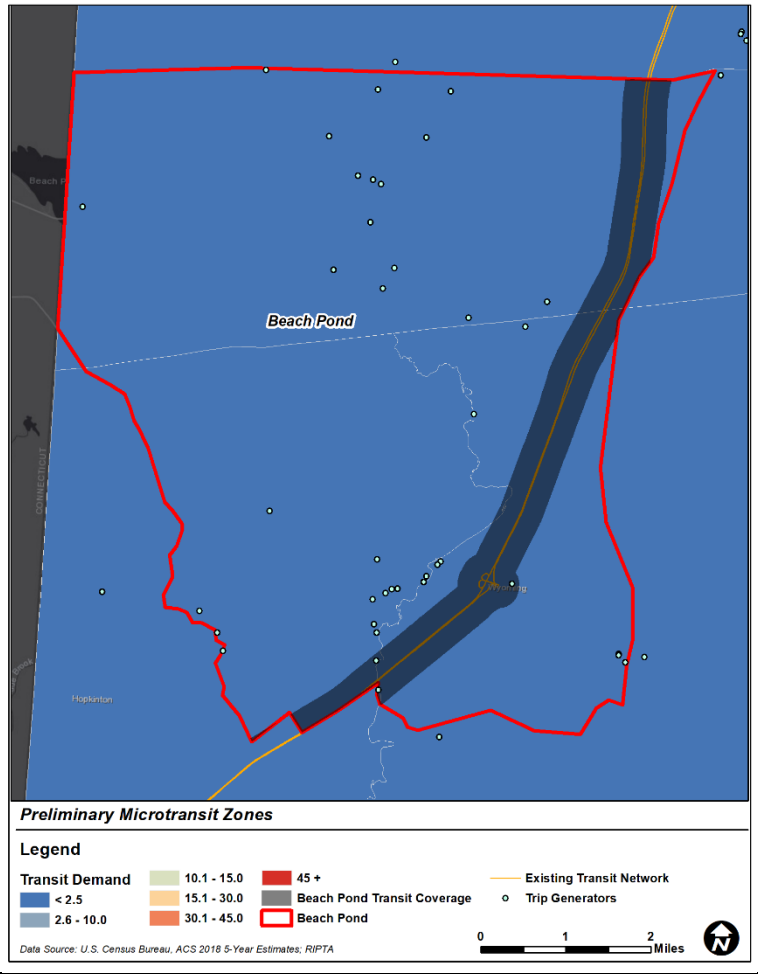
Zone Name: Beach Pond	**Profile Statistics**	
	**Acreage**	29,152.6
	Population	6,887
	Employment	5794
	Transit Demand	0.4
	Transit Coverage	9.1%
	Trip Generators	38

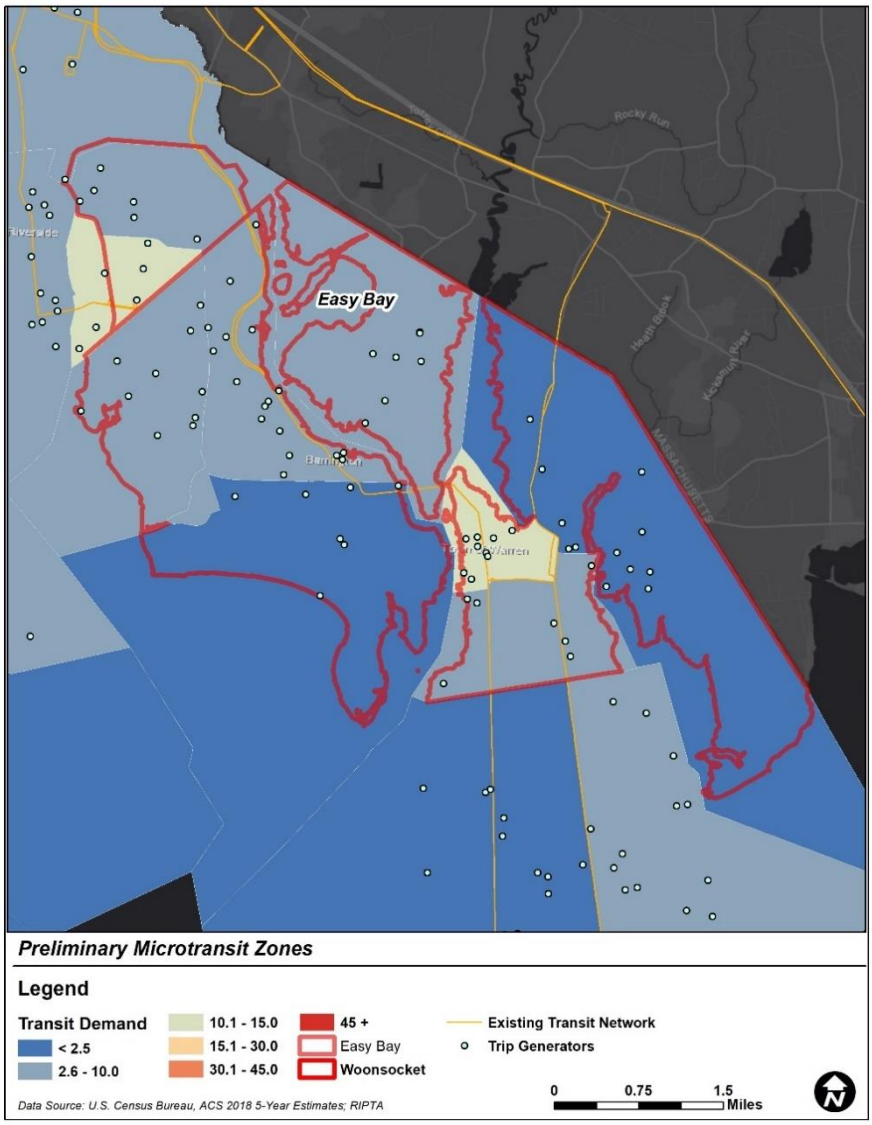
Table 3-11: Beach Pond Existing Services

Route	Weekday				Saturday			Sunday		
	Start Time	End Time	Peak Headway	Off Peak Headway	Start Time	End Time	Headway	Start Time	End Time	Headway
95x	5:37 AM	6:22 PM	30							
301	9:00 AM	1:47 PM								

3.2.10 East Bay

The East Bay zone was added later in the study and was not a part of the analysis. While not included as part of the statewide analysis, this zone was included in the service design. The borders of this zone are included on Figure 3-15 below.

Figure 3-15: East Bay Zone Map



3.3 SSIM Analysis

Once the candidate Mobility Zones were identified, they were scored to determine the likely performance of the Zones should a MOD service be piloted. The SSIM analysis consisted of two major steps. The first step was to score the zones based on a series of predictive metrics, such as existing transit service density. Then a weighting was applied to each metric to calculate a weighted final score that ranged between 0 and 10 for each mobility zone candidate. This process is described in more detail below.

3.3.1 SSIM Analysis Data Points

Table 3-12 presents the metrics and weightings being used in this SSIM analysis. All metrics are classified into four major categories: “Existing Service”, “Equity”, “Community”, and “Demand”.

- **Transit Service Density** calculates the transit stop density per mobility zone.
- **Weekday and Weekend Span Average** are calculated by averaging all transit routes’ service spans on weekdays and weekends respectively.
- **Weekday and Weekend Headway Average** are calculated by averaging all transit routes’ headways on weekdays and weekends respectively.
- **Area Coverage** measures the proportion of the total Mobility Zone area within 0.25 miles of existing transit service.
- The metrics under **Equity** and **Community** calculate the percentages of specific demographic metrics (e.g. Limited-English Speaking Households) as well as trip generator, job, and housing density in each mobility zone.
- **Percent Flex In-Zone Trips** calculates the percentage of the trips traveling within the current Flex Zone boundaries and gauges the demand for short trips within the mobility zone.
- **Population and Percentages (within Zone) <0.25 Mile** and **Jobs and Percentages (within Zone) <0.25 Mile** measure the percentage of population and jobs, respectively, in the zone located within 0.25 of a transit route. The higher percentages, less demand for microtransit as a first/last mile option to access the existing fixed route transit lines.
- **Annual Boarding** numbers are normalized by a combining factor of population and employment to estimate how likely the population within each zone will use transit compared to other modes.

Table 3-12: SSIM Metric Selection and Weighting Distribution

Existing Service	**30%**	0.05	Transit Service Density
		0.05	Weekday Span Average
		0.05	Weekend Span Average
		0.05	Weekday Headway Average
		0.05	Weekend Headway Average
		0.05	Area Coverage
Equity	**30%**	0.05	% Limited English-Speaking Households
		0.05	% Unemployed Population
		0.05	% Low-Income Households
		0.05	% Non-White
		0.06	% Zero Vehicle Households
		0.04	% People with Disabilities
Community	**15%**	0.05	Trip Generator Per Acre
		0.05	Jobs Per Acre
		0.05	Housing Units Per Acre
Demand	**25%**	0.0625	% FLEX In-Zone Trips
		0.0625	Population and Percentages (within zone) <0.25 mile
		0.0625	Jobs and Percentages (within zone) <0.25 mile
		0.0625	Annual Boarding/ (Employment + Population)

A sensitivity analysis with different weighting scenarios was conducted to understand potential changes in the outcome that could result from different emphases among these metrics and showed little impact on the final scores. In the end, most of the metrics were allocated 5% weighting with the exception of metrics under "Demand", the "% of zero vehicle households," and the "% of People with Disabilities" under "Equity". The metrics under "Demand" are higher as they are more directly related to the ridership success of the future implementation.

Under "Equity", the metric "% of zero vehicle households" was increased to 6% and the metric "% of People with Disabilities" was decreased to 4%. This was done because people with disabilities are likely to continue using the existing paratransit service which provides extra help in boarding and alighting, while households with zero vehicles have a strong likelihood of taking advantage of new MOD service. These modifications also reflect RIPTA's service priorities.

3.3.2 SSIM Analysis Scoring

The proposed weighting distribution is outlined below in Table 3-13 and Table 3-14. As shown in the tables, West Warwick, Smithfield, and Quonset are the top three performing zones under "Existing Service" because these are the areas where existing transit service is lacking either in geography or span of service. Providence, Woonsocket, and Middletown perform better under "Equity," mostly due to their population density. Providence, Woonsocket, and West Warwick have better community scores due to the relatively high density of trip generators. South Kingstown, Quonset, and Smithfield have higher demand based on their existing travel patterns.

Table 3-13: SSIM Analysis Results

Category			Existing Service						Equity						Community										Demand			
Subcategory			Transit Service Density	Transit Service Interoperability					Demographic and Socioeconomic						Activity Nodes								Employment Density	Housing Density	In zone trip	Proximity to Fixed Route Transit		Transit Service Utilization
Metric			Transit Service Density	Weekday Span Average	Weekend Span Average	Weekday Headway Average	Weekend Headway Average	Area Coverage	% Limited English Speaking Households	% unemployed population	% low-income households	% Non-White	% Zero Vehicle Households	% Disabled Population	Grocery Store	Employment Institute	Townhall	Recreational Center	Schools	Rail Ferry Stops	Nursing and assisted living facilities	Libraries	Jobs per acre	Housing units per acre	% FLEX In-zone Trips	Population and percentages (within zone) <0.25 mile	Jobs and percentages (within zone) <0.25 mile	Annual Boarding/(Employment+ Population)
Zone	Zone Name	Zone Size (Acreage)																										
1	Woonsocket	6486	97	14:54	16:25	32	65	36%	4.9%	19%	33%	26%	4.39%	17%	3	4	1	22	28	0	6	1	3.9	2.7	23%	51%	50%	31140
2	Smithfield	17772	83	15:35	14:39	38	45	23%	2.0%	13%	35%	9%	1.66%	12%	4	7	1	19	16	0	5	3	0.4	0.4	0%	27%	27%	4260
3	Providence	9845	637	15:51	14:39	33	48	96%	16.2%	19%	38%	67%	7.03%	13%	22	34	2	104	98	3	13	25	5.7	5.7	1%	96%	96%	738072
4	West Warwick	13727	147	10:30	12:33	65	98	33%	2.1%	16%	32%	11%	1.28%	18%	10	2	1	37	25	0	2	1	1.7	1.7	2%	40%	40%	7296
5	Quonset	11420	52	14:33	14:55	48	69	33%	1.9%	18%	29%	11%	1.31%	16%	2	3	0	12	11	1	1	1	0.4	0.4	0%	31%	31%	1488
6	Middletown	17417	201	14:24	12:04	41	60	27%	1.5%	14%	30%	21%	6.26%	13%	22	11	2	58	36	2	6	5	1.0	1.0	9%	46%	45%	56688
7	South Kingstown	52851	213	13:07	11:02	59	79	20%	0.1%	11%	37%	11%	1.86%	10%	5	6	2	72	34	2	3	6	0.3	0.3	24%	30%	30%	17196
8	Westerly	22003	5	10:00		30		4%	2.8%	15%	32%	9%	2.56%	14%	4	1	1	23	13	1	4	1	0.4	0.4	34%	14%	14%	168
9	Beach Pond	29168	1	8:46		30		9%	0.3%	16%	27%	6%	1.54%	10%	1	1	1	30	4	0	0	1	0.3	0.1	36%	10%	10%	120

Table 3-14: SSIM Analysis Scoring Results

Category			Existing Service						Equity						Community			Demand			
Weighting			30%						30%						15%			25%			
			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.04	0.05	0.05	0.05	0.0625	0.0625	0.0625	0.0625
Zone	Zone Name	Total Score	Transit Service Density	Weekday Span Average	Weekend Span Average	Weekday Headway Average	Weekend Headway Average	Area Coverage	% Limited English Speaking HH	% unemployed population	% low-income households	% Non-White	% Zero Vehicle Households	% Disabled Population	Trip Generator per acre	Jobs per acre	Housing units per acre	% FLEX In-zone Trips	Population and percentages (within zone) <0.25 mile	Jobs and percentages (within zone) <0.25 mile	Annual Boarding/(Employment+Population)
1	Woonsocket	5.79	5.57	3.78	3.39	3.64	5.72	6.41	7.00	7.43	6.44	6.44	7.11	8.10	5.51	7.12	6.27	6.02	4.92	4.98	4.86
2	Smithfield	4.74	5.70	3.32	3.89	4.43	4.66	7.73	4.66	2.13	7.04	2.85	4.39	3.87	4.18	3.96	4.04	3.31	7.32	7.33	4.25
3	Providence	5.46	0.66	3.14	3.89	3.80	4.80	0.43	8.85	7.67	8.50	8.77	8.50	4.82	9.46	8.76	9.18	3.43	0.43	0.43	9.56
4	West Warwick	5.45	5.11	6.72	4.48	8.17	7.46	6.71	4.86	4.82	5.73	3.91	3.56	8.70	4.68	5.14	5.26	3.54	6.03	6.04	4.16
5	Quonset	5.03	5.98	4.02	3.81	5.88	5.91	6.75	4.55	6.68	3.91	4.23	3.68	7.23	4.11	3.93	4.01	3.31	6.87	6.93	4.17
6	Middletown	5.12	4.62	4.12	4.61	4.90	5.48	7.29	4.15	3.12	4.62	6.09	7.98	4.86	5.15	4.46	4.57	4.37	5.37	5.46	5.41
7	South Kingstown	5.10	4.51	4.97	4.90	7.35	6.46	8.02	2.21	1.58	8.10	3.87	4.78	1.98	4.06	3.85	3.92	6.14	7.03	6.99	4.50
8	Westerly	5.69	6.40	7.05	8.01	3.41	2.25	9.56	5.65	4.03	5.77	2.92	5.81	5.14	4.01	3.96	4.04	7.32	8.60	8.63	4.04
9	Beach Pond	5.13	6.44	7.88	8.01	3.41	2.25	9.09	2.25	4.94	2.29	1.46	4.11	1.58	3.84	3.82	3.69	7.56	9.04	9.04	4.05

3.4 Zones Recommended for Further Pilot Discussion

Table 3-15 ranks the candidate Mobility Zones from the highest to lowest score across three tiers. These three tiers allowed for identifying potential zones by having a mix of scores represented in the potential pilot programs. Of the zones analyzed, six of the zones were selected to develop operating plans: Middletown, Smithfield, South Kingstown, West Warwick, Westerly, and Woonsocket. Also, a seventh zone, which was not analyzed, was selected to improve geographic coverage within the state. An operating plan was developed for the East Bay zone which is an area that has very little fixed route service today,

A MOD Zone in Providence was analyzed as part of the RIPTA MOD Study. Based on the analysis the Providence zone did have a high score which would be indicative of a zone that would have a high probability of success. Indeed, the Providence Zone would likely be well utilized but it is not suggested as a candidate zone for a few reasons which are presented below.

The primary reason that the Providence Zone performs well is because of the population density and transit dependent populations. These characteristics are general transit propensity statistics and the Providence Zone is well served by fixed route services, with very good coverage and service frequency. The implementation of MOD services in Providence would likely not expand transit use as many of the users of an MOD service are existing fixed route passengers, therefore MOD would act as competition to fixed route ridership and degrade fixed route ridership. The cost per passenger on an MOD service would be higher than fixed route thus the Providence Zone would not represent a cost-effective deployment of MOD.

The study goals also play a part in the reasons why a Providence Zone is not the best demonstration of MOD. One of the goals of MOD is to provide service where fixed route does not make sense or expand access to transit service to more Rhode Island residents. The good transit coverage in Providence does not meet the goal of expanding transit service nor does it extend transit service to areas of the state that are either unserved or underserved. Therefore, providing MOD service within Providence does not meet the goals of the MOD program.

While the analysis of MOD service was general, consideration of the Providence Zone was for a specific use case – serving as a vehicle to expand the span of service within Providence beyond the current fixed route hours of service. Through discussions of meeting the goals of the study, it was determined that this use case would not be a primary use of MOD services but may be secondary after a successful demonstration of MOD. The analyses conducted in the early stages of this study could form the basis for a service design of a late night/early morning service in the Providence Zone after proof of concept of an MOD program.

Table 3-15: Final SSIM Score by Zone

Zone Name	Total Score	Zone Name	Total Score	Zone Name	Total Score
Woonsocket	5.79	**West Warwick**	5.45	**South Kingstown**	5.10
Westerly	5.69	**Beach Pond**	5.13	**Quonset**	5.03
Providence	5.46	**Middletown**	5.12	**Smithfield**	4.74

4 Pilot Design

Key findings:

- Seven service zones with diverse use cases were analyzed for MOD service: East Bay, Middletown, Smithfield, South Kingstown, West Warwick, Westerly, and Woonsocket.

- Recommended span of service for MOD pilots based on observed demand is weekdays generally between 7:00 AM and 5:00 PM (pending community input, agency resources, and other considerations).

- The West Warwick, Westerly, and Woonsocket Zones provide the most compelling use cases for MOD pilots, with substantial in-zone demand and strong estimated latent demand.

- The Smithfield and East Bay Zones are not recommended for an MOD pilot due to low overall trip demand and the high proportion of the trip demand for cross-zone trips. Pilot service in either zone runs a risk of high cost per trip and low ridership.

MOD can fulfill several purposes in meeting typical goals of public transportation services. The optimal service design is dependent on the context in which the service is operating, with urban areas requiring a service that complements existing public transportation and rural areas needing a service that fills in transportation gaps.

This section evaluates seven potential MOD service zones:

- **East Bay** – Located southeast of Providence in a suburban area.
- **Middletown** – Comprised of Middletown and Newport, an historic area and tourist destination.
- **Smithfield** – Located northwest of Providence in a lower-density suburban area.
- **South Kingstown** – Located on the south coast of Rhode Island and including the University of Rhode Island.
- **West Warwick** – Located southwest of Providence, containing multiple commercial destinations.
- **Westerly** – Located in the southwest corner of the state, a smaller community with existing strong Microtransit ridership.
- **Woonsocket** – Located north of Providence in a diverse, higher-density area.

The use cases described in this section respond to existing travel demand and available resources in those zones, and recommendations are made on where an MOD pilot would be most likely to succeed.

Table 4-1 provides summary information on the potential zones, which are explored in greater detail below.

Table 4-1:. Summary Table

	East Bay	Middletown	Smithfield	South Kingstown	West Warwick	Westerly	Woonsocket
Current Ridership (Pick-ups in FY19)	10,294	22,254	11,789	22,408	22,471	20,392	52,078
% of Trips In-Zone	6.2%	74.5%	14.5%	83.9%	39.9%	89.9%	89.5%
Latent In-Zone Demand (Trips/Weekday)	7	134	5	92	98	81	156
Available Slack Capacity (Trips/Weekday)	18	11	10	7	19	0	9
Estimated Minimum Annual Cost of MOD Service Recommendations	$0	$166,664	$0	$166,664	$166,664	$166,664	$166,664
Estimated Maximum Annual Cost of MOD Service Recommendations*	$0	$1,166,648	$0	$874,199	$748,547	$766,370	$1,474,261

**Estimated cost to serve full in-zone latent demand*

4.1 Service Mode Description

This report proposes three service options:

1. **Utilizing demand response slack**: RIPTA could follow the example of other transit providers and add incremental general public same-day microtransit service using a mobile application (app) to provide MOD. Using slack in the existing demand response service, some same-day on-demand trips could be served without impacting operations. This would require minimal dedication of additional resources.
2. **Converting existing Flex Service to MOD**: There are some zones where service efficiency might improve by converting existing Flex Service to MOD. This would require minimal dedication of additional resources.
3. **Expanded RIPTA-operated service**: Particularly in areas with minimal slack time availability, RIPTA could devote additional in-house capacity to a microtransit service. This could be done through adding vehicle revenue hours to a new microtransit service. However, this could have substantial operating costs associated with implementation.

These three strategies are not mutually exclusive – for example, RIPTA could use slack capacity in a zone to provide some on-demand trips in addition to dedicating additional vehicles to an MOD service.

There are several other transit agencies using paratransit fleets to operate microtransit. These include the Stark Area RTA (Ohio), SMART Bus (Southeast Michigan), Norwalk Transportation District in Connecticut (which runs off-peak paratransit vehicles), and the City of Lone Tree Colorado. Additionally, the Greater Dayton RTA (Ohio) specifically uses slack time in its ADA schedule for microtransit service, providing a potential model for the first option above.

4.2 Service Guidelines

When considering microtransit as an MOD solution, it is important to understand typical service guidelines that have worked in other regions. Below are various aspects of microtransit service that informed the service recommendations in this section.

4.2.1 Service Availability

In general, the availability of the service is a function of:

- The size of the service area.
- The density of travel demand within the service area; and
- The amount of service provided to meet that demand.

As the service area decreases in size, trip density increases, and/or service level increases, one can anticipate that wait times are reduced and on-time performance improves.

Figure 4-1: Illustrative Example of Service Statistics

Number of Trips	Number of Vehicles	Hours of Service	Rides per hour per Vehicle	Average Wait Time (minutes)	Average Ride Time (minutes)	Cost per Trip ($)	Ride Pooling %
50	2	11	2.3	2	17	28	25
100	2	11	4.5	10	24	14	41
100	4	11	2.3	2	15	28	20
100	6	11	1.5	0	15	43	15
300	6	11	4.5	8	23	14	40
300	10	11	2.7	2	16	24	25

Note: Ride pooling represents the percent reduction in number of vehicle stops due to pooling of rides. Cost per trip is based on $65 per vehicle hour.
Source: TransLoc, Inc. (22).

Source: TCRP Synthesis 141

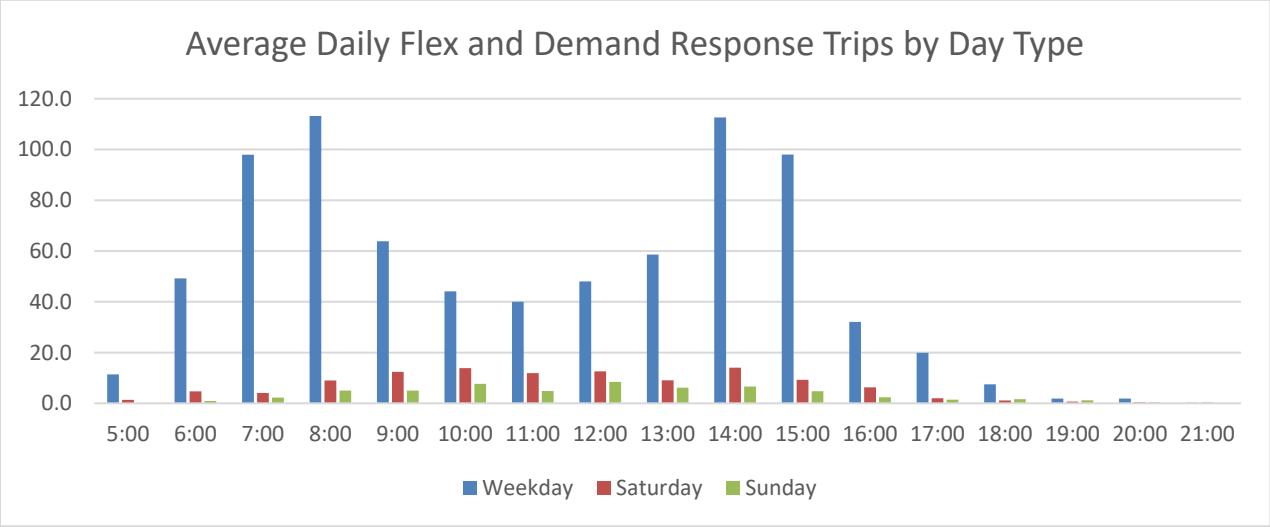
TCRP Synthesis 141 provides an illustrative example of wait times and cost per trip that microtransit operators can expect from various levels of service (Figure 4-1). As can be seen in the table, as there is an increase in the number of trips, the number of vehicles providing service, and ride pooling percentage, there is a commensurate improvement in service efficiency and wait times.

In terms of service availability, it is important to note that RIPTA does not divide the state into paratransit service zones for its paratransit system. Rather, a paratransit vehicle may undertake trips in any part of the state based on the trip manifest generated by RIPTA's scheduling system, powered by Reveal. While this may make for more efficient trips overall, it also means less certainty that there will be a RIPTA demand response vehicle in any given part of the state at any given time. In a system where a vehicle's slack time is used to provide microtransit during its down-time, this lack of paratransit zones increases the potential wait time for a person requesting an on-demand trip, particularly in lower-density parts of the state.

4.2.1.1 General Trip Distribution

RIPTA's weekday service (Flex Service and demand response) has two peaks, one in the morning and one in the afternoon, with relatively fewer trips in the mid-day time period (Figure 4-2). Weekend service peaks in the mid-day time period, and overall has much less demand relative to weekdays. Even though RIPTA used split shifts in 2019, which reduces slack time in the mid-day period, the overall trip distribution indicates opportunity for providing trips using slack capacity.

Figure 4-2: Average CY 2019 Flex and Demand Response Trips by Day Type



4.2.1.2 Induced Ridership

Introduction of a new on-demand service is likely to generate new transit demand on top of the existing ridership shown above. People who previously were too far from the nearest fixed route bus stop or outside of the demand response service zone will begin using the service; estimating that level of latent demand is important for developing an appropriate service model.

The National Center for Transit Research[1] provides a methodology for estimating potential ridership demand based on two key factors: estimated population outside of ¼ mile of fixed route service and the percentage of that population that is estimated to be transit dependent. Using those two factors, a model can estimate likely weekday ridership. Table 4-2 shows the estimated latent weekday ridership for the seven zones. It is important to note that ridership will vary based on the amount of service operated and times service is provided.

Table 4-2: Estimated Latent Transit Demand

Zone	Potential for Induced Transit Demand	Estimated In-Zone Weekday Ridership Potential
East Bay	107	7
Middletown	180	134
Smithfield	36	5
South Kingstown	110	92
West Warwick	247	98
Westerly	90	81
Woonsocket	174	156

[1] National Center for Transit Research. "Estimating Ridership of Rural Demand-Response Transit Services for the General Public" page 27. Accessed from: https://www.nctr.usf.edu/wp-content/uploads/2016/09/21177060-NCTR-NDSU08.pdf

Actual and estimated latent demand may differ due to rider preferences in the modeled zones and the structure and levels of service of existing Flex Service. Nonetheless, the model provides useful insight into the expected magnitude of latent demand for the zones. Smithfield can be expected to have the smallest amount of new ridership generated while West Warwick will have the highest.

4.2.1.3 Wait Times

Currently, RIPTA demand response service and Flex Service require prior day advance notice for a trip request. It is recommended that an MOD service strives to fulfill trip requests within an hour of receiving the request. Actual wait times will depend heavily on how the service is designed, with higher density service areas able to achieve lower wait times. Sacramento Regional Transit District (SacRT) reports wait times for its microtransit service are typically 15 minutes or less, though at times the wait can be closer to an hour.

RIPTA should set a goal for its target MOD wait time based on customer profile, available resources, and desired service outcomes.

4.2.2 Vehicle and Stop Guidelines

In general, it is a federal requirement that the transit agency provide vehicles and transit stops that are fully accessible to the public regardless of ability. This means that a person using a mobility aid, such as a wheelchair, should have the same level of access to an MOD service as a person without disabilities. Vehicle capacity and microtransit stops are discussed below to examine the application of these access principles in the context of MOD.

4.2.2.1 Vehicle Capacity/Design

RIPTA plans to use fully accessible vehicles for any MOD service. Using fully accessible vehicles guarantees compliance with Americans with Disabilities Act (ADA) standards, which requires comparable service to people with disabilities as to those without. If there are insufficient vehicles that are fully accessible, RIPTA runs the risk of having longer wait times for people using mobility aids, which would be a violation of ADA regulations.

Although RIPTA plans on using its fully accessible vans for any pilot service, it could run a mixed fleet of, for example, sedan-style vehicles and fully accessible vans. In that case, RIPTA must track the performance of the two vehicle types closely to ensure that there is a comparable level of service for those requiring fully accessible vehicles. Failure to do so could result in a finding during federal compliance reviews or run the risk of an ADA complaint filed with the Federal Transit Administration.

4.2.2.2 Microtransit Stops

A system using microtransit stops can help with increasing service efficiency, as it creates a mutual meeting point for multiple users and increases the likelihood of a shared-ride service (increasing trips per hour). However, it is not recommended to develop stops in zones without adequate sidewalk infrastructure or in low-density rural settings. Any place where a stop is designated should be ADA compliant, including a 5-foot x 8-foot concrete landing pad and connections to the existing sidewalk network.

Given the number of zones being considered in this analysis, including low-density options such as Beach Pond and Quonset, there will be areas where microtransit stops are not feasible. However, more urban zones may have the possibility of successfully implementing "virtual" stops, also known as "corner-to-corner" microtransit service. A key decision will be whether this service structure (e.g., door-to-door versus corner-to-corner) is the same across all zones or if variation in policies between zones is acceptable.

4.2.3 Service Productivity

Typical microtransit productivity is similar to general demand response, from 2.5 trips per revenue hour to 4 trips per revenue hour (for reference, RIPTA averaged 2.2 trips per hour in its demand response system in FY 2019). RIPTA considers a "successful" MOD pilot to average at least the systemwide demand response average, though understands that more rural areas may have modest ridership while more urban areas will have higher service productivity. Service statistics from other agencies running microtransit are shown in Figure 4-3.

Figure 4-3: Service Statistics from Microtransit Operators

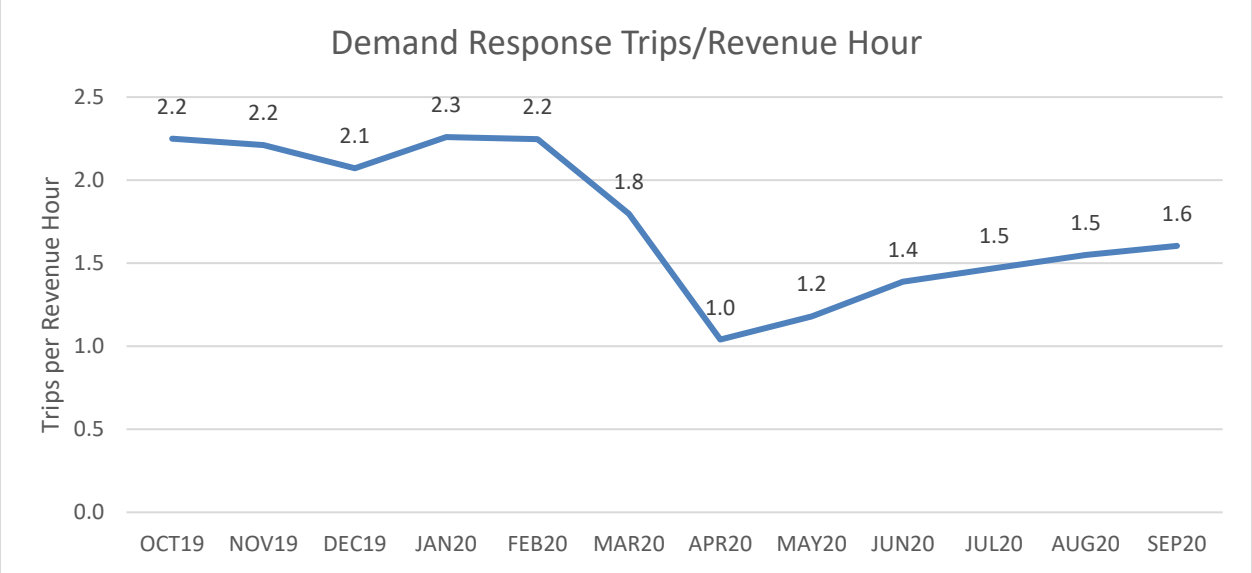
Transit Agency	Contract or In house	Cost per Vehicle Service Hour	Passengers per Vehicle Service Hour	Cost per Passenger Trip
AC Transit	In house	$214.00 (fully allocated)	3	$71.00
Cherriots	In house	$65.00	3.5	$18.57
DART (Dallas)	Contracted. DART provides vehicles and facilities but not fuel.	$46.00	2.5 for original DRT service and 3.5 for new GoLink service.	$18.40 $13.14
Greater Dayton RTA	In house and contracted	RTA pays Lyft and taxis and uses in-house paratransit.	Not applicable	$13.00
Denver RTD	Contracted	$83.00	3.8	$21.84
HART	Contracted	HART pays contractor by trip and not by hour.	3.5	$10.00
Houston METRO	In house	$75.00	2.4	$31.25
Kitsap Transit	In house	$130.72	3.66	$35.68
LYNX	Contracted	$41.17	3.3	$12.60
MST	Contracted	$54.18	4.03	$13.44
NVTA	Contracted	$44.48	2.6	$17.00
NCTD	Contracted	$97.00	2.7	$36.00
TDU	Contracted and in house	$34.69	4.7	$7.34

Note. The numbers are self-reported figures from agencies that responded.

Source: TCRP Synthesis 141

The determination of acceptable service performance is complicated by the severe disruption introduced by the COVID-19 pandemic. This disruption has made what would have been unusually low service productivity in the pre-pandemic time period (e.g., 1.5 trips per revenue hour) much more typical since April of 2020 (see Figure 4-4).

Figure 4-4: RIPTA Demand Response Service Productivity



Source: National Transit Database

4.2.4 Slack Capacity

The nature of demand response service is that there are periods between trips where a driver is neither in revenue service nor deadhead service, also called "Slack Time." Slack can be a result of several factors, such as a late cancellation, a no-show, or simply a product of operating a large service area. Slack periods that are longer than 40 minutes may be able to accommodate an on-demand trip without impacting the driver's next scheduled pick up. While many of these slack periods are minimal (more than three-quarters are under 40 minutes), over 20% of them could support a short on-demand trip (slack duration longer than 40 minutes).

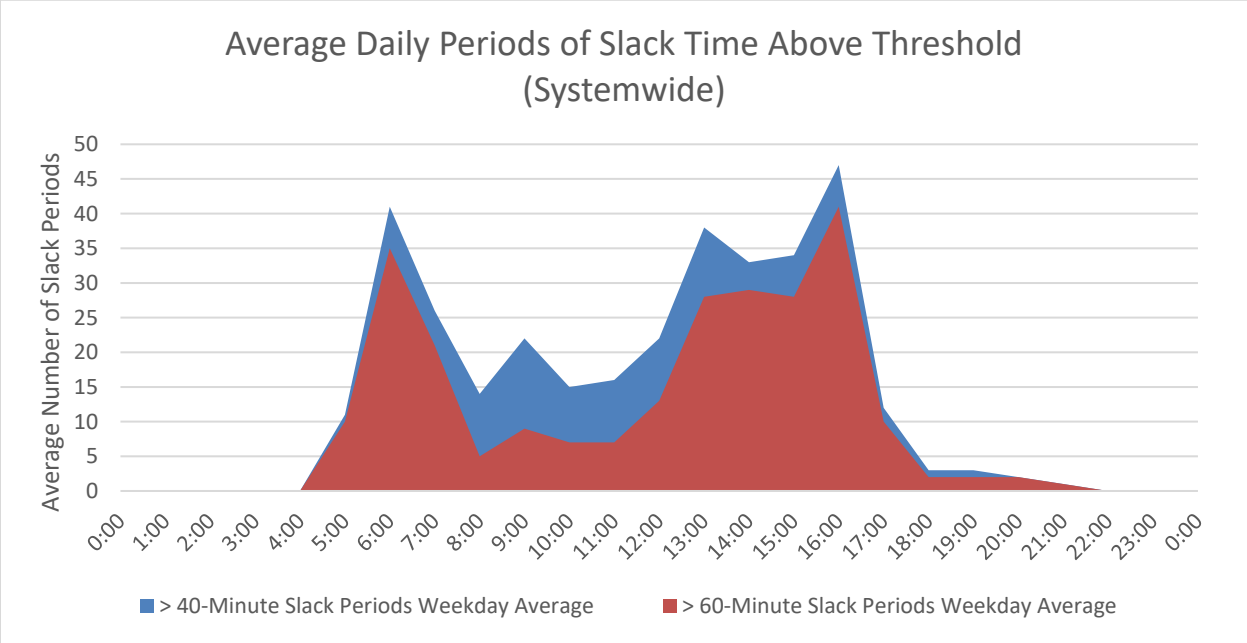
Table 4-3: Demand Response Slack Time Distribution

Slack Time Duration*	Proportion of Total
< 10 Minutes	15.3%
10 - 40 Minutes	63.5%
40 - 60 Minutes	5.6%
> 60 Minutes	15.7%

**Slack time analysis based on two sample weeks from October 2018 and April 2019.*

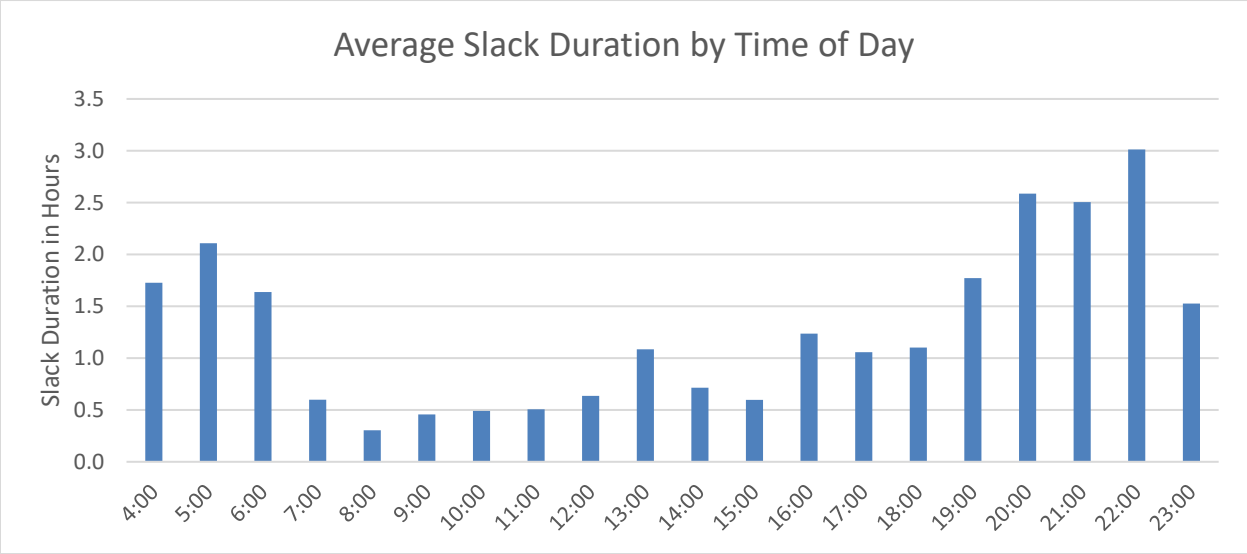
Times of day when there is slack time are reflective of the general trip distribution, with the number of slack periods peaking in the early morning and mid-afternoon.

Figure 4-5: Average Number of Slack Periods Above Threshold Values



Conversely, the duration of slack periods is longest when trip volumes are lower, especially in the evening and early morning. The lower frequency of trips during these off-peak periods means that drivers have longer periods of slack waiting to begin revenue or deadhead service. The use of split shifts minimizes the amount of slack time during the middle part of the day.

Figure 4-6: Average Slack Duration by Time of Day



This analysis of slack time indicates capacity for on-demand curb-to-curb service for some trips using existing resources. This slack capacity is further explored at the zone level in the detailed analysis of the zones below.

4.2.5 Financial Guidelines

Based on 2019 statistics, RIPTA's directly operated demand response service costs an average of $83 per hour and $38 per trip. This can be used to estimate potential costs for operating additional service over-and-above the service already being run. However, it should be noted that trips in low-density areas that typically require long deadheads are more expensive to operate on a per-trip basis, sometimes substantially.

4.2.6 Connectivity

In select locations and times of day, the focus of an MOD service can be on connecting people to higher-frequency public transportation service. This kind of service, often used for work commutes, can be considered a last-mile service. Encouraging these public transportation connections through fare policy (e.g. free transfers to fixed route transit) or service guidelines (e.g. in-zone service only) can help to encourage these public transportation connections.

4.2.7 Technology Platform

MOD is defined by an integrated mobile technology platform (i.e. smartphone app) that connects customers to a variety of on-demand transportation options. RIPTA has made progress in important aspects of their service that pave the way for more extensive deployment of an MOD solution.

- **Mobile Application**: RIPTA has a relationship with INIT, a mobile payment and smart card platform for transit. RIPTA may be able to work with INIT to develop greater capabilities for its app, such as trip planning, microtransit ride requests, and "Where's My Ride?" tracking.
- **Mobile Data Tablets**: RIPTA has tablets on board its paratransit vehicles, making real-time manifest changes feasible for the drivers. This is an essential capability, regardless of how the service is designed.

An additional functionality for consideration is integration of the mobile application with other transportation services not provided by RIPTA, such as ride-hailing (Uber/Lyft), taxi companies, municipal services such as Senior Center vans, vanpools, and micromobility (such as bikeshare and scootershare, if and when such systems are implemented in Rhode Island). This sort of transportation integration through a mobile platform is referred to as Mobility as a Service, or MaaS. Each additional option integrated into a smartphone app expands customers' mobility options

4.3 Service Zone Design

The analysis in this section is based on ridership from calendar year 2019. In general, as shown in Table 4-4, demand response origins and destinations tend to be same-zone trips (highlighted light green), not including origins or destinations that are outside of any proposed zone ("non-zone"). The exceptions are East Bay and Smithfield, both of which have a stronger orientation to cross-zone trips (such as to/from Providence).

Table 4-4: Origin/Destination by Zone

Destination

Origin	Beach Pond	East Bay	Middletown	Providence	Quonset	Smithfield	South Kingstown	West Warwick	Westerly	Woonsocket	Non-Zone	Total
Beach Pond	127	0	0	2	0	0	0	1	14	0	7	**151**
East Bay	0	540	2,252	4,760	18	577	62	321	0	118	1,646	**10,294**
Middletown	0	2,154	11,785	706	235	3	613	316	2	4	6,436	**22,254**
Providence	0	4,680	825	16,593	125	2,008	218	2,939	904	1,878	28,080	**58,250**
Quonset	0	22	242	105	449	8	274	240	0	0	1,931	**3,271**
Smithfield	0	543	2	1,894	7	731	30	406	0	1,418	6,758	**11,789**
South Kingstown	0	65	918	220	279	28	15,996	320	1,218	16	3,348	**22,408**
West Warwick	0	320	311	2,296	239	361	337	2,572	0	17	16,018	**22,471**
Westerly	14	0	2	929	0	1	1,074	0	18,033	1	338	**20,392**
Woonsocket	0	147	9	2,497	0	1,495	22	21	0	35,624	12,263	**52,078**
Non-Zone	7	1,580	6,062	29,555	1,580	6,925	3,089	15,046	337	12,815	0	**76,996**
Total	**148**	**10,051**	**22,408**	**59,557**	**2,932**	**12,137**	**21,715**	**22,182**	**20,508**	**51,891**	**76,825**	**300,354**

*Contains a Flex Zone

The trip demand distribution has important bearing on the policy regarding cross-zone trips. On the one hand, there is substantial trip demand between zones and customers typically prefer one-seat rides if possible. On the other hand, limiting microtransit to only in-zone trips increases the likelihood that there will be a microtransit vehicle nearby to quickly fulfill an on-demand trip request, reducing customer wait times.

The next seven sections provider a closer analysis of the proposed zones. Appendix A presents the methodology used to develop the service design cost for each zone.

4.3.1 East Bay

Key Take-Aways:

- There is no Flex Service in East Bay to redirect to an in-zone MOD pilot service, so a pilot service would rely on existing demand response slack capacity or additional resources.

- Demand response slack would be able to serve approximately 18 weekday in-zone trips, which exceeds the estimated in-zone latent demand of 7 trips.

- The vast majority of trip demand in East Bay (~95%) is cross-zone, indicating some potential for an MOD pilot serving fixed route stops for cross-zone trips.

- Due to low in-zone demand for service, a pilot MOD service is not recommended.

4.3.1.1 Zone Overview

The East Bay Zone is located southeast of Providence along the Massachusetts border and is comprised of East Providence, Barrington, and Warren. Its population density is approximately 4.1 people per square mile, putting it in the middle-range compared to the other six zones examined. Most of the population is centered in East Providence.

While the City of East Providence has relatively robust fixed route service (routes 32, 33, 34, 60, 61X, and 24L), Barrington and Warren have scarcer service with only the 60 and 61X traveling through them. Perhaps due to the proximity to the major population center of Providence, East Bay has the highest proportion of cross-zone travel demand of the seven zones examined.

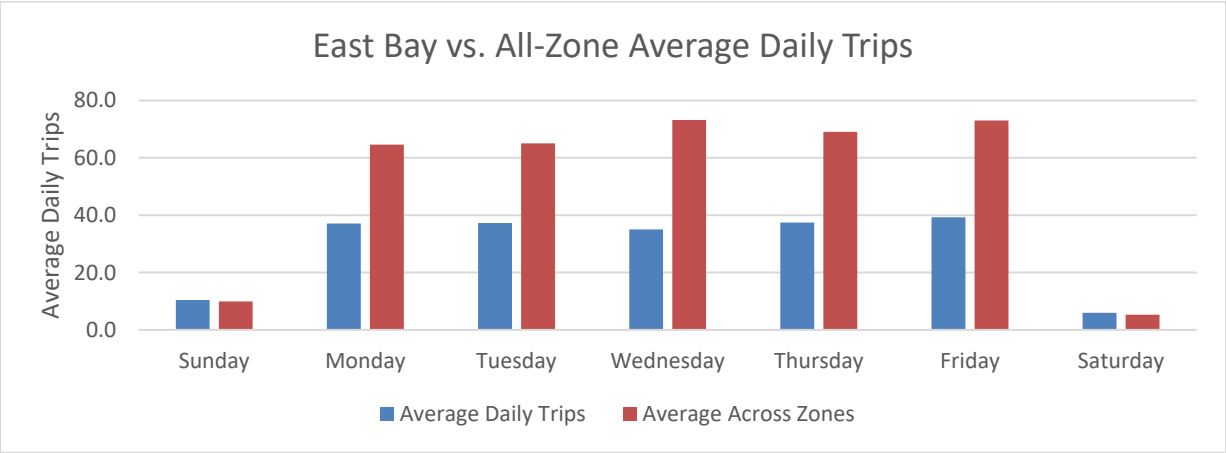
4.3.1.2 Operating Parameters

An MOD service would be challenging to operate in this proposed zone. Because Barrington and Warren have not demonstrated in-zone travel demand, it is unclear what the usage rate of an on-demand service might be if only provided within the zone. Conversely, an MOD service that provides cross-zone service is less efficient due to larger deadhead distances. Therefore, an MOD pilot service is not recommended for this zone.

4.3.1.2.1 Level of Service

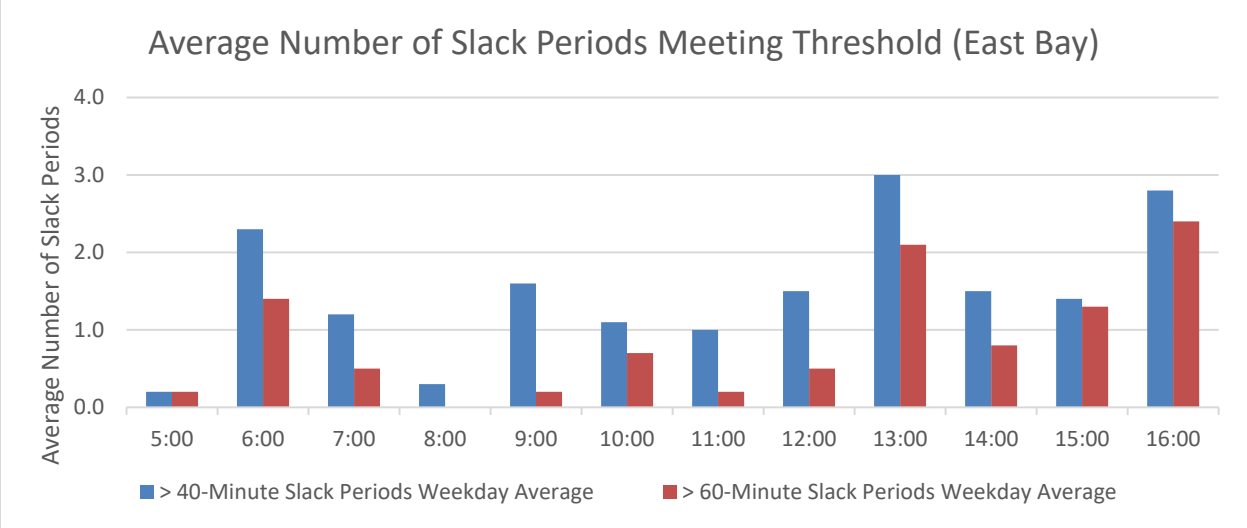
The East Bay Zone shows a relatively small amount of demand for demand response transportation during the week, with substantially reduced demand on weekends (Figure 4-7). It has the lowest trip demand levels of the seven zones analyzed.

Figure 4-7: Average Daily Trips for East Bay Zone by Day Type Compared to All-Zone Average



The number of slack periods which could accommodate a trip are highest in the afternoon, with an average of 18 periods of slack that could accommodate an in-zone trip during weekdays (Figure 4-8). This slack capacity exceeds estimated latent demand for in-zone service (7 trips).

Figure 4-8: Average Number of Slack Periods in East Bay



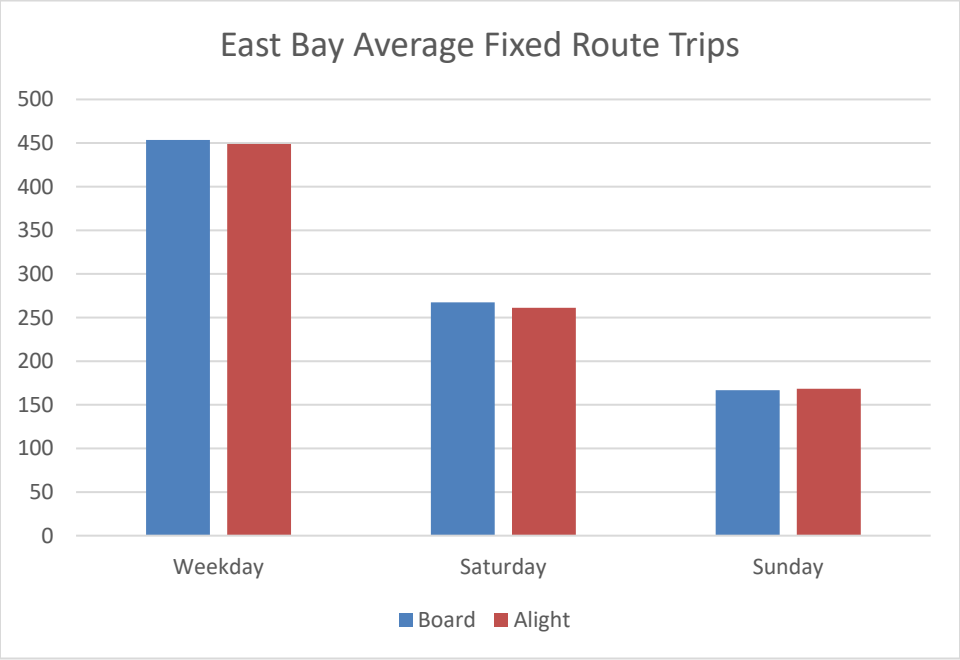
For those demand response trips that begin in East Bay, the top cross-zone destination is the Providence Zone, followed by Middletown Zone (Table 4-5). In-zone trips (within East Bay) account for a very small proportion of overall trip demand in the zone (just under 6%, not counting “non-zone” trips), the smallest proportion of all zones examined. This suggests that an in-zone service would have limited demand.

Table 4-5: Drop Zones for Pick Ups in East Bay

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	331
Middletown	1,417
Providence	3,477
Quonset	8
Smithfield	274
South Kingstown	31
West Warwick	142
Westerly	0
Woonsocket	60
Non-Zone	1,287
Grand Total	**7,027**

Fixed route service in the East Bay Zone serves approximately 450 weekday trips, and roughly half that on weekends (Figure 4-9). This could suggest opportunity to provide last-mile service to feed the fixed route system. However, it is unclear whether riders traveling to Providence or Middletown will be dissuaded from using an MOD service if it requires a transfer at the nearest in-zone bus stop.

Figure 4-9: East Bay Zone Average Fixed Route Trips by Day Type

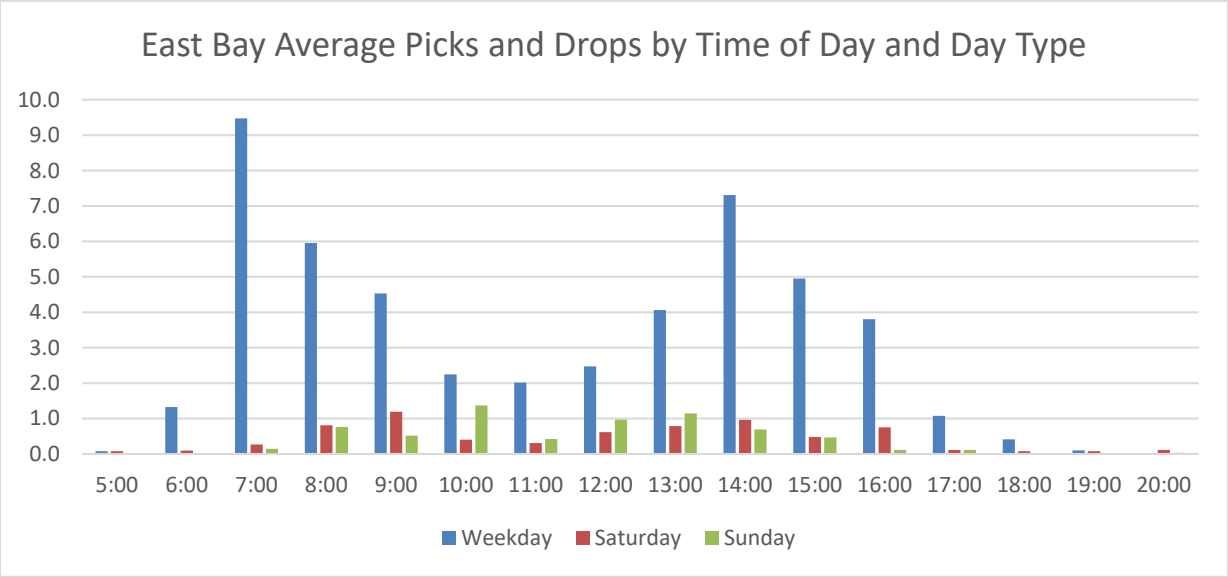


4.3.1.2.2 Span of Service

Demand response trips in the East Bay Zone, similar to the overall demand response trip distribution for the entire statewide system, has two peaks on weekdays, one in the morning and one in the afternoon.

This suggests that a microtransit pilot would face the highest trip demand during these time periods on weekdays, and relatively little demand during the middle of the day (Figure 4-10).

Figure 4-10: East Bay Average Demand Response Trips by Time of Day and Day Type*



**Includes both pick-ups and drop-offs.*

Based on observed travel demand, a pilot MOD service should operate between 7:00 AM and 5:00 PM on weekdays only.

4.3.1.2.3 Number of Vehicles

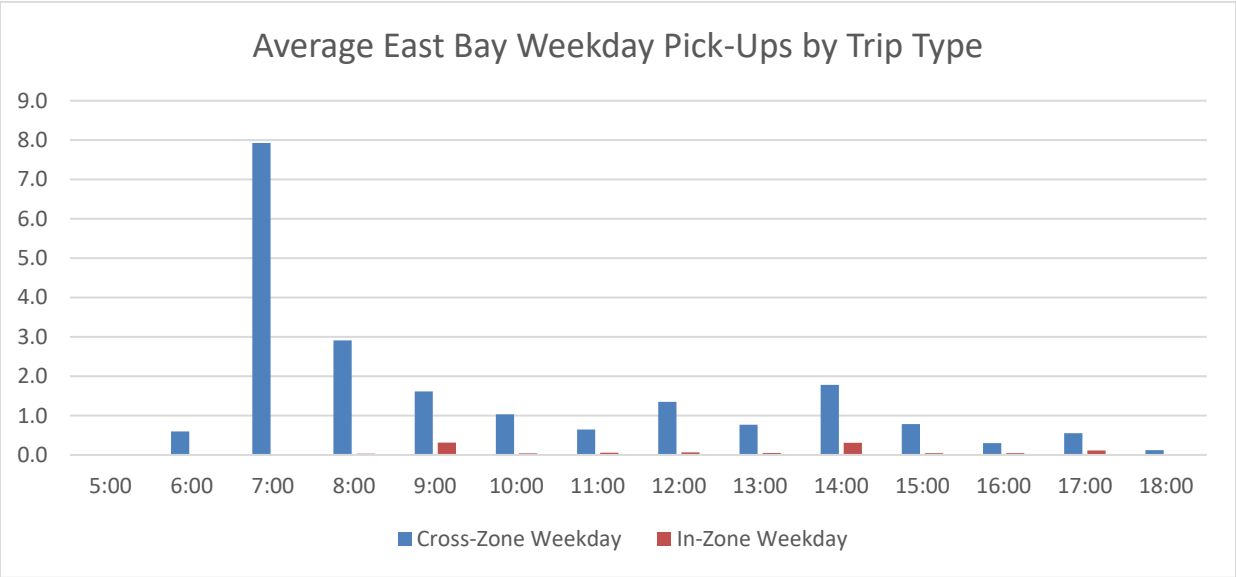
Given the very modest demand for in-zone MOD service, a dedicated vehicle is not recommended should RIPTA choose to pursue a pilot program in East Bay. Utilizing existing slack time of demand response vehicles already in East Bay would be a cost-neutral solution (excluding any software development costs associated with implementing an MOD platform).

4.3.1.2.4 Connections to the Statewide Transit Network/Schedule Coordination

Multiple bus routes serve the East Bay zone, though mostly centered in East Providence. The Route 33 provides service between East Providence and Kennedy Plaza in downtown Providence for 18 hours a day, between 5:10 AM and 11:07 PM. The Route 60 also provides a wide span of service, though it is the only local service in Barrington and Warren. It operates between Newport and Providence, traveling through East Bay Zone, for nearly 21 hours per weekday.

Given that there is strong demand for cross-zone service (Figure 4-11), microtransit service may need to operate at times that are complementary to the fixed route service. This could provide last-mile connections for people traveling to Providence or Middletown Zone.

Figure 4-11: Average East Bay Weekday Pick-ups by Trip Type



**Does not include cross-zone trips outside of a proposed MOD zone.*

4.3.1.3 Service Costs

The East Bay Zone has slack time availability beyond the estimated latent demand for in-zone trips (Table 4-6).

Table 4-6: Estimated East Bay Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity of Service if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service	0	0	0
Demand Response Slack	0	18	18
Total	0	18	18

**Estimated at 2.2 trips per revenue hour*

***Net Capacity = Estimated Capacity – Trips Served*

As shown in Table 4-7, there is an estimated latent demand of 107 weekday trips, with an in-zone latent demand of 7 weekday trips. Latent in-zone demand could easily be served using existing resources, as up to 18 in-zone trips could be provided using slack time. Should an MOD pilot be implemented, it is recommended to focus on leveraging existing slack capacity to serve in-zone trips and/or provide service to in-zone bus stops.

Table 4-7: East Bay MOD Service Estimates

Total Latent Weekday Trip Demand	107
Total In-Zone Latent Demand*	7
Total Customers Served per shift**	18
Shifts Needed to Serve In-Zone Demand	0
Total Cost for all Shifts***	$0

**Assumes 6.2% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.3.2 Middletown

Key Take-Aways:

- The existing Flex Service in the Middletown Zone is estimated to be modestly more efficient if run as an on-demand system.

- Demand response slack would be able to serve approximately 9 in-zone trips generated by latent demand without additional vehicles.

- There is an estimated latent demand of 180 weekday trips in the Middletown Zone, and existing trip patterns suggest that much of this demand (75%) is for in-zone service.

- Due to existing robust fixed route service, this zone is recommended as low priority for an MOD pilot as it would likely siphon existing fixed route ridership into lower-efficiency MOD service.

4.3.2.1 Zone Overview

The Middletown Zone is located at the mouth of Narragansett Bay and is comprised of the communities of Middletown and Newport. At 2.3 people per acre, it is a relatively low-density zone with the main population center of Newport. The zone is served by RIPTA fixed routes 63, 64, 67, 24L, 14, 60, as well as the Aquidneck Flex Service. Fixed route service provides connections to Providence and South Kingstown, as well as limited circulator service.

The Middletown Zone has the third-highest proportion of people of color of all zones behind Providence and Woonsocket, and the second-highest proportion of zero-vehicle households behind Providence. The zone has good economic indicators with relatively low unemployment and a low proportion of low-income households.

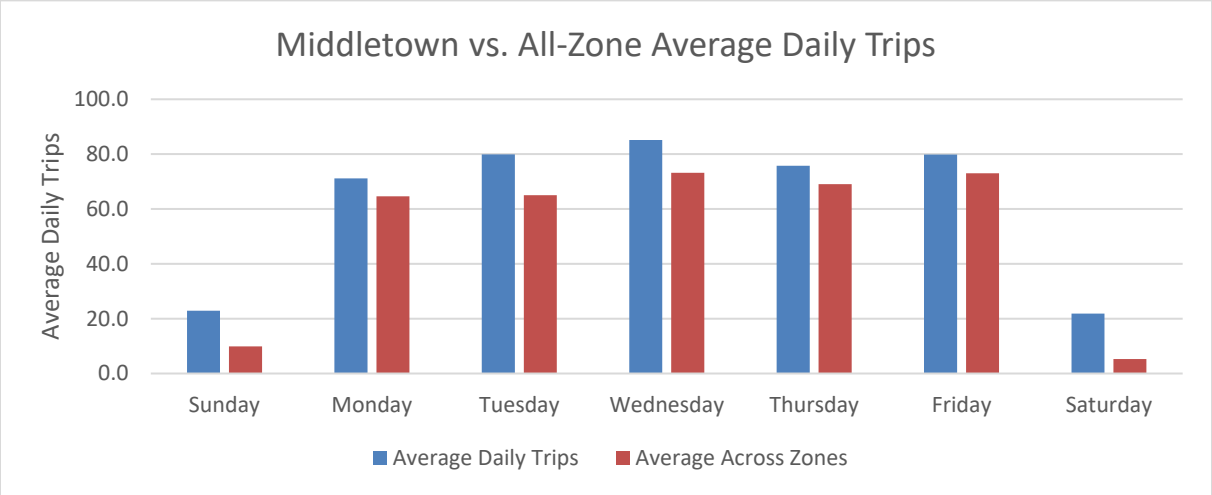
4.3.2.2 Operating Parameters

Despite its relatively low population density, Middletown has a strong transit market, particularly for fixed route transit. Due to this rich fixed route transit market, the Middletown Zone may not have as pronounced unmet service needs as some of the other zones considered in this analysis such as Westerly or Woonsocket.

4.3.2.2.1 Level of Service

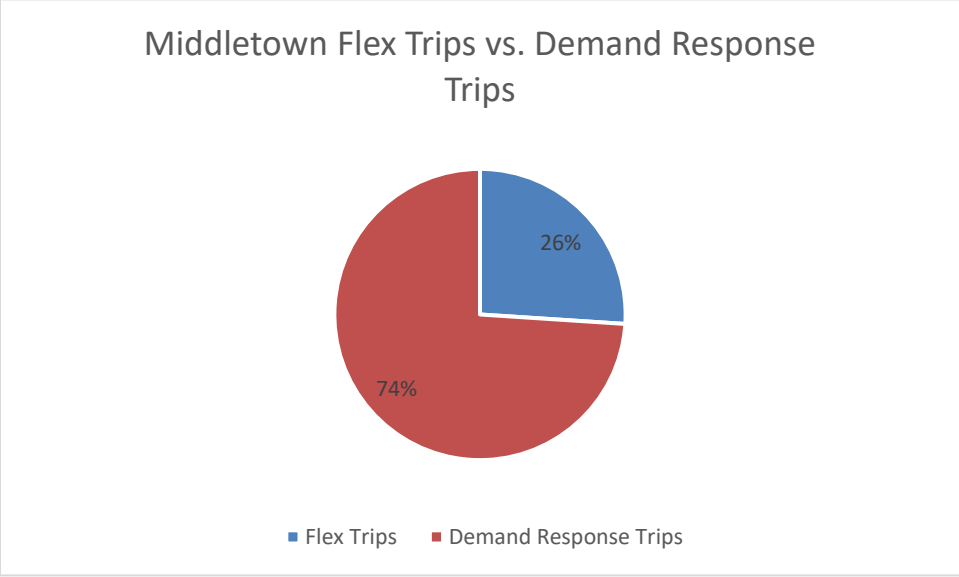
The Middletown Zone shows a strong service demand for demand response transportation relative to the average of all zones that were considered (Figure 4-12).

Figure 4-12: Average Daily Trips for Smithfield Zone by Day Type Compared to the Average for All Zones



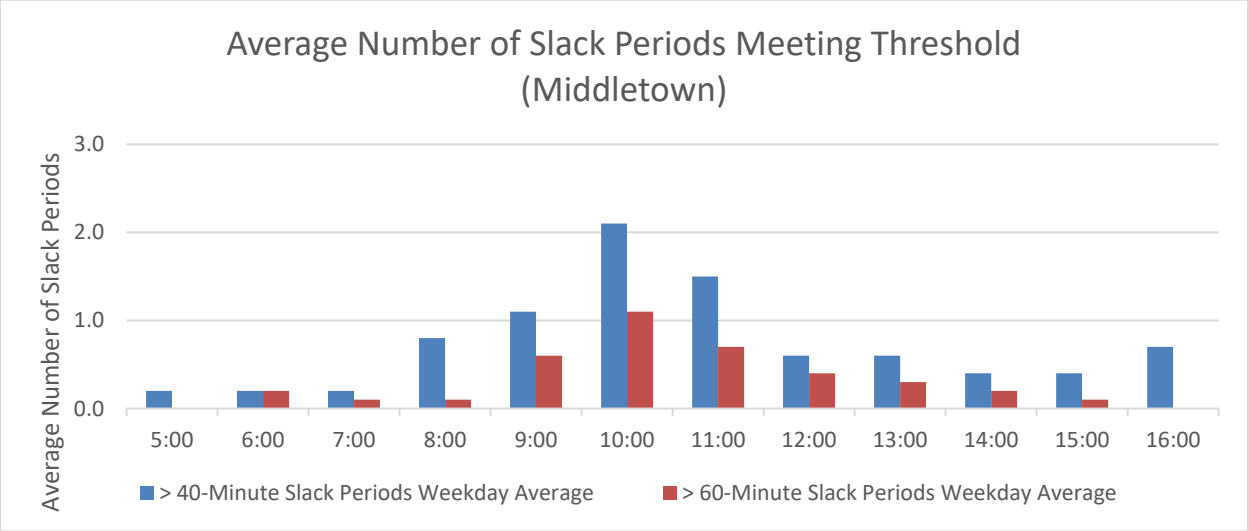
Middletown is served by both Flex Service and demand response, with flex trips comprising a little more than one-quarter of all service (Figure 4-13). This may be reflective of the extensive fixed route network in the zone, which makes for more robust ADA transportation options for residents.

Figure 4-13: Flex Trips vs. Demand Response Trips in Middletown



Middletown has 9 daily periods of slack time on average when demand response drivers could accommodate an on-demand trip (40 minutes or greater), and 4 periods of slack time 60 minutes or greater per weekday. Slack periods peak in the mid-day, suggesting greater capacity for additional trips in off-peak times (Figure 4-14).

Figure 4-14: Average Number of Slack Periods in Middletown



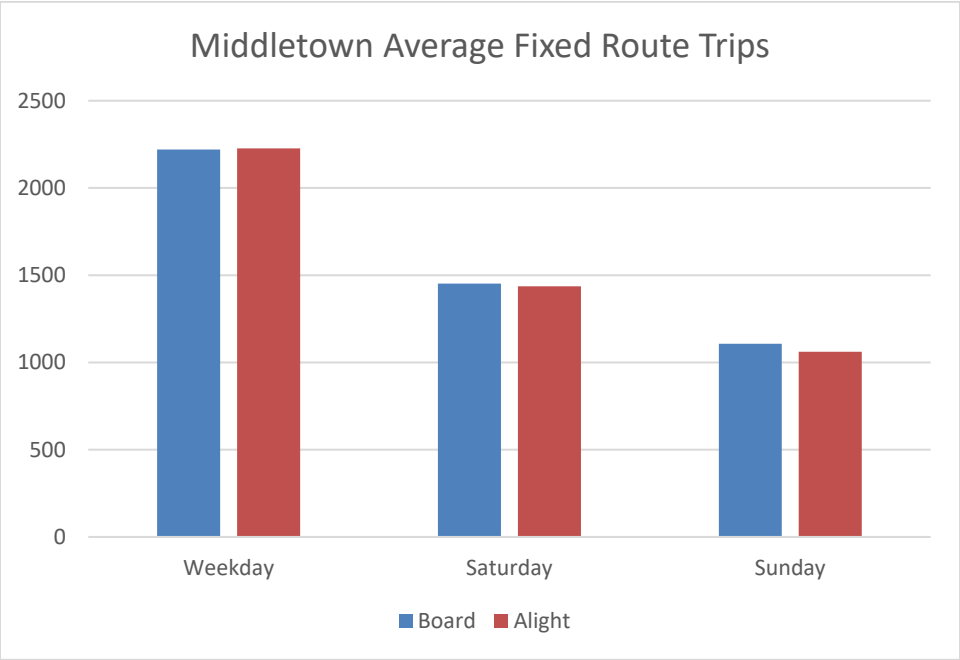
For those demand response trips that begin in Middletown, the top cross-zone destination is the East Bay Zone (Table 4-8). The majority of trips are in-zone, suggesting that an MOD pilot which focused on in-zone trips would have a strong market.

Table 4-8: Drop Zones for Pick Ups in Middletown

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	1,121
Middletown	8,403
Providence	166
Quonset	91
Smithfield	0
South Kingstown	153
West Warwick	107
Westerly	2
Woonsocket	2
Non-Zone	2,579
Grand Total	**12,624**

Fixed route service in the Middletown Zone is robust, as reflected by the large number of average daily trips on the fixed route system shown in Figure 4-15. There are over 2,000 fixed route trips served daily in the Middletown Zone as compared to roughly 80 demand response trips. This suggests that an MOD pilot runs the risk of siphoning off riders from the fixed route system.

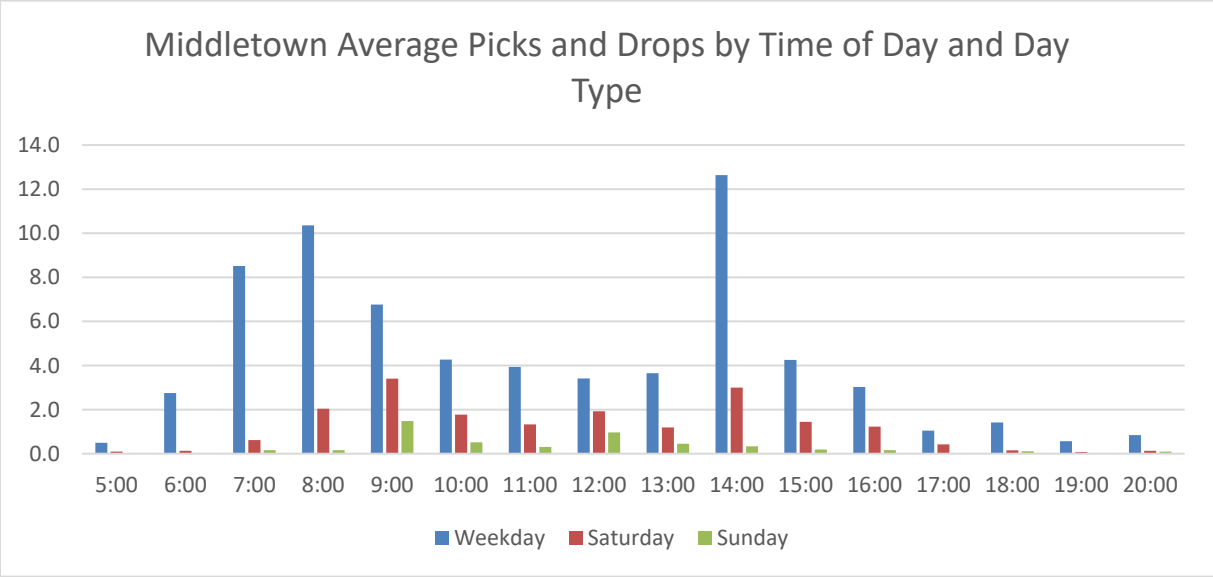
Figure 4-15: Middletown Zone Average Fixed Route Trips by Day Type



4.3.2.2.2 Span of Service

Demand response trips in the Middletown Zone, similar to the overall demand response trip distribution for the entire statewide system, peaks in the morning and in the afternoon – particularly in the 2:00 PM hour. This suggests that a microtransit pilot would face the highest trip demand during these time periods on weekdays, and relatively little demand during the middle of the day (Figure 4-16).

Figure 4-16: Middletown Average Demand Response Trips by Time of Day and Day Type*



**Includes both pick-ups and drop-offs in Middletown.*

Based on observed travel demand distribution, an MOD pilot should operate between 7:00 AM and 4:00 PM on weekdays only.

4.3.2.2.3 Number of Vehicles

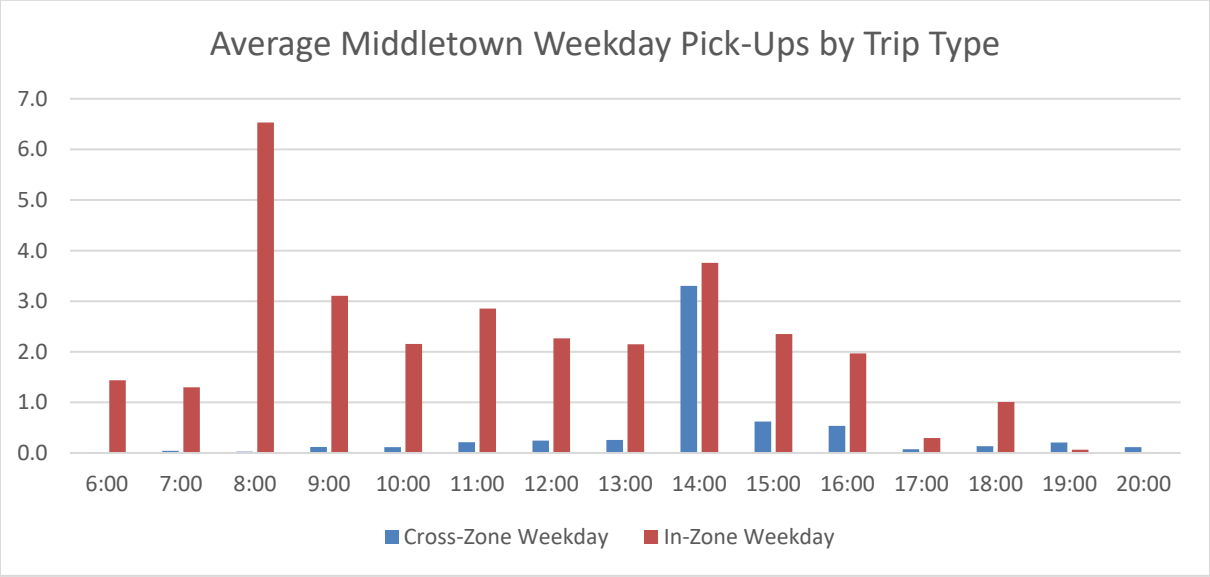
Given the relatively low Flex Service ridership, it is estimated that converting the service to an MOD service would serve an additional two riders per weekday (increasing from 21 trips to 23 trips per day). That, in combination with the estimated 9 additional trips available to serve through slack capacity, would increase trip capacity by a net 11 trips per day without adding any vehicles. In order to serve the total estimated in-zone latent demand (135 trips per day), 7 additional vans would be needed.

4.3.2.2.4 Connections to the Statewide Transit Network/Schedule Coordination

Six bus routes serve the Middletown Zone. Most of them operate roughly 12 hours per day, though the Route 60 operates 20 hours per day providing service between Newport and Providence. Given the small demand for cross-zone service (Figure 4-17), microtransit could focus on in-zone trips during the day while the fixed route system provides service to cross-zone destinations.

The spike in cross-zone service pick-ups at the 2:00 PM hour is a result of trips from the Looking Up program located in Middletown. This program provides support services to people with disabilities.

Figure 4-17: Average Middletown Weekday Pick-ups by Trip Type



**Does not include cross-zone trips outside of a proposed MOD zone.*

4.3.2.3 Service Costs

The Middletown Zone has a limited amount of weekday slack time that could be dedicated to providing on-demand microtransit service. The Flex Service is slightly less efficient than a microtransit service is estimated to be, serving 21 trips per weekday as opposed to an estimated 23 trips for an MOD service (Table 4-9).

Table 4-9: Estimated Middletown Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service	21	23	2
Demand Response Slack	0	9	9
Total	**21**	**32**	**11**

**Estimated at 2.2 trips per revenue hour*

***Net Capacity = Estimated Capacity – Trips Served*

There is an estimated latent demand of 180 weekday trips, with an in-zone latent demand of 134 weekday trips (Table 4-10). It would require significant resources to meet the estimated in-zone demand, with a strong possibility of drawing riders from the well-utilized fixed route system.

Table 4-10: Middletown MOD Service Estimates

Total Latent Weekday Trip Demand	180
Total In-Zone Latent Demand*	134
Total Customers Served per 8-Hour Shift**	18
Shift Needed to Serve In-Zone Demand	7
Total Cost by VRH***	**$1,164,818**
Total Cost for Shifts	$1,166,648

Total Latent Weekday Trip Demand	**180**
Total In-Zone Latent Demand*	134
Total Customers Served per 8-Hour Shift**	18
Shifts Needed to Serve In-Zone Demand	7
Total Cost for Shifts***	$1,166,648

**Assumes 75% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.3.3 Smithfield

Key Take-Aways:

- There is no Flex Service in Smithfield to redirect to an in-zone MOD pilot service, so a pilot service would rely on existing demand response slack capacity or additional resources.

- Demand response slack would be able to serve approximately 10 in-zone trips generated by latent demand.

- There is an estimated latent demand of 36 weekday trips in the Smithfield Zone, but existing trip patterns suggest that much of this demand (~85%) is for cross-zone service.

- Due to low existing and potential in-zone trip demand, this zone is not recommended for a pilot MOD demonstration project.

4.3.3.1 Zone Overview

The Smithfield Zone is northwest of Providence and has a relatively low population density, at 1.2 people per acre (as compared to 15.9 people per acre in the Providence Zone). In general, the zone has a relatively low proportion of people of color, people with disabilities, or zero-vehicle households. The main population center is in the Village of Greenville in the southwest section of the zone, which is served by two fixed bus routes, the Route 9x and the Route 58. RIPTA Route 50 runs to the Fidelity Investments Corporate Office, with Bryant University nearby.

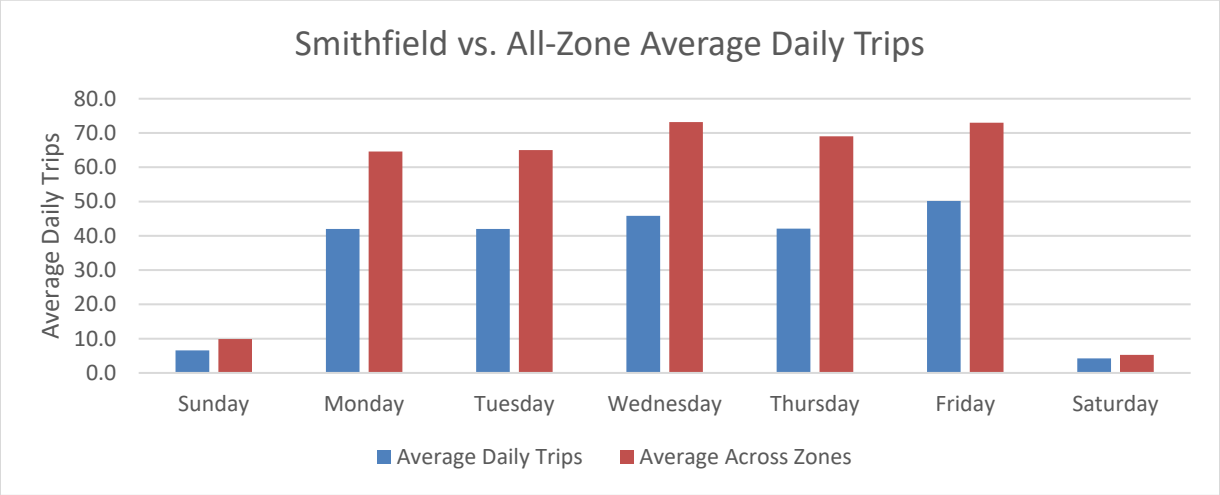
4.3.3.2 Operating Parameters

Due to the low-density operating environment and existing trip patterns of the zone, a microtransit service pilot is not recommended. If a microtransit pilot is implemented, it should focus on lifeline service and last-mile connections to RIPTA's fixed routes in the zone. Smithfield is one of two zones (the other being East Bay) where trip demand is strongest cross-zone (the top origin/destination pair with Smithfield is the Providence Zone). This suggests that cross-zone microtransit service *may* be appropriate in this context.

4.3.3.2.1 Level of Service

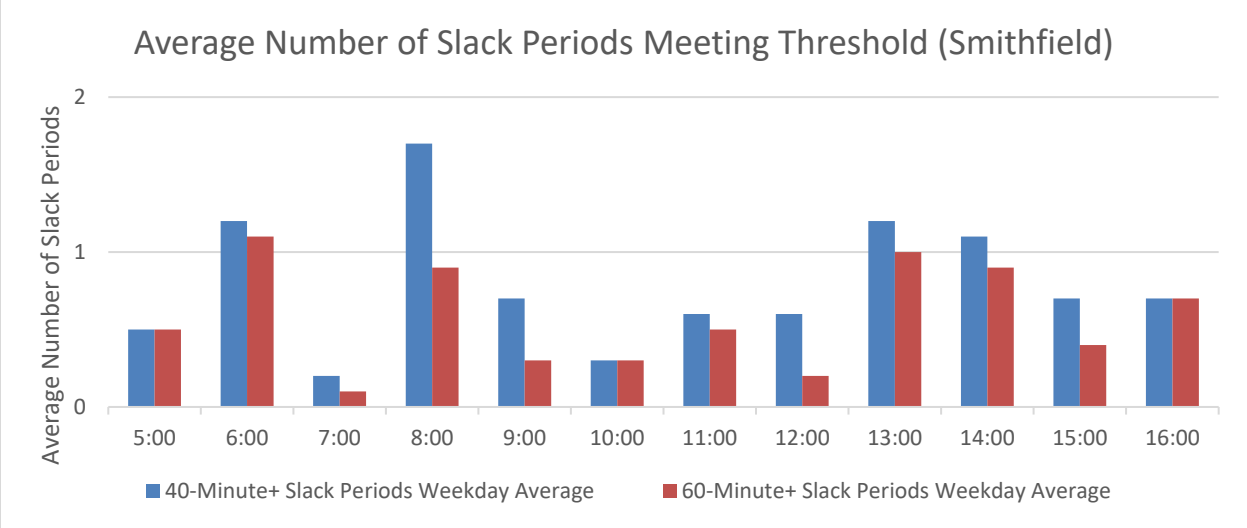
The Smithfield Zone shows a relatively small amount of demand for service during the week, with substantially reduced demand on weekends (Figure 4-18). Smithfield has the second-lowest trip demand of the zones analyzed.

Figure 4-18: Average Daily Trips for Smithfield Zone by Day Type Compared to All-Zone Average



Due to the fact that service levels provided in Smithfield are among the lowest of the zones examined, the opportunity for on-demand trips provided during slack periods is not robust. On average, there are 10 periods of 40-minutes-or-greater slack time in the Smithfield Zone per weekday, and seven periods of 60-minutes-or-greater slack time. Periods of slack time meeting these time thresholds are greatest in the morning and mid-afternoon (Figure 4-19).

Figure 4-19: Average Number of Slack Periods in Smithfield



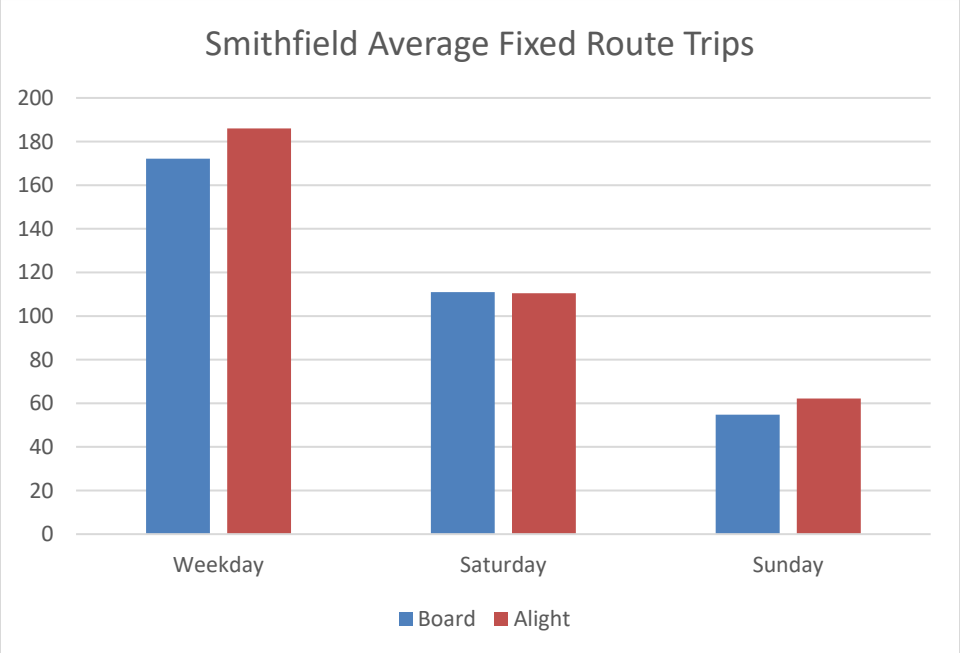
For those demand response trips that begin in Smithfield, the top cross-zone destination is the Providence Zone, followed by the Woonsocket Zone (Table 4-11). In-zone trips (within Smithfield) account for a very small proportion of overall trip demand in the zone (slightly over 16%, not counting "non-zone" trips). This suggests that a microtransit service using slack time to provide in-zone trips would have limited demand, even considering latent transit demand.

Table 4-11: Drop Zones for Pick Ups in Smithfield

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	344
Middletown	2
Providence	1,268
Quonset	3
Smithfield	422
South Kingstown	16
West Warwick	345
Westerly	0
Woonsocket	929
Non-Zone	5,126
Grand Total	**8,455**

Fixed route service into the Smithfield Zone serves more than four times the number of trips as the demand response service, as shown in Figure 4-20. This could suggest opportunity to provide last-mile service to feed the fixed route system, although the estimated latent demand for additional service was the lowest of the zones analyzed (36 trips per weekday, and only 5 in-zone). It is also unclear whether riders traveling to Providence or Woonsocket will be dissuaded from using an MOD service if it requires a transfer at the nearest in-zone bus stop.

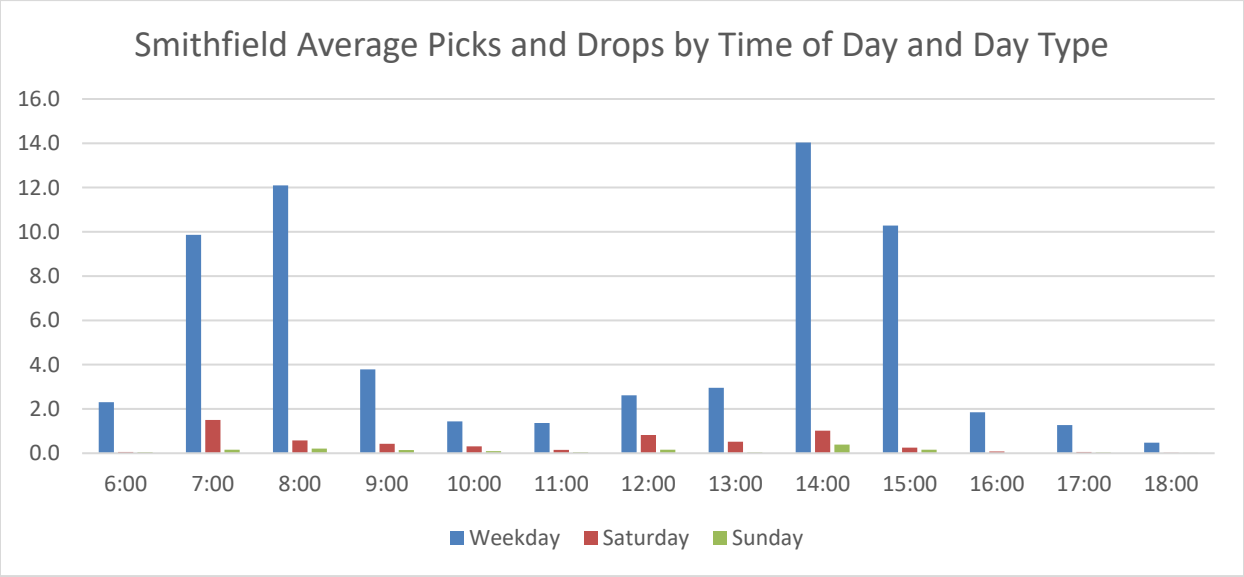
Figure 4-20: Smithfield Zone Average Fixed Route Trips by Day Type



4.3.3.2.2 Span of Service

Demand response trips in the Smithfield Zone, similar to the overall demand response trip distribution for the entire statewide system, has two peaks on weekdays, one in the morning and one in the afternoon. Surprisingly, Saturday has the same trip distribution pattern, though overall demand on Saturdays is much lower. This suggests that a microtransit pilot would face the highest trip demand during these time periods on weekdays, and relatively little demand during the middle of the day (Figure 4-21).

Figure 4-21: Smithfield Average Demand Response Trips by Time of Day and Day Type*



**Includes both pick-ups and drop-offs in Smithfield.*

Based on observed travel demand distribution, an MOD pilot should operate between 7:00 AM and 4:00 PM on weekdays only.

4.3.3.2.3 Number of Vehicles

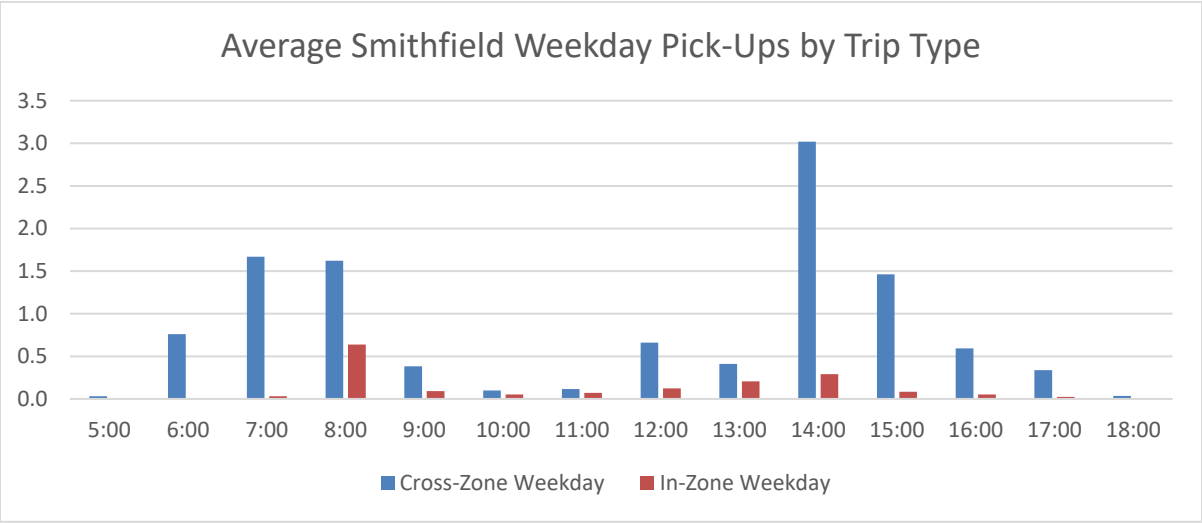
Given the very modest demand for in-zone MOD service, a dedicated vehicle is not recommended should RIPTA choose to pursue a pilot program in Smithfield. Utilizing existing slack time of demand response vehicles already in Smithfield would be a cost-neutral solution (excluding any software development costs associated with implementing an MOD platform).

4.3.3.2.4 Connections to the Statewide Transit Network/Schedule Coordination

Three bus routes serve the Smithfield Zone. The 9x operates for roughly 12 hours between 6:46 AM and 6:32 PM, Monday through Friday. Route 50 operates nearly 20 hours per weekday and provides reduced service on Saturday and Sunday, serving Fidelity Corporate Campus and nearby Bryant University. Route 58 operates from 5:43 AM to 8:30 PM Monday through Friday with limited Saturday service.

Given that there is very strong demand for cross-zone service (Figure 4-22), microtransit service may need to operate at times that are complementary to the fixed route service. This could provide last-mile connections for people traveling to Providence, to which all of these routes provide service.

Figure 4-22: Average Smithfield Weekday Pick-ups by Trip Type



**Does not include cross-zone trips outside of a proposed MOD zone.*

4.3.3.3 Service Costs

The Smithfield Zone has a limited amount of weekday slack time that could be dedicated to providing on-demand microtransit service. There is no Flex Service capacity that could be redirected toward a microtransit pilot.

Table 4-12: Estimated Smithfield Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service	0	0	0
Demand Response Slack	0	10	10
Total	**0**	**10**	**10**

**Estimated at 2.2 trips per revenue hour*

***Net Capacity = Estimated Capacity – Trips Served*

There is an estimated latent demand of 36 weekday trips, with an in-zone latent demand of 5 weekday trips (Table 4-13). Latent in-zone demand could easily be served using existing resources, as 10 trips could be served by using slack time in the schedule for on-demand service. Therefore, it is not recommended to allocate additional resources to run an on-demand microtransit service. Should RIPTA wish to pursue an MOD pilot in the Smithfield Zone, it is recommended to use existing slack resources.

Table 4-13: Smithfield MOD Service Estimates

Total Latent Weekday Trip Demand	36
Total In-Zone Latent Demand*	5
Total Customers Served per Shift**	18
Shift Needed to Serve In-Zone Demand	0
Total Cost for all Shifts***	**$0**

**Assumes 14.5% of total latent demand is for in-zone trips.*
***Assumes 8 revenue hours per shift at 2.2 trips per hour.*
****Assumes $166,664 operating cost per 8-hour shift.*

4.3.4 South Kingstown

Key Take-Aways:

- The presence of the University of Rhode Island in an otherwise low-density setting provides for a unique context.

- It would significantly diminish service efficiency to reallocate existing Flex Service capacity to an MOD pilot.

- Demand response slack would be able to serve approximately 7 in-zone trips generated by latent demand.

- There is an estimated latent demand of 110 weekday trips in the South Kingstown Zone, and existing trip patterns suggest that much of this demand (84%) is for in-zone service.

- Due to the strong in-zone transit demand and presence of URI, as well as the lack of transit options to outlying areas, there is some potential for a successful MOD pilot.

4.3.4.1 Zone Overview

The South Kingstown Zone is on the south coast of Rhode Island and has the lowest population density of any zone examined, at 0.87 people per acre (as compared to a statewide average of 1.6 people per acre). The population is centered in Narragansett and has strong fixed route options due to the presence of the University of Rhode Island (URI). Routes 14, 62, 64, 65X, and 66 serve the zone, as well as the Kingston and Narragansett Flex Service Zones. With the exception of the Flex Zones, transit service is focused on URI and Narragansett, with no service in outlying areas.

The zone has the lowest unemployment rate of the zones examined, though among the highest rates of low-income households. This may be due to the presence of the URI, which may classify students as "low-income" but would not impact the unemployment rate. The large student population may also contribute to an observed low rate of people with disabilities.

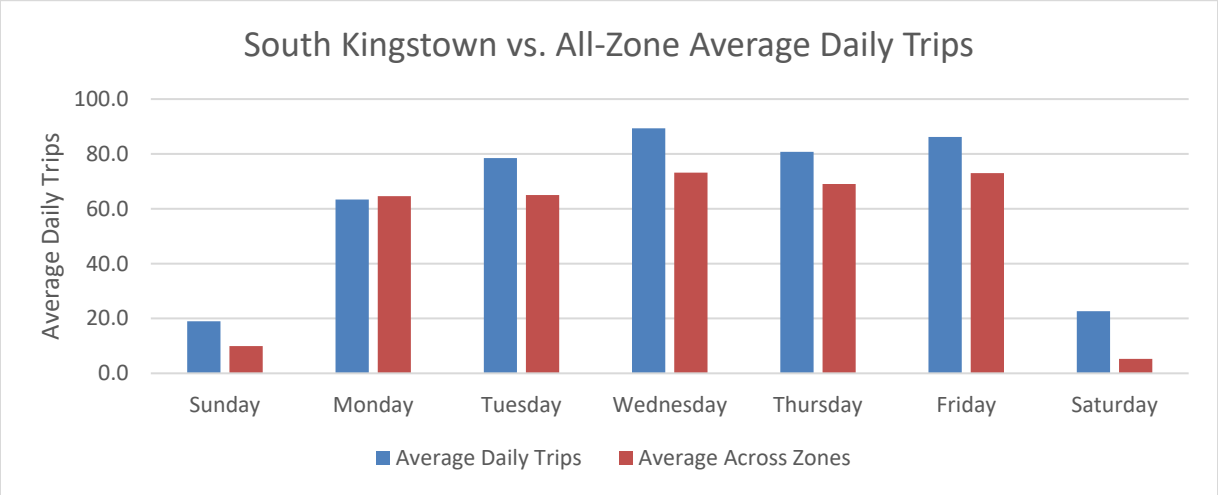
4.3.4.2 Operating Parameters

Despite a very low density overall, the presence of the flagship university and nearly 20,000 students create a strong transit market, particularly for fixed route service. There is little demand response service relative to the Flex Service, perhaps due to the operation of two Flex Zones in the proposed zone. An MOD pilot would best serve the zone by filling in gaps in existing service, such as late-night service or service to outlying areas currently unserved.

4.3.4.2.1 Level of Service

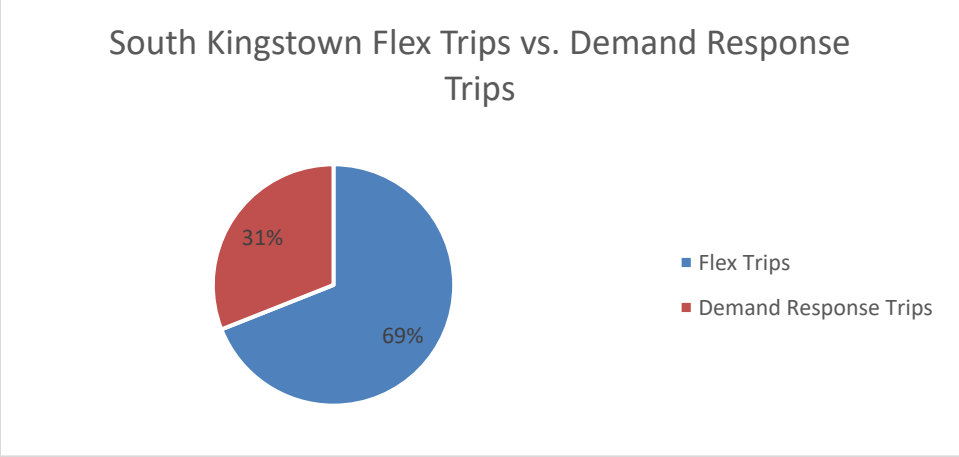
The South Kingstown Zone shows a somewhat stronger demand for service relative to the average across all zones (Figure 4-23).

Figure 4-23: Average Daily Trips for South Kingstown Zone by Day Type Compared to the Average of All Zones



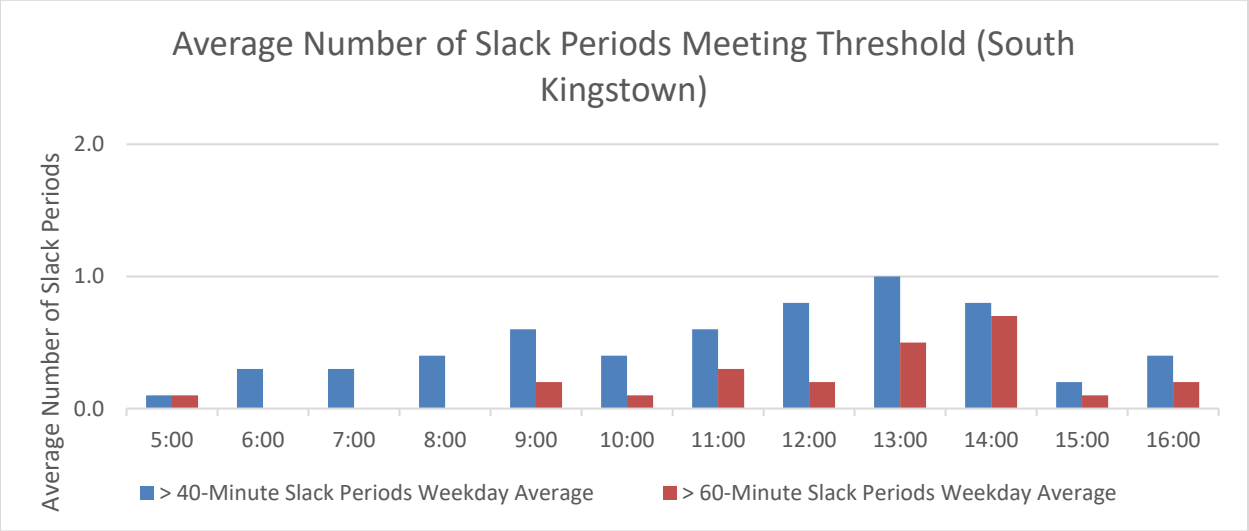
South Kingstown is served by both Flex Service and demand response, with flex trips comprising over two-thirds of non-fixed route service (Figure 4-24). This may be the result of two Flex Service zones in the proposed zone, or the presence of the large student population reducing the proportion of trips provided by ADA service.

Figure 4-24: Flex Trips vs. Demand Response Trips in South Kingstown



Because of the low proportion of demand response service provided in the South Kingstown Zone, there are relatively few slack periods that could be repurposed for on-demand trips. There is an average of 7 periods per weekday which could accommodate an on-demand trip (40 minutes or greater), and fewer than 3 periods of slack 60 minutes or greater. Periods of slack time meeting these time thresholds are greatest in the morning and mid-afternoon (Figure 4-25).

Figure 4-25: Average Number of Slack Periods in South Kingstown



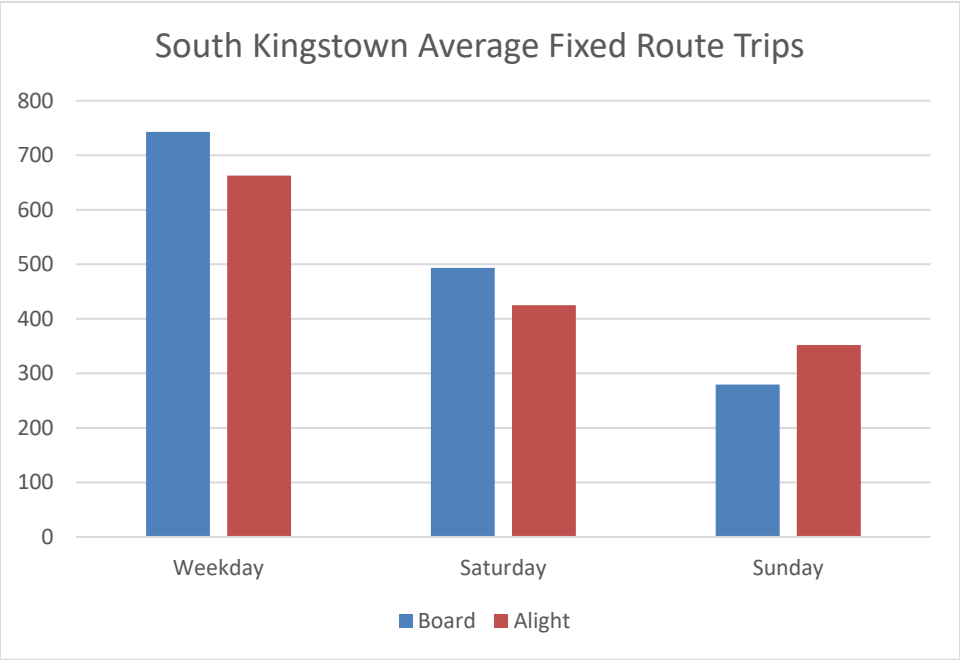
For those demand response trips that begin in South Kingstown, the top cross-zone destination is the Westerly Zone (Table 4-14). In-zone trips (within South Kingstown) account for the vast majority of overall trip demand in the zone (slightly 84%, not counting "non-zone" trips). This suggests that a microtransit service using slack time to provide in-zone trips would have a significant market.

Table 4-14: Drop Zones for Pick Ups in South Kingstown

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	29
Middletown	343
Providence	83
Quonset	46
Smithfield	7
South Kingstown	12,272
West Warwick	154
Westerly	1,099
Woonsocket	5
Non-Zone	1,851
Grand Total	**15,889**

Fixed route service into the South Kingstown Zone serves roughly ten times the number of trips as the demand response service, as shown in Figure 4-26. However, fixed route ridership is likely skewed by the presence of URI, and there are significant portions of the zone that are not served by fixed route or Flex Service transit. Given the estimated latent demand estimate of 92 in-zone trips per day, there is opportunity for a MOD service to enhance mobility.

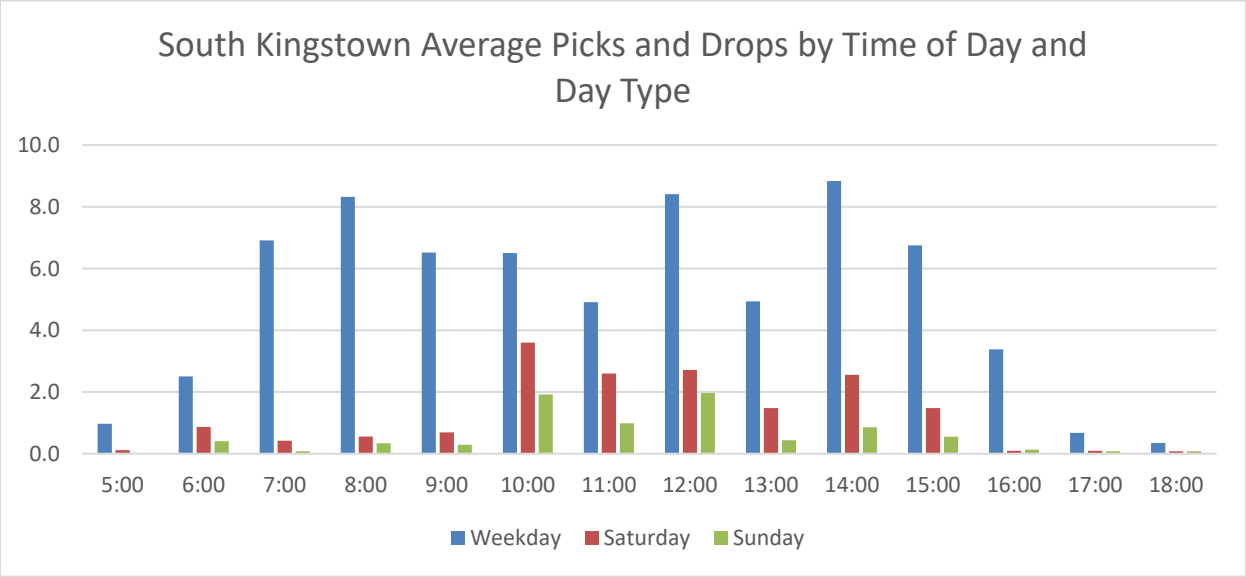
Figure 4-26: South Kingstown Zone Average Fixed Route Trips by Day Type



4.3.4.2.2 Span of Service

Demand response trips in the South Kingstown Zone have peaks in the morning and afternoon, but also have a surge during the 1 PM hour, potentially due to lunch trips. There is also surprisingly strong mid-day demand on Saturdays. This suggests that, unless an MOD project were limited to only late-night service, the strongest periods of demand would follow the trend found in Figure 4-27.

Figure 4-27: South Kingstown Average Demand Response Trips by Time of Day and Day Type*



**Includes both pick-ups and drop-offs in South Kingstown.*

Based on observed travel demand distribution, an MOD pilot should operate between 7:00 AM and 5:00 PM on weekdays only.

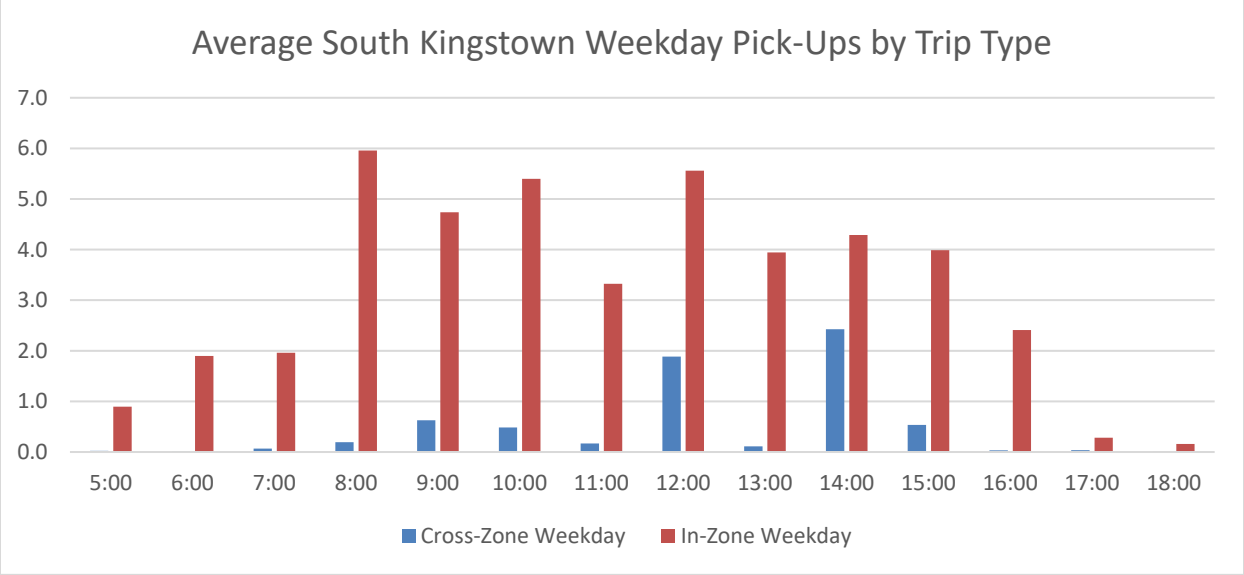
4.3.4.2.3 Number of Vehicles

Given the robust use of Flex Service, it is not recommended to reallocate those vehicles to an MOD pilot. Existing slack capacity can only serve a modest number of new in-zone trips (7 per weekday on average), and so if an MOD pilot were initiated, it is recommended to dedicate up to 5 additional vehicles. That would provide the capacity for estimated in-zone latent demand (92 trips).

4.3.4.2.4 Connections to the Statewide Transit Network/Schedule Coordination

Five bus routes and two Flex Service Zones serve the South Kingstown Zone. The routes serving URI provide a relatively high level of service, with the Route 66 running from 5:30 AM to midnight on weekdays. The Narragansett Flex Service operates for 12 hours per day, while the Kingston Flex Service operates for 9 hours per day. Given that there is very weak demand for cross-zone service (Figure 4-28), microtransit service should focus on providing service within the zone.

Figure 4-28: Average South Kingstown Weekday Pick-ups by Trip Type



**Does not include cross-zone trips outside of a proposed MOD zone.*

4.3.4.3 Service Costs

The South Kingstown Zone has a limited amount of weekday slack time that could be dedicated to providing on-demand microtransit service. The Flex Service provides a relatively high number of trips that is not estimated to be matched if it were converted to an MOD service. There would be an estimated net drop in trip capacity of 27 trips per weekday if the Flex Service were converted to MOD service (Table 4-15).

Table 4-15: Estimated South Kingstown Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service	55	28	(27)
Demand Response Slack	0	7	7
Total	**55**	**35**	**(20)**

**Estimated at 2.2 trips per revenue hour*

***Net Capacity = Estimated Capacity – Trips Served*

There is an estimated latent demand of 110 weekday trips, with an in-zone latent demand of 92 weekday trips. Latent in-zone demand could be served using existing resources, as 7 trips could be served by using slack time in the demand response schedule for on-demand service. However, it is not recommended to reallocate any Flex Service vans to an MOD service. Therefore, it is recommended to devote up to 6 weekday shifts to an MOD pilot at a cost of just under $1,000,000 per year should a pilot be pursued.

Table 4-16: South Kingstown MOD Service Estimates

Total Latent Weekday Trip Demand	**110**
Total In-Zone Latent Demand*	92
Total Customers Served per 8-Hour Shift**	18
Shifts Needed to Serve In-Zone Demand	6
Total Cost for Shifts***	$999,984

Total Latent Weekday Trip Demand	110
Total In-Zone Latent Demand*	92
Total Customers Served per 8-Hour Shift**	18
Shift Needed to Serve In-Zone Demand	6
Total Cost by VRH***	**$874,199**
Total Cost for Shifts	$999,984

**Assumes 84% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.3.5 West Warwick

Key Take-Aways:

- The vast majority of trips (84%) are demand response trips and the remainder are Flex trips.

- Given available slack time, 7 on-demand in-zone trips could be served on weekdays with minimal impact to operating costs.

- Converting the Flex Service to a microtransit service would expand capacity by 12 trips per weekday.

- There is an estimated latent demand of 247 weekday trips in the West Warwick Zone, with an in-zone latent demand of 98 weekday trips.

- Due to the presence of the major commercial corridor along Route 2 and the expected development of a transit hub at the Community College of Rhode Island - Knight Campus, West Warwick is recommended for an MOD pilot.

4.3.5.1 Zone Overview

The West Warwick Zone, which includes the communities of West Warwick, Coventry, and a portion of Warwick, is located to the southwest of Providence and includes a major commercial corridor located along Route 2. At just under 4 people per acre, it is a somewhat lower density zone, with the City of West Warwick comprising the main population center.

West Warwick is served by four bus routes: Route 12x, Route 13, Route 29, and Route 242 (Flex Service). With the exception of the Route 12x, the routes generally provide service on an east-west alignment between Warwick, West Warwick, and Coventry. There is limited or no service on weekends on these routes.

The 2040 Transit Master Plan *Transit Forward* identified the Community College of Rhode Island (CCRI) Knight Campus in Warwick as a potential Community Mobility Hub. This would create a locus of transportation options centered on the campus and could provide a strong rationale for first mile/last mile service provided by an MOD solution.

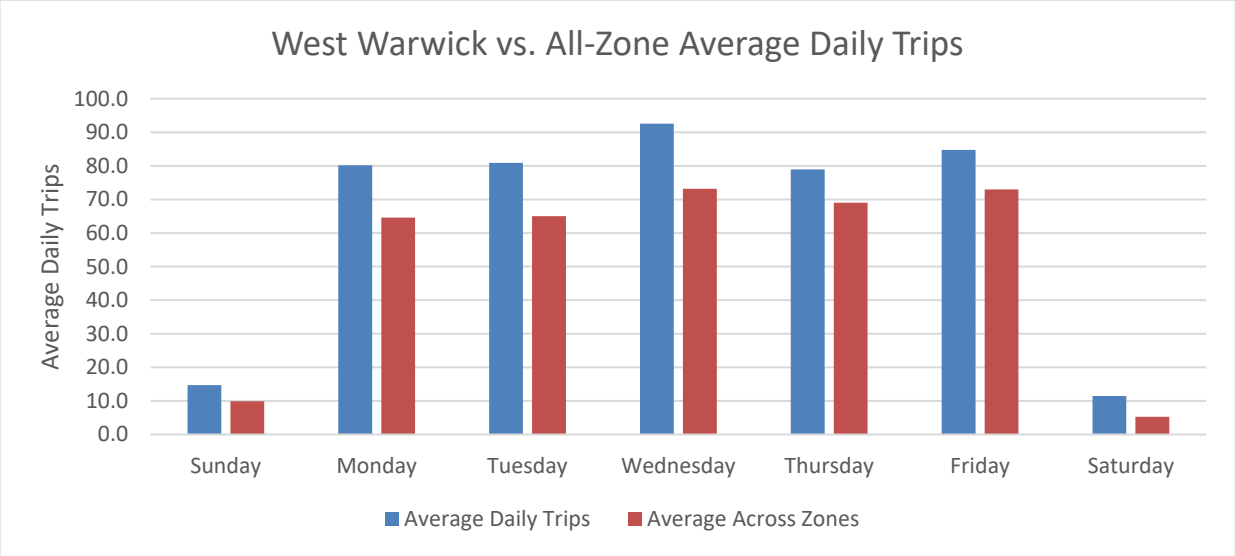
4.3.5.2 Operating Parameters

Existing trip patterns suggest demand for both in-zone door-to-door service and last-mile service to fixed route bus stops. The Warwick Mall serves as the transfer point for most fixed route trips into and out of Providence, with a planned creation of a mobility hub at CCRI. MOD options that provide greater access to Warwick Mall and/or CCRI could satisfy not only local employment and shopping trips, but also demand for service into Providence.

4.3.5.2.1 Level of Service

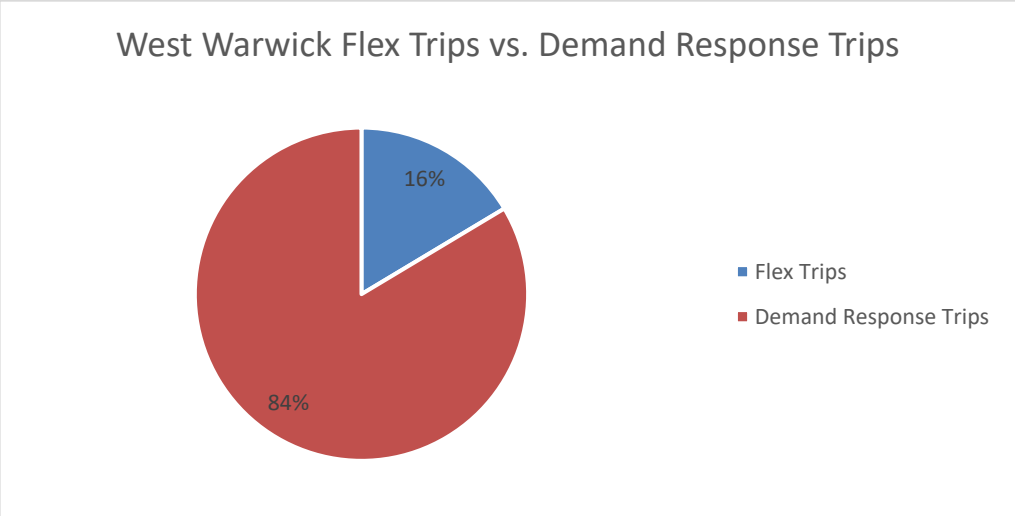
The West Warwick Zone has the second-highest level of trips of the zones analyzed in this section, behind Woonsocket (Figure 4-29). This is attributable to its higher residential and commercial density as well as the existence of both Flex Service and demand response service.

Figure 4-29: Average Daily Trips for West Warwick Zone by Day Type Compared to Average of All Zones



West Warwick has both demand response and Flex Service, with 16% of trips served on the Flex Service (Figure 4-30).

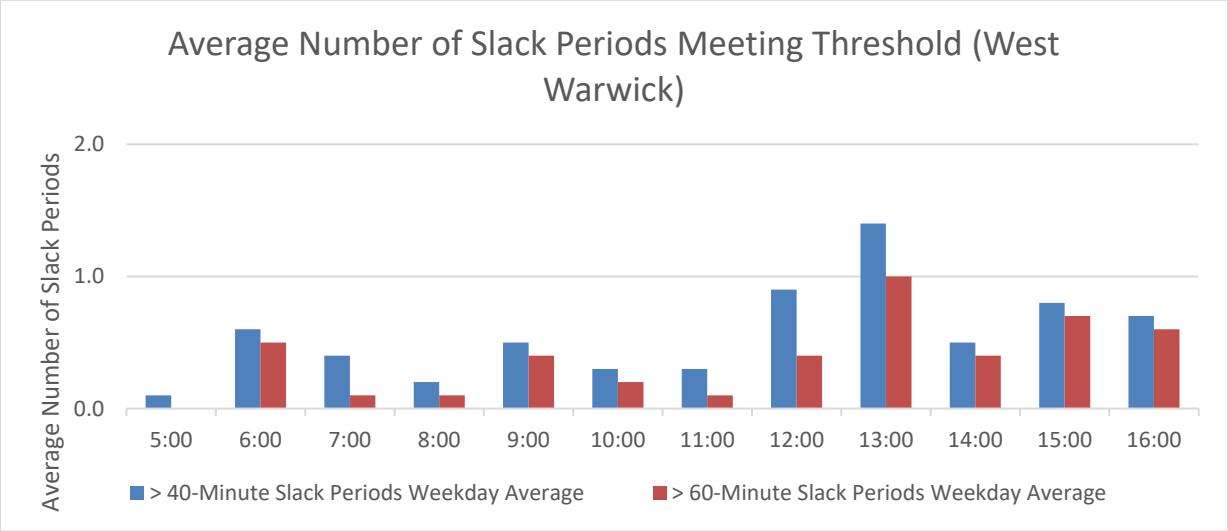
Figure 4-30: Flex Trips vs. Demand Response Trips in West Warwick



** Includes only pick-ups in the West Warwick Zone*

While Flex Service operates deviations along a fixed route, demand response service has periods of slack. This provides the opportunity to deliver some on-demand service during periods between pre-scheduled pick-ups and drop-offs. As seen in Figure 4-31, the greatest opportunity for picking up an on-demand trip during a period of slack is in the afternoon time period.

Figure 4-31: Average Number of Slack Periods Meeting Minimum Duration Threshold



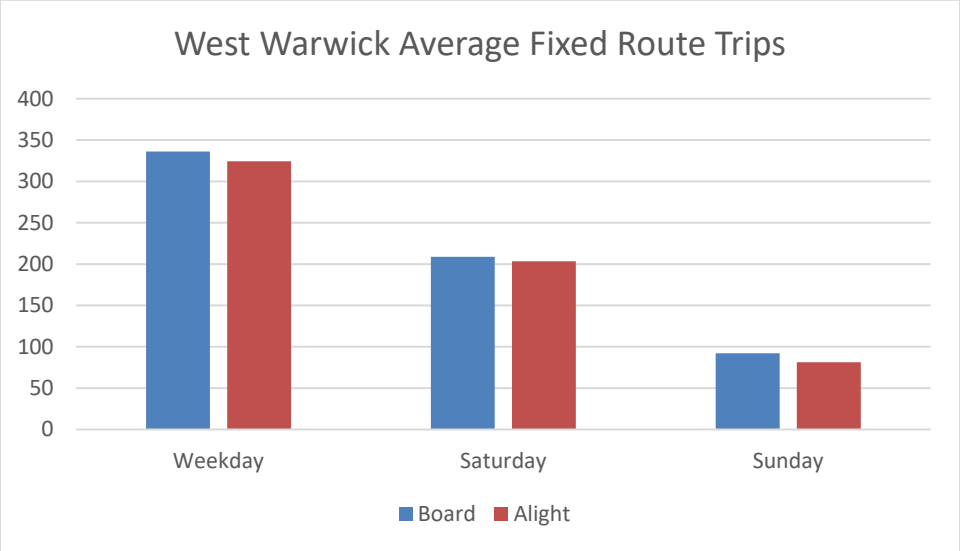
There is substantial demand for in-zone trips, which could be reasonably served during a slack time window. As shown in Table 4-17, the top destination for demand response trips originating in the West Warwick Zone is to another location in the West Warwick Zone (not counting trips into areas outside of a zone, or "non-zone" trips). A close second is destinations in the Providence Zone, with the other zones comprising relatively small proportions of other trip destinations.

Table 4-17: Drop Zones for Pick-Ups in West Warwick

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	230
Middletown	85
Providence	1,479
Quonset	82
Smithfield	309
South Kingstown	115
West Warwick	1,745
Westerly	0
Woonsocket	15
Non-Zone	11,380
Grand Total	**15,440**

As shown above in Table 4-17, there is a relatively small percentage of trips served by Flex Service. The fact that existing Flex Service is not well utilized relative to demand response service could indicate that transportation needs are generally being met with fixed route service. Indeed, fixed route service provides roughly four times the number of average daily trips as compared to demand response service, suggesting that the service is well utilized (Figure 4-32).

Figure 4-32: Average Fixed Route Trips in West Warwick by Day Type

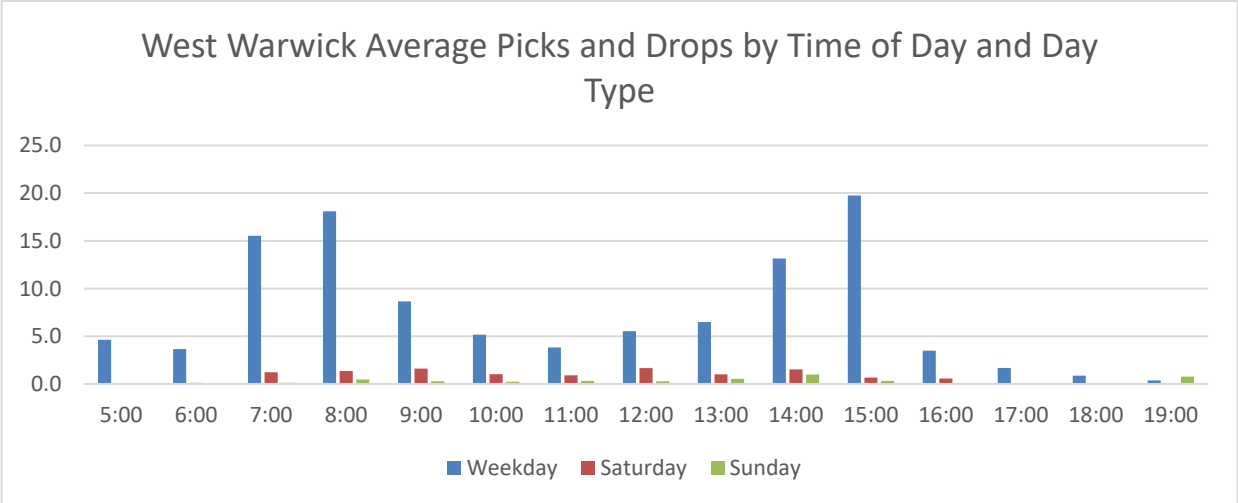


Modeled latent demand for the zone is relatively robust, at an estimated 247 additional trips per day (98 in-zone trips per day). This suggests substantial opportunity for expanding travel options for residents in the West Warwick Zone based on the population distribution and characteristics of the area. All of these factors should be considered when deciding whether to implement an MOD service in the West Warwick Zone, even on a pilot basis.

4.3.5.2.2 Span of service

Most trips take place in the morning and mid-afternoon, with a mid-day lull at its lowest between 11:00 AM and noon (Figure 4-33). Very few trips take place on Saturdays or Sundays, and trip demand ends around 7:00 PM.

Figure 4-33: Average Trips by Time of Day and Day Type in the West Warwick Zone



**Includes Pick-Ups in and Drop-Offs into the West Warwick Zone*

Based on observed travel demand distribution, an MOD pilot should operate between 7:00 AM and 4:00 PM on weekdays only.

4.3.5.2.3 Number of Vehicles

If microtransit service is provided for in-zone trips only, and if periods of slack greater than 40 minutes could be converted into on-demand trips, then an additional seven trips could be provided without adding any additional van capacity.

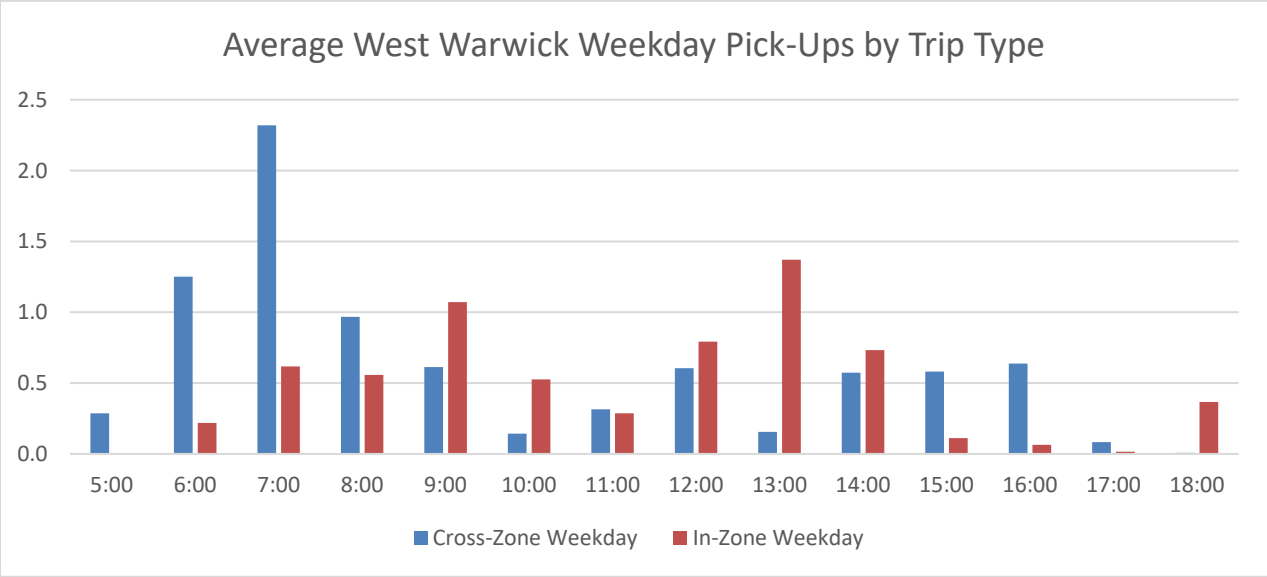
Furthermore, there are only 14 weekday trips on average being served by the Flex Service. Based on the number of Flex Service revenue hours available (12 hours), 26 on-demand trips could be served in the West Warwick Zone if the Flex Service were converted to an on-demand service (assuming it achieves an average rate of 2.2 trips per revenue hour).

However, there is still substantial latent in-zone demand for service in the West Warwick Zone (98 trips per weekday are estimated). An additional 4 vans per weekday would be needed to meet the estimated in-zone trip demand.

4.3.5.2.4 Connections to the Statewide Transit Network/Schedule Coordination

As shown in Figure 4-34, cross-zone pick-ups tend to take place earlier in the day while in-zone trips are spread more evenly throughout. Due to the potential development of a Community Mobility Hub at CCRI, if a microtransit service for the West Warwick Zone were implemented, there may be strong transit demand for first-mile/last-mile service to CCRI. Based on existing weekday trip patterns, this would likely take the form of travel *to* CCRI in the morning for people traveling to Providence, and then the reverse (*from* CCRI) in the afternoon. If a van or vans were dedicated to door-to-door microtransit service in the West Warwick Zone, this travel pattern should be taken into consideration when assigning areas for MOD vehicles to "float."

Figure 4-34: Average Weekday Pick-Ups by Trip Type in West Warwick



4.3.5.3 Service Costs

Existing resources (demand response slack time and Flex Service) in the West Warwick Zone could support a net additional 19 microtransit trips out of an estimated in-zone latent demand of 98 trips (Table 4-18).

Table 4-18: Estimated West Warwick Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service* **	14	26	12
Demand Response Slack	0	7	7
Total	**14**	**33**	**19**

**Estimated at 2.2 trips per revenue hour*

***Net Capacity = Estimated Capacity – Trips Served*

****Assumes 12 vehicle revenue hours per weekday*

It is recommended to provide additional service using existing slack capacity and converting the existing Flex Route into an in-zone on-demand service if a pilot is pursued. This would be cost-neutral or at a very low cost, not counting the software development costs for creating an MOD mobile application.

Should RIPTA choose to add additional vehicles to an on-demand service, it would cost approximately $833,320 to serve all in-zone latent demand (Table 4-19). This assumes a cost of $166,664 per 8-hour shift and an average of 18 customers served per shift.

Table 4-19: West Warwick MOD Service Estimates

Total Latent Weekday Trip Demand	**247**
Total In-Zone Latent Demand*	98
Total Customers Served per 8-Hour Shift**	18
Shifts Needed to Serve In-Zone Demand	5
Total Cost for Shifts***	$833,320

**Assumes 40% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.3.6 Westerly

Key Take-Aways:

- The Westerly Zone has no demand response service provided and therefore no slack capacity to use for on-demand in-zone service.

- There is an estimated latent demand of 90 weekday trips in the Westerly Zone, with an in-zone latent demand of 81 trips.

- Converting the existing Flex Service to an on-demand microtransit service is not recommended, as it would result in a net loss of capacity.

- The majority of Flex trips served are in-zone trips. Due to the strong in-zone demand and general lack of transportation resources, this zone is recommended for a pilot MOD demonstration project in addition to maintaining existing Flex Service.

4.3.6.1 Zone overview

The Westerly Zone is in the southwestern part of Rhode Island bordering Connecticut and consists of the Town of Westerly. It is in a relatively low-density portion of the state at just over one person per acre, the second-lowest population density of the zones examined (behind South Kingstown).

Given the rural nature of the zone, it is unsurprising that transit service is minimal. There is no weekend service provided and weekday service does not run later than 6:30 PM. The 95x provides commuter-style service into Providence in the morning and back to Westerly in the afternoon/evening, while the other two public transportation options are Flex Service (Route 204 provides connectivity east to Narragansett while Route 301 provides connections north to Hope Valley).

The main commercial area is along US Route 1, and the largest nearby population center is New London, Connecticut. In terms of demographics, Westerly is on the low end for proportion of the population that is low-income, has a disability, or people of color.

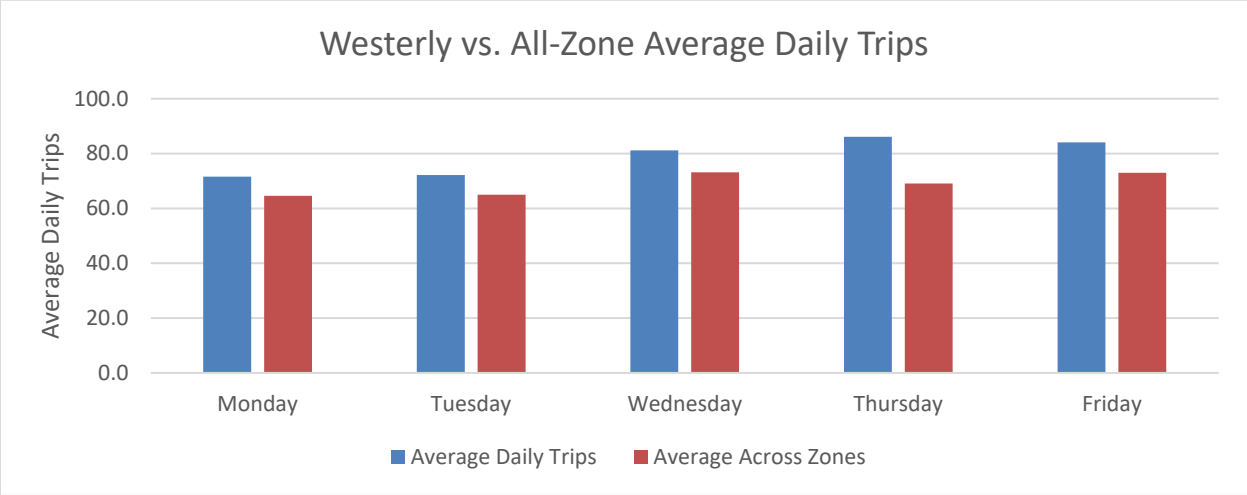
4.3.6.2 Operating Parameters

The presence of the two existing Flex Services, in addition to existing demand response trip patterns, creates a use-case for a microtransit service that focuses on trips within the Westerly Zone. Aspects of the existing service and the implications for a potential MOD service pilot are explored in greater detail below.

4.3.6.2.1 Level of Service

Westerly shows the strongest trip demand on Thursdays and Fridays, with Thursdays presenting especially strong demand relative to the average across zones (Figure 4-35).

Figure 4-35: Average Daily Trips for Westerly Zone by Day Type Compared to Average Across Zones



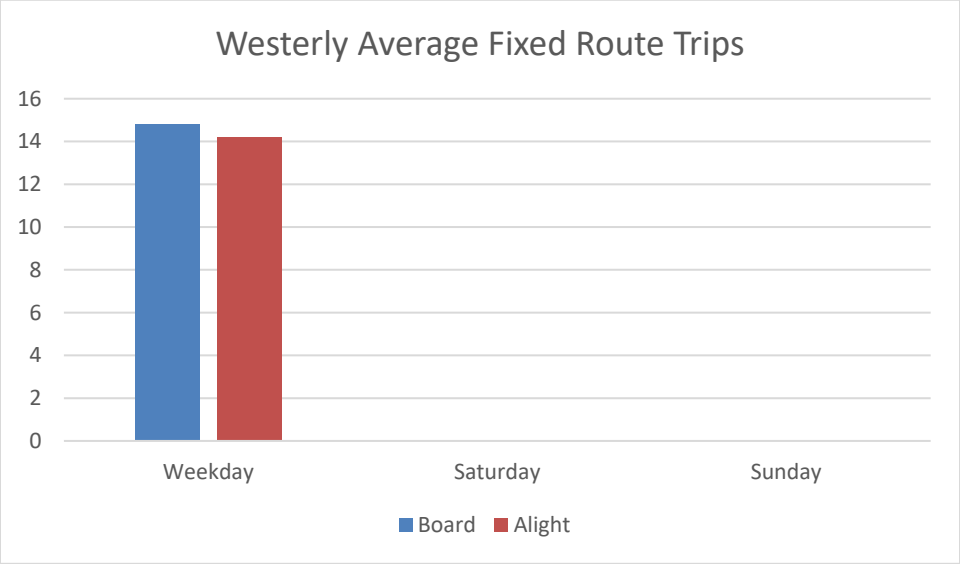
With 90% of all trips provided in-zone, Westerly has among the highest proportion of trips with both the origin and destination inside its zone of the zones analyzed. Of trips originating in Westerly, no other zone comes close to the level of service demand as Westerly-to-Westerly trips (Table 4-20). This suggests that a service design focusing on in-zone trips would be effective for a microtransit pilot.

Table 4-20: Drop Zones for Pick-Ups in Westerly

Drop Zone	Number of Drop-Offs
Beach Pond	13
East Bay	0
Middletown	2
Providence	673
Quonset	0
Smithfield	1
South Kingstown	980
West Warwick	0
Westerly	15,408
Woonsocket	1
Non-Zone	291
Grand Total	**17,369**

The existence of two existing Flex Service routes in the proposed Westerly Zone also suggests that the residents in that area are primed for non-traditional transit options. The lack of traditional fixed route transit is a strong argument for utilizing new service delivery models and technologies to meet the mobility needs of the residents in Westerly. While nearly 90 pick-ups are delivered every weekday on the Flex Service, only 14 trips are taken on weekdays using the fixed route service (Figure 4-36).

Figure 4-36:. Average Fixed Route Trips by Day Type

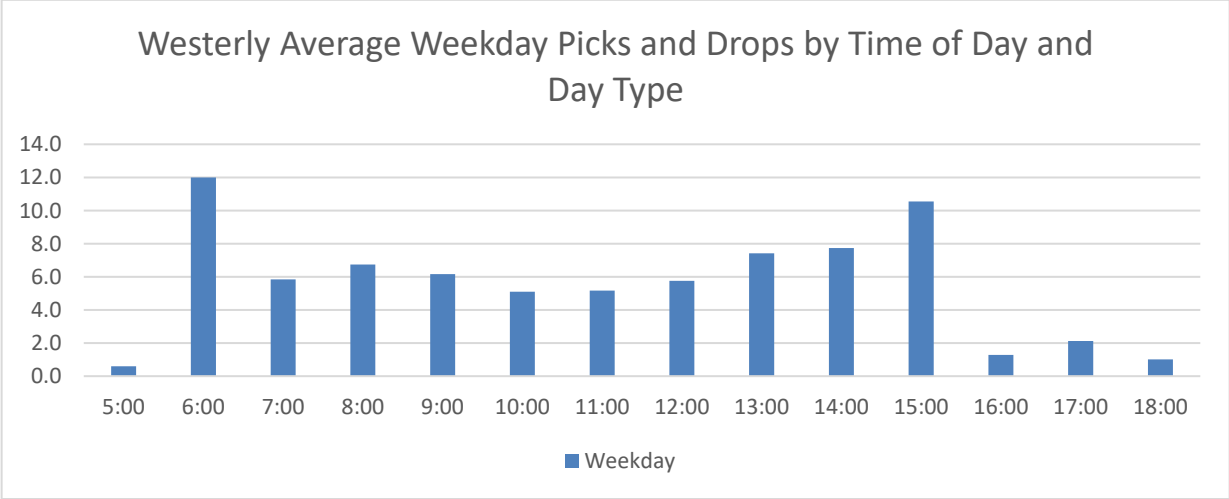


**Fixed route service not provided on weekends*

4.3.6.2.2 Span of service

There is currently no weekend public transportation service provided in Westerly. Similar to the overall travel demand, peak periods of travel on the demand response system are in the morning and mid-afternoon (Figure 4-37).

Figure 4-37: Flex vs. Demand Response Weekday Westerly Trips by Time of Day



**Includes both pick-ups and drop-offs*

Based on observed travel demand distribution, an MOD pilot should operate between 7:00 AM and 4:00 PM on weekdays only.

4.3.6.2.3 Number of Vehicles

The Westerly Zone is one of the most geographically removed from the population center of the state (Providence). Because the deadhead cost of going into and out of the Westerly Zone is relatively high

due to its rural location, there may be even more rationale for assigning a vehicle or vehicles as a part of an MOD service and providing only in-zone trips.

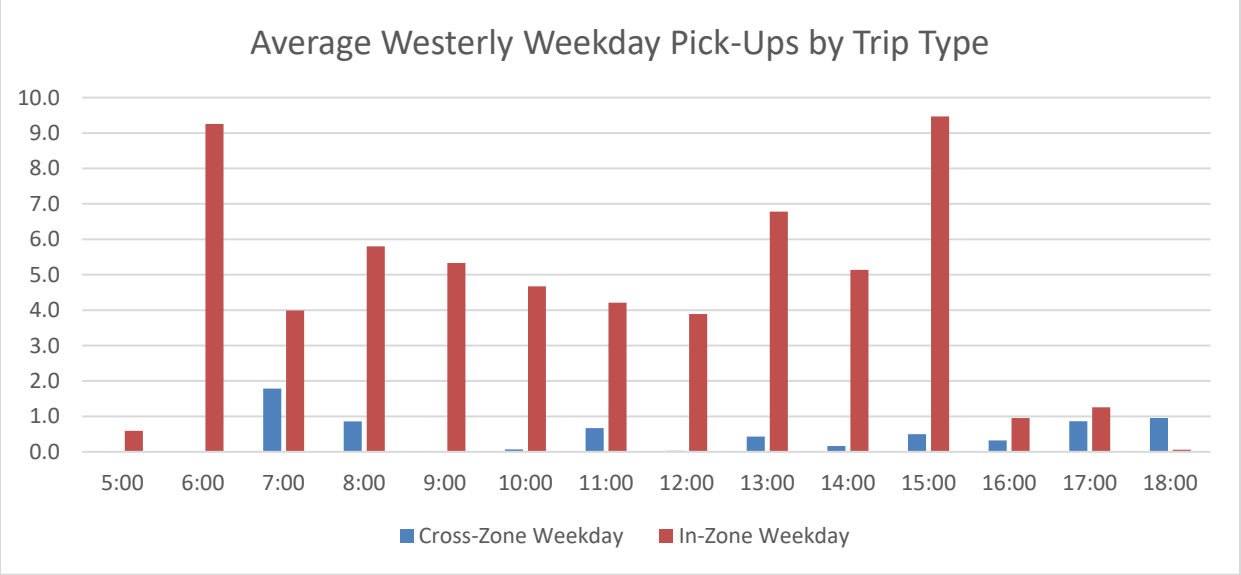
There are currently two vehicles serving the two Flex Service routes operating in Westerly, each operating for roughly 8 hours per weekday. It is not recommended to repurpose the vehicles serving those routes to an on-demand service, as that would reduce overall trip capacity (see Table 4-21 for a detailed breakdown of trip capacity).

Based on an in-zone latent demand of 81 trips per weekday, it is estimated that 5 vans running 8 hours per day would be able to meet MOD trip demand. However, it is recommended that a pilot start with one van to gauge market demand and grow the service as appropriate.

4.3.6.2.4 Connections to the Statewide Transit Network/Schedule Coordination

The one traditional fixed route bus route serving Westerly (Route 95x) is an express commuter bus running to and from Providence. An on-demand microtransit service could provide last-mile service to the Park and Ride for commuters traveling to/from the city. Conveniently, one of the stops on the 95x is Westerly Railroad Station, which is served by Amtrak's Northeast Regional Rail. An MOD service could also provide last-mile connectivity for those using Amtrak. As seen in Figure 4-38, in-zone service would meet most of the travel demand in the Westerly Zone.

Figure 4-38: Average Weekday Pick-Ups by Trip Type in the Westerly Zone



4.3.6.3 Service Costs

There is no slack capacity available to provide on-demand service like in some other zones because there is no current demand response service provided. Converting the Flex Service to a purely on-demand system, assuming the system average of 2.2 trips per revenue hour, would *reduce* system capacity from a current average of 79 trips per day to 35 (Table 4-21). Therefore, conversion of the Flex Service is not recommended.

Table 4-21: Estimated Westerly Additional Trip Capacity

Source	Average Weekday Trips Served	Capacity if Converted to Demand Response*	Net Capacity of Service if Converted to Demand Response**
Flex Service* **	79	35	(44)
Demand Response Slack	0	0	0
Total	**79**	**35**	**(44)**

*Estimated at 2.2 trips per revenue hour

**Net Capacity = Estimated Capacity – Trips Served

***Assumes 8 vehicle revenue hours per weekday

Should RIPTA have funding availability, it would cost approximately $833,320 to serve the estimated in-zone latent demand of 81 weekday on-demand trips (Table 4-22). A single van running 8 hours per weekday would cost roughly $166,664 per year, and it is recommended to start with one van and grow the service as appropriate. One van would serve 18 on-demand in-zone trips per day.

Table 4-22: Westerly MOD Service Estimates

Total Latent Weekday Trip Demand	**90**
Total In-Zone Latent Demand*	81
Total Customers Served per 8-Hour Shift**	18
Shifts Needed to Serve In-Zone Demand	5
Total Cost for Shifts***	$833,320

**Assumes 90% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.3.7 Woonsocket

Key Take-Aways:

- The Woonsocket Zone provides a case of "low-hanging fruit" for MOD implementation due to several factors, including the demographic composition, large proportion of trips taken in-zone, and a unique Flex Zone that operates as pure demand response (other Flex Zones are deviated fixed route);

- Demand response slack would be able to serve approximately 9 in-zone trips generated by latent demand.

- There is an estimated latent demand of 174 weekday trips in the Woonsocket Zone, and existing trip patterns suggest that the vast majority (89.5%) is for in-zone service.

- Based on the demographic profile, trip demand, and Flex Service structure, it is recommended to absorb existing Flex Service into an app-enabled MOD pilot and increase the number of vans in order to accommodate estimated latent demand.

4.3.7.1 Zone Overview

The Woonsocket Zone is in the northwest corner of Rhode Island and is comprised of the City of Woonsocket along with portions of North Smithfield, Lincoln, and Cumberland. At 9.8 people per acre, it is the most densely populated zone examined. The Woonsocket Zone has the second-highest proportion of people of color of all zones behind Providence, as well as the second-highest proportion of the population with a disability and limited-English proficiency. It is tied with the Providence Zone for the highest unemployment rate at 19%.

Woonsocket has already been identified in the 2040 Transit Master Plan *Transit Forward* as an area that, due to distance and topography, has limited public transportation offerings. As a response, RIPTA designed the Flex Service zone as a fully demand-response service (other Flex Service zones operate as deviated fixed route). Currently, customers using the Flex Service must book their rides at least a day in advance. However, if an in-zone MOD pilot were implemented in Woonsocket, the existing Flex Service could easily be folded into the new on-demand service.

An MOD pilot could also provide first-mile/last-mile connections. The zone is served by RIPTA fixed routes 54, 87, and 59X, as well as the Woonsocket Flex Service. The 54 and 59X both provide service into Providence, while the 87 is local circulator service. *Transit Forward* indicated potential for improving frequency on the Route 54 from 30-minutes to 15-minute headways. An MOD service could help to expand access to fixed route bus stops for residents wishing to travel to Providence or other areas outside of the zone.

4.3.7.2 Operating Parameters

The Woonsocket Zone has several features which make it a promising zone for MOD. From a Title VI/equity perspective, it has a relatively large share of minority residents and the fourth-highest

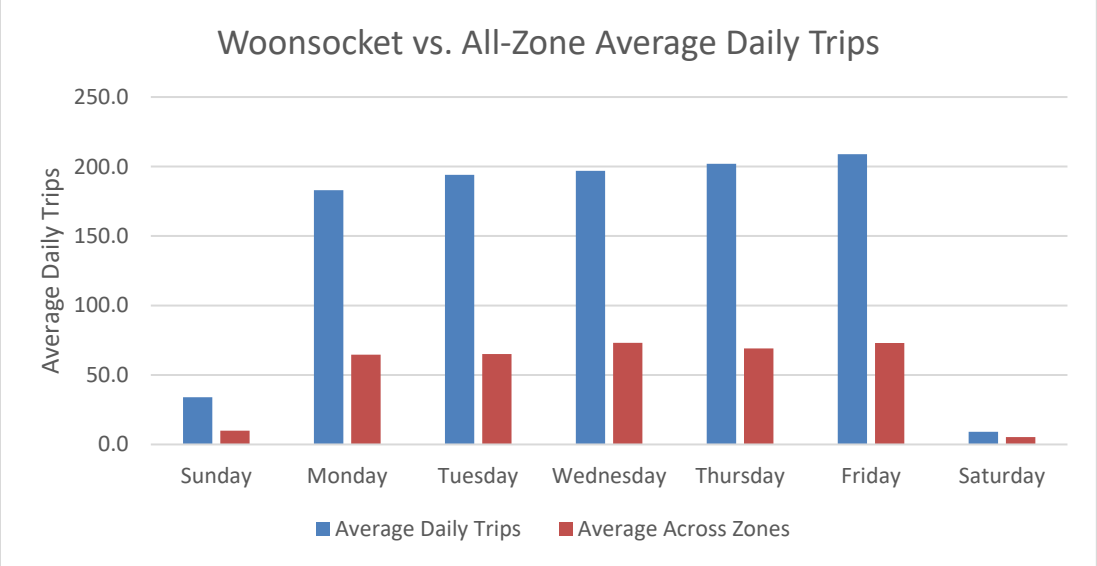
proportion of low-income households of the zones examined. There are likely to be fewer (if any) Title VI compliance issues should a new service be introduced there.

Also, the relatively high population density of the zone suggests that a new transit service would be well utilized. The overall score in the SSIM analysis confirms this, with Woonsocket receiving the highest overall score of any proposed MOD zone.

4.3.7.2.1 Level of Service

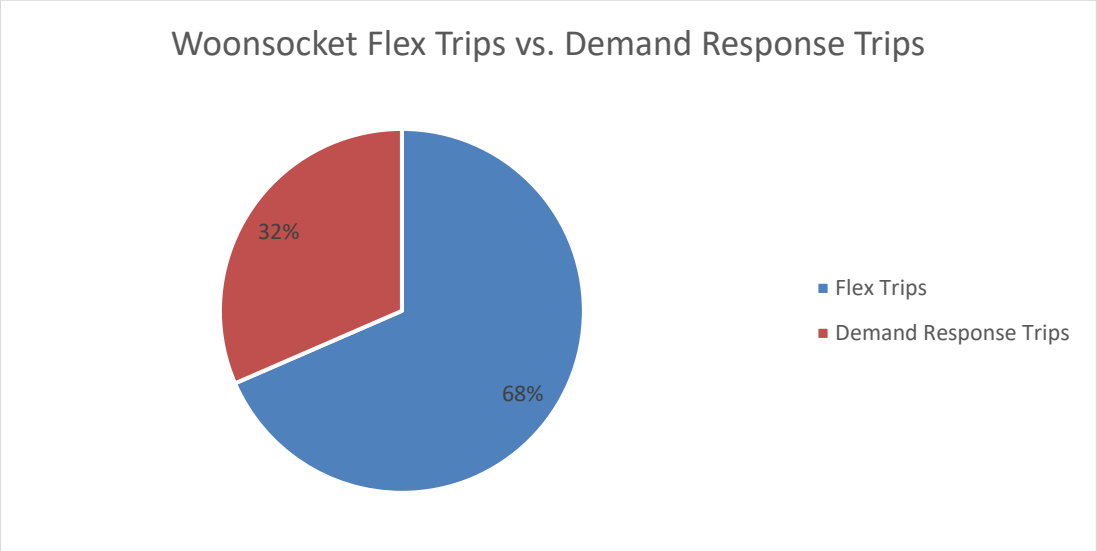
The Woonsocket Zone shows a strong market for demand response service during the week, with relatively lower demand on Saturdays and Sundays. The strong demand on Sundays is due to the fact that holidays on which Sunday service is provided were coded as "Sunday," and may not indicate a generally higher demand on calendar Sundays (Figure 4-39). Among the zones analyzed in this section, Woonsocket has the highest trip demand.

Figure 4-39: Average Daily Trips for Woonsocket Zone by Day Type Compared to Average for All Zones



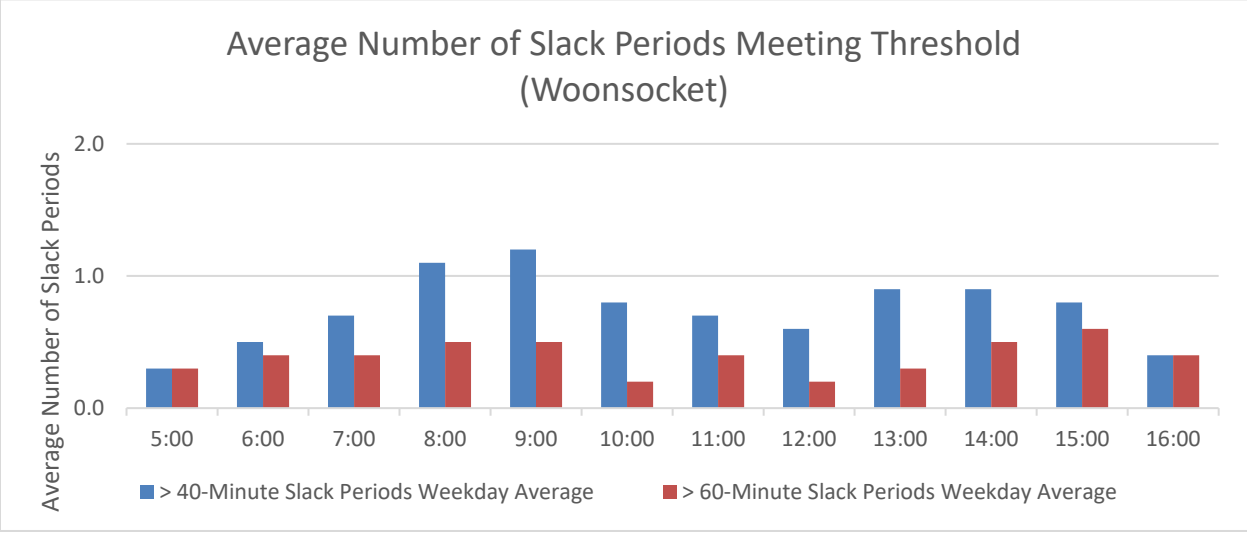
Woonsocket is served by both Flex Service and demand response, with flex trips comprising over two-thirds of all service (Figure 4-40). This suggests that riders in the Woonsocket Zone are familiar with non-ADA demand response service and would be receptive to a new MOD service.

Figure 4-40: Flex Trips vs. Demand Response Trips in Woonsocket



Despite the relatively high number of demand response trips provided in Woonsocket, there are only 9 periods of slack per weekday which could accommodate an in-zone trip (40-minute period or greater of slack). There are approximately 5 periods of slack lasting 60 minutes or longer. Slack periods follow general trip distribution, with larger concentrations in the morning and afternoon, which suggests use of split shifts (Figure 4-41). This lack of slack could result from the relatively dense operating context resulting in high service efficiency, resulting in fewer 40-minute-plus slack periods.

Figure 4-41: Average Number of Slack Periods in Woonsocket



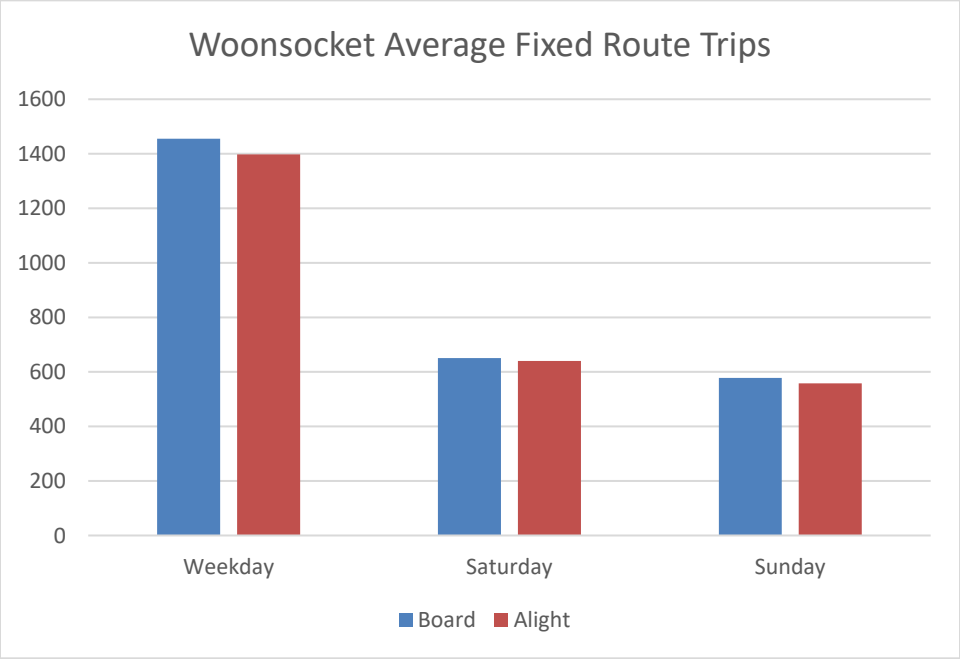
For those demand response trips that begin in Woonsocket, the top cross-zone destination is the Providence Zone, followed by the Smithfield Zone (Table 4-23). In-zone trips (within Woonsocket) account for the majority of trip demand, at nearly 90% of all trips. This indicates that an in-zone MOD service would be well utilized should it be implemented.

Table 4-23: Drop Zones for Pick Ups in Woonsocket

Drop Zone	Number of Drop-Offs
Beach Pond	0
East Bay	79
Middletown	4
Providence	1,681
Quonset	0
Smithfield	969
South Kingstown	9
West Warwick	14
Westerly	0
Woonsocket	25,620
Non-Zone	8,788
Grand Total	**37,164**

Fixed route service into the Woonsocket Zone serves more than 7 times the number of trips as the demand response service, as shown in Figure 4-42. Given the fact that transit service to Providence or other communities is limited, this suggests a robust demand for travel within the Woonsocket Zone.

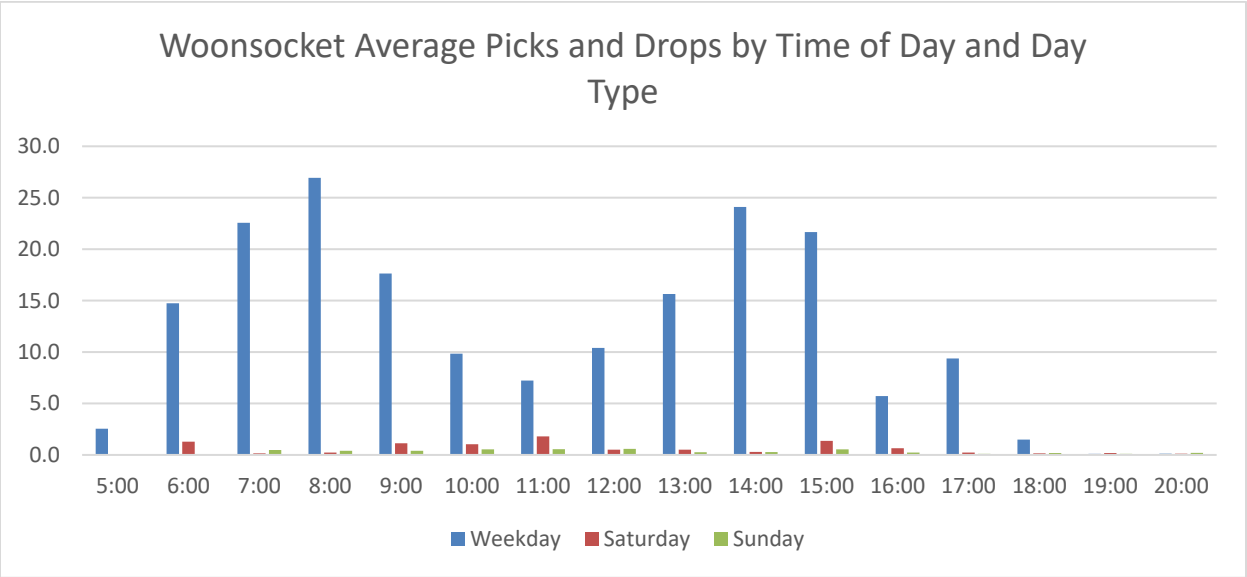
Figure 4-42: Woonsocket Zone Average Fixed Route Trips by Day Type



4.3.7.2.2 Span of Service

The demand profile of the Woonsocket Zone matches the general demand profile of the system overall, though the number of trips is much higher than the system average per weekday (Figure 4-43).

Figure 4-43: Woonsocket Average Demand Response Trips by Time of Day and Day Type*



**Includes both pick-ups and drop-offs in Woonsocket.*

Based on observed travel demand distribution, an MOD pilot should operate at a minimum between 6:00 AM and 6:00 PM on weekdays only. However, if the MOD structure is oriented toward a first-mile/last-mile service, then it may be necessary to run the service for the span of service that the Route 54 runs in the Woonsocket Zone (5:19 AM to 12:38 AM on weekdays).

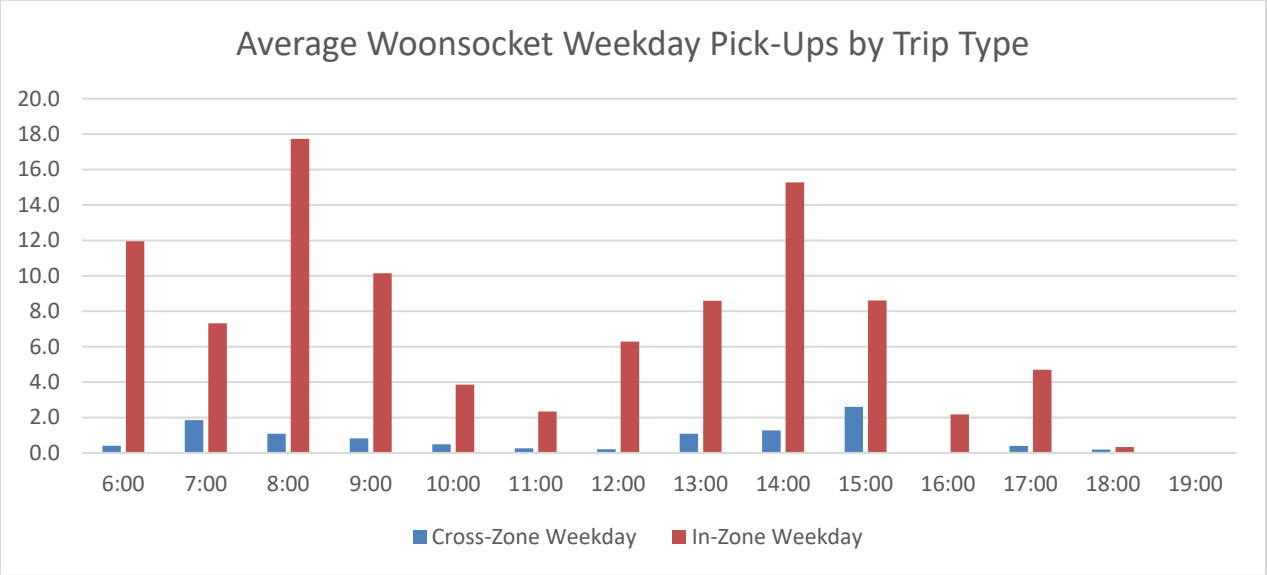
4.3.7.2.3 Number of Vehicles

Woonsocket presents the highest in-zone demand of the proposed MOD zones examined. Latent demand is estimated at 174 weekday trips, with 156 trips in-zone and 18 cross-zone. It is estimated to require 9 vans to meet the latent in-zone demand for service in addition to the existing Flex Service and ADA service in the zone.

4.3.7.2.4 Connections to the Statewide Transit Network/Schedule Coordination

As discussed earlier, the 59X and 54 are the only cross-zone services provided in Woonsocket. While there is limited cross-zone demand (Figure 4-44), MOD service may be able to provide first-mile/last-mile connections. This is especially important in the context of enhanced service, as recommended in *Transit Forward*.

Figure 4-44: Average Woonsocket Weekday Pick-ups by Trip Type



**Does not include cross-zone trips outside of a proposed MOD zone.*

4.3.7.3 Service Costs

The Woonsocket Zone has a limited amount of weekday slack time that could be dedicated to providing on-demand microtransit service. The Flex Service currently operating in Woonsocket provides a unique opportunity relative to the other zones, as it is purely demand response (other Flex Service zones operate as a deviated fixed route). Therefore, it would be relatively easy to convert the prior-day scheduled Flex Service into an on-demand MOD pilot.

Given the level of estimated latent demand, in-zone MOD service would require up to 9 weekday shifts at a cost of almost $1.5 million to completely fulfill demand (Table 4-24). Estimated latent demand is in addition to the current ridership on the Flex Service, and so the 9 shifts are in addition to those currently serving the Flex Service.

Table 4-24: In-Zone MOD Service Estimates

Total Latent Weekday Trip Demand	**174**
Total In-Zone Latent Demand*	156
Total Customers Served per 8-Hour Shift**	18
Shifts Needed to Serve In-Zone Demand	9
Total Cost for Shifts***	$1,499,976

**Assumes 90% of total latent demand is for in-zone trips.*

***Assumes 8 revenue hours per shift at 2.2 trips per hour.*

****Assumes $166,664 operating cost per 8-hour shift.*

4.4 Conclusion

The seven zones chosen as illustrative examples present diverse use cases for an MOD service. Service Recommendations are as follows:

- **Recommended:** The West Warwick Zone, Westerly Zone, and Woonsocket Zone present different but compelling use cases for an MOD pilot. The West Warwick Zone has a planned multimodal hub at CCRI that could be served by MOD as a first-mile/last-mile connection. Westerly Zone has strong in-zone travel demand with limited existing fixed route or demand response service and suggests strong potential for ridership within the Westerly Zone. The Woonsocket Zone is a diverse community with strong in-zone demand and opportunities for first-mile/last-mile service.
- **Potential:** The Middletown and South Kingstown Zones have aspects which show potential for an MOD pilot. It is recommended to implement MOD service using existing slack time for demand response vehicles already serving the zones to better gauge the market.
- **Not Recommended:** The East Bay and Smithfield Zones are both lower density suburban communities outside of Providence which show a high demand for cross-zone trips. Due to existing low ridership and the expected long trip distances of a cross-zone MOD service, there is a strong possibility for low ridership and high costs of MOD pilot service in either of these zones.

5 Mobility on Demand (MOD) Pilot Monitoring Plan

This chapter lays out a comprehensive plan to monitor the performance of a potential MOD pilot deployment described earlier in this report. The performance monitoring plan will serve as a tool to help RIPTA gauge the success of a pilot service through benchmarking a set of key performance indicators (KPIs) against previous performing periods and/or peer agencies' performance.

5.1 Suggested Guiding Principles

Four principles will be laid out as the foundation of the KPIs design. They are:

1. Expanding the existing transit user base
2. Enhancing the transit user experience
3. Strengthening interoperability with existing services
4. Cost effectiveness

5.2 KPIs Design

The design process for KPIs is based on the four primary evaluation principles and the selected KPIs can be organized into three categories based on the purpose they are serving. The three categories are "Customer Acquisition", "Customer Experience", and "Service Monitoring". Table 5-1 presents a relation matrix of the guiding principles in previous section and the KPI categories in this section.

Table 5-1: Guiding Principles and KPI Categories Relation Matrix

		Guiding Principles			
		Expanding the existing transit user base	**Enhancing the transit user experience**	**Strengthening interoperability with existing services**	**Cost Effectiveness**
Categories	**Customer Acquisition**	New riders User loyalty			Marginal cost per new rider
	Customer Experience		Average wait time Frequency of use App rating Customer satisfaction	On-Time Arrivals	
	Service Monitoring	Active Users Percentage of ADA certified riders Demand Generation Percentage of user who locate outside of the quarter mile fixed route buffers Percentage of ADA certified riders Title VI population percentage Total trips delivered Average trip distance	Trip cancellation	Percentage of trips to transit stops Percentage of solo trips	Fare collected through electronic payment methods Percentage fares paid in cash Cost/Trip Cost per service hours Cost per service miles

Not all KPIs in this section will be applicable to every proposed service zone but rather serve as a menu of relevant KPIs. They can be individually picked to form a tailored set of KPIs which match the use cases of the service zones.

5.2.1 Customer Acquisition

Under the guiding principle of "Expanding the existing transit user base," the pilot should serve potential transit users that are not currently using public transportation. These customers include residents living outside of the first-/last-mile range accessible by non-automobile modes from transit stops and residents who don't make frequent long-distance regional trips, but rather local short-distance trips. The KPIs selected for this category are:

- New riders (New signups without the existing Wave account)
- Marginal cost per new rider ((Marketing expenditure/Zone potential rider)*Conversion Rate (actual riders/potential riders))
- User loyalty (% of repeat customers current week and/or month over the previous week and/or month)

5.2.2 Customer Experience

On-demand service should have an excellent customer experience, including on-time performance, smooth transfers to other transit services, clean vehicles, and measures to ensure rider safety. The KPIs selected for this category are:

- Average wait time
- On-time arrivals (Total drop-offs within a 3-minute window of proposed drop-off time/Total drop-offs)
- Frequency of use (Total Active Users/Total Trips)
- App rating (4 stars and above)
- Customer satisfaction (Complaints per 1,000 trips)

5.2.3 Service Monitoring

This category is designed to monitor cost effectiveness. The selected KPIs in this category can be further detailed by their correlation to ridership, trip, revenue, and cost. Ridership KPIs gauge the demand for the new service. Trip KPIs also monitor demand but exclude the number of riders per trip since most of the MOD trips are anticipated to be shared trips. Revenue and cost KPIs are designed to reflect the cost effectiveness of the service. Detailed KPIs in this category are:

- Rider Characteristics
    - Active users (user who made at least one booking in the last 6 months)
    - Demand generation (Ridership/Active users)
    - Percentage of user who locate outside of the quarter mile buffer from the fixed route services.
    - Percentage of ADA certified riders
    - Title VI population percentage
- Trip Characteristics

    - Total trips delivered
    - Percentage of trips to transit stops (Trips to transit stop/Total trips delivered)
    - Percentage of solo trips (Trips with one rider/Total trips delivered)
    - Average trip distance (Total trip revenue miles/Total trips delivered)
    - Trip cancellation (% of cancelled Trips/Total Trips requested)
- Revenue
    - Fare collected through Wave or other electronic payment method
    - Percentage fares paid in cash
- Cost
    - Cost/Trip
    - Cost per service hours (Total operating cost/total MOD service hours)
    - Cost per service miles (Total operating cost/total MOD miles)

5.3 Data Management Plan

These KPIs are designed to leverage existing data that minimizes the staff resources needed for data collection and analysis. Below is an overview of data analysis resources and workflow requirements.

5.3.1 MOD Data Collection

In order to execute a successful service monitoring plan, data used to calculate the KPIs and perform service monitoring should be collected by either RIPTA or the future service platform provider. The data collection list includes, but is not limited to:

- Monthly app signups not using the same signup methods through wave.
- Total app users
- Total active users (used the system within the last six months)
- Repeat app users (service users) current week/month over the previous week/month
- App rating
- Number of customer complaints
- Wait time
- Total trips delivered
- Total trips to transit stops
- Total trips with one rider
- Total trips completed within a 3-minutes window of proposed drop-off time
- Total trip revenue miles
- Total service hours
- Total farebox revenue
- Total cash revenue
- Operating cost
- Marketing cost
- Customer Information from App (Unique customer ID, demographic information (if available))
- Customer Complaint Logs

- Trip Information (Request time, O/D arrive times, O/D arrive locations, lift deployment, ride time/distance, Trip Status (delivered, canceled, missed, no-show))
- Fare Revenue Information
- Operating Cost Information

The MOD operator should also enable monitoring in real-time operations. All the parties involved in the project including the drivers, dispatch teams, operation teams, and customers should be coordinated and make sure the data needed for monitoring are collected.

The unity and interoperability of the data format collected from either fixed route information system or on-demand service is essential to enable the next step data processing. The implementation of multi-agency integrated mobility platforms should comply with the public transportation exchange format norms and standards such as the General Transit Feed Specification (GTFS), GTFS- Real Time (RT), GTFS-FLEX, and Transit Communications Interface Profiles (TCIP).

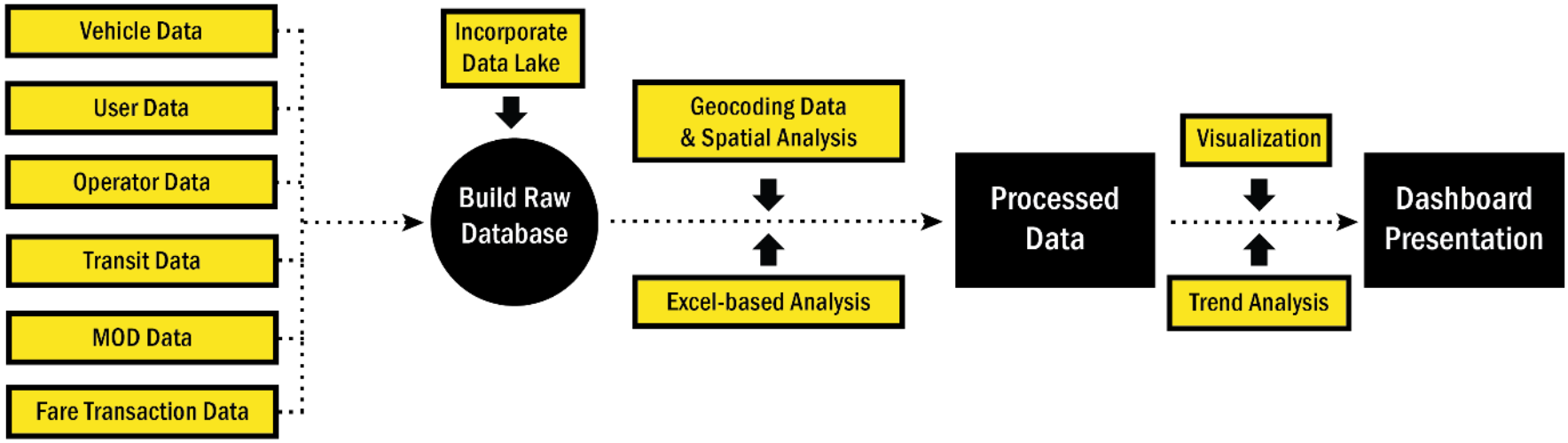
5.3.2 Data Processing

The data presented in this section should be made accessible through service platform provider and operator throughout the life of the project and be processed for further analyses and presentation by either RIPTA's in-house staff or through staff augmentation.

1. Vehicles
    a. Vehicle fleet characteristics
    b. Vehicle real-time location
    c. Vehicle real-time capacity
2. Users
    a. Real-time trip
    b. User profile
3. Operators
    a. Operator work schedule
4. Transit Data
    a. Transit provider
    b. GIS routes and stops
    c. Transfer points
    d. Service schedule
    e. Event updates
5. MOD Data
    a. Website and app settings
    b. Communication template
    c. Service configuration
6. Fare Transaction Data
    a. Number of fare transactions
    b. Fare transaction amounts

Figure 5-1 illustrates how data processing transforms raw data collected by RIPTA into presentable information for system designer and users.

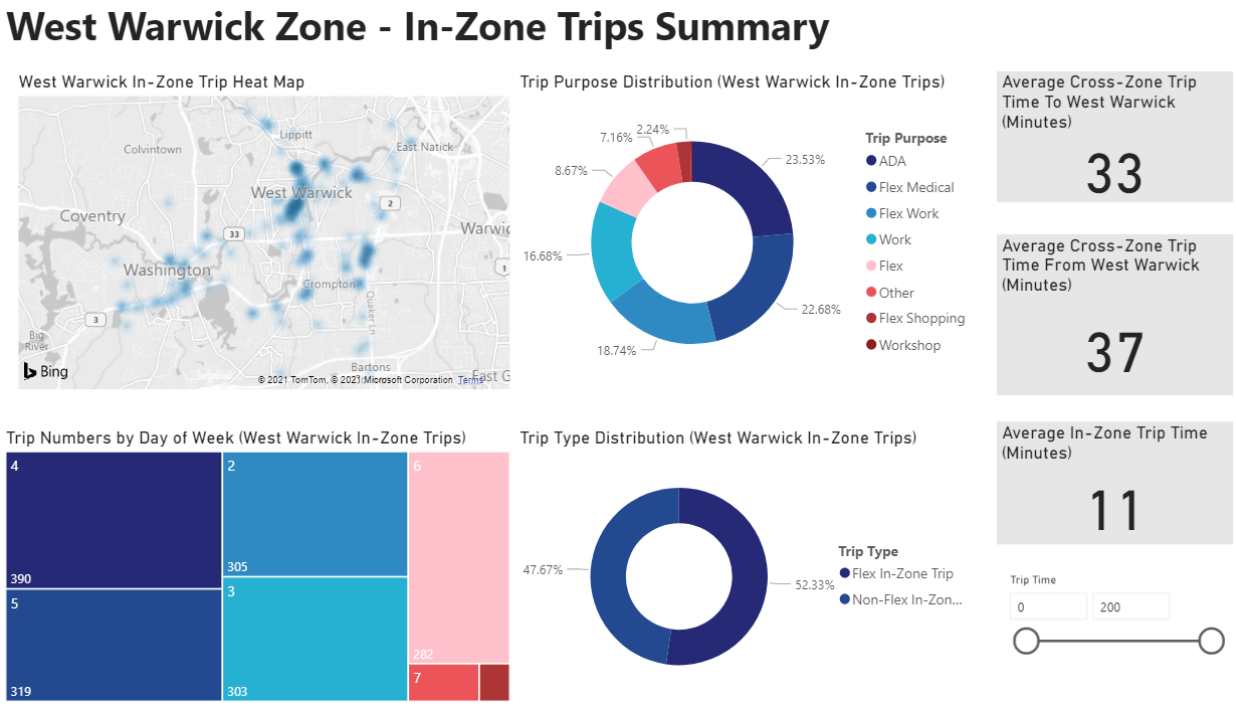
Figure 5-1: Example MOD Service Dashboard



5.3.3 Data Aggregation and Reporting

All input/output data will be collected, stored, and processed for further analysis and reporting purposes. No personal private information will be individually displayed; it will be aggregated and displayed in the format of MOD trend and KPIs through Power BI or other reporting solutions provided by the operator and/or technology vendor. Figure 5-2 presents an example dashboard summary of a set of MOD KPIs.

Figure 5-2: Example MOD Service Dashboard



Source: AECOM

Table 5-2 below summarizes the performance monitoring metrics designed for the proposed three MOD service zones. The metrics included in each zone-level package are tailored as recommended metrics to meet the use case of that specific service zone. RIPTA should adjust the metric package based on data availability and reporting purpose changes.

Table 5-2: Performance Monitoring Plan Design by Service Zone

Performance Metric	Zone Names		
	West Warwick	Smithfield	Westerly
Customer Acquisition			
New Riders	✔	✔	✔
Marginal Cost per New Rider	✔	✔	✔
User Loyalty	✔		✔
Customer Experience			
Average Wait Time	✔	✔	✔
On Time Arrival	✔		
Usage Frequency	✔	✔	✔
App Rating	✔	✔	✔
Customer Satisfaction	✔	✔	✔
Service Monitoring			
Active Users	✔	✔	✔
Induced Demand		✔	
Percentage of user who locate outside of the quarter mile fixed route buffers	✔	✔	✔
Percentage of ADA certified riders	✔	✔	✔
Title VI population percentage	✔	✔	✔
Total Number of Trips Delivered	✔	✔	✔
Percentage of trip to transit stops	✔		
Percentage of solo trips	✔		✔
Average trip distance	✔	✔	✔
Trip cancellation	✔		✔
Fare collected through Wave or other electronic payment method	✔		✔
% of cash payment collected		✔	
Operating cost/Trip	✔	✔	✔
Cost per operating hours	✔	✔	✔
Cost per operating miles	✔	✔	✔

6 Technology Review

This section has been redacted from this public version of the study as the contents within include third party proprietary material that is privileged and confidential in nature. Any requests for public records should be directed to the following:

Rhode Island Public Transportation
Attn: Public Records Officer
705 Elmwood Ave. Providence, RI 02907
Telephone: 401-784-9500 ext. 171 Facsimile: 401-784-9513
Email: PublicRecordsOfficer@RIPTA.com.

RIPTA will respond to each request to the fullest extent required by law.

7 Conclusion

RIPTA is committed to improving the mobility of residents across the state in all different types of communities. Traditional fixed route bus, complementary paratransit service, and commuter rail are able to fulfill much of this demand. However, on-demand services such as microtransit can help to fill the gap where traditional forms of public transportation are lacking. This study has laid out multiple zones and service design opportunities for residents around the state.

In this study, RIPTA considered 10 zones for an MOD pilot:

- Beach Pond
- East Bay
- Middletown
- Providence
- Quonset
- Smithfield
- South Kingstown
- West Warwick
- Westerly
- Woonsocket

Each of these zones presented unique context for analysis – a mix of urban and rural, hills and coasts, and a diversity of communities. After considering the opportunities each zone presented, three zones were recommended for pilot service: West Warwick, Westerly, and Woonsocket.

The technology review presented in Chapter 5 provides an overview of potential technology platforms. This review serves as a first step to identify technology platforms that meet the goals of the MOD program. The next step will be to further research these platforms to determine the interoperability with RIPTA's current technology and can be seamlessly integrated to allow for trips to be booked and paid with one-call or one-click by the user.

7.1 Next Steps

This study not only identified three zones recommended for pilot MOD service, but also outlined the metrics which would measure the success of the pilot as well as the technologies available to aid with implementation. Recommended next steps include the following:

1. **Procure Technology** – It is recommended to issue a Request for Information for a Mobility on Demand smart phone application. In keeping with the service design findings, there are opportunities for using slack time in the demand response system to perform on-demand trips within the proposed zones. However, this would require a smart phone application that customers could use to request rides. A Request for Information (RFI) would allow RIPTA to gauge the opportunities and capabilities such an application would have and would set the stage for issuing a Request for Proposals (RFP) to procure a technology vendor.
2. **Coordinate with Local Stakeholders** – RIPTA should coordinate with local stakeholders in the recommended potential pilot zones. Stakeholders could include local elected officials, human

service organization staff and clients, or major employers. This coordination could take the form of phone calls, meetings, or online surveys. This will help to confirm the proposed service design and assist with raising awareness about the MOD service once it is launched.

3. **Confirm Internal Logistics** – RIPTA should develop its own internal logistics for operating the proposed MOD service. This should include establishing the budget for the new service, assigning drivers and vehicles, integrating IT elements, discussions with the marketing team, and confirming other internal resources necessary for the successful piloting of the service.

RIPTA's interest in Mobility on Demand is a timely exploration of new technology to expand the mobility of the state's residents, particularly in underserved regions or times of day. This study lays the foundation for implementing pilot service and evaluating the service's success and could lead to permanent implementation of a new mode of public transportation service in The Ocean State.

Appendix A: Cost Estimation Methodology

Costs were estimated using observed travel demand, modeled latent demand, and average costs per hour of revenue service. The following description shows step-by-step how the cost estimates were developed.

Step 1: Latent Demand Estimation

The National Center for Transit Research provides a methodology for estimating potential ridership demand based on two key factors: estimated population outside of ¼ mile of fixed route service and the percentage of that population that is estimated to be transit dependent. Variations between modeled and actual latent demand in the context of the proposed MOD zones could result from rider preferences and existing Flex Service structure and service levels. Nonetheless, the model provides a guide for estimating latent service demand.

Latent demand was further refined to focus only on demand for in-zone trips. Using West Warwick as an example, 40% of all trips were taken in-zone. While the full estimated latent demand for weekday trips was 247 trips, the estimated in-zone latent demand is 40% of that, or 98 trips.

Table A- 1: Step 1: Latent Demand

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	
Step 3: Net Flex Capacity	
Step 4: Latent Demand Met with Existing Capacity	
Step 5: Shifts Needed	
Step 6: Estimate Cost	

Step 2: Demand Response Slack

Once latent demand is established, the opportunity for using existing latent capacity in the ADA service to meet that demand was assessed. This was estimated by calculating the number of 40-minute slack periods in the ADA system per weekday, because 40-minutes was established as the minimum time needed in order to reasonably perform an on-demand in-zone trip. In the example of West Warwick, there is an estimated slack capacity to serve 7 trips per weekday.

Table A- 2: Step 2: Demand Response Slack

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	7 Weekday Trips
Step 3: Net Flex Capacity	
Step 4: Latent Demand Met with Existing Capacity	
Step 5: Shifts Needed	
Step 6: Estimate Cost	

Step 3: Net Flex Capacity

The next step is to estimate additional trips that could be served if the Flex Service were converted to an on-demand system. Some Flex Service routes are underutilized relative to the systemwide demand response average of 2.2 trips per hour. Using this benchmark, it can be assessed whether more customers would be served if the Flex Service were converted to an MOD service.

In the West Warwick example, there are 12 service hours provided every weekday on the Flex Service. The Flex Service moves 14 customers per weekday on average, but if a same-day MOD service were able to achieve 2.2 customers per hours, we would anticipate 26 customers being served per weekday. This means that there is an estimated latent net capacity of 12 trips per weekday (26 – 14 = 12).

Table A- 3: Step 3: Net Flex Capacity

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	7 Weekday Trips
Step 3: Net Flex Capacity	12 Weekday Trips
Step 4: Latent Demand Met with Existing Capacity	
Step 5: Shifts Needed	
Step 6: Estimate Cost	

Step 4: Latent Demand Met with Existing Capacity

Once in-zone latent demand is estimated and available existing capacity is established, total in-zone latent demand that could be potentially served using existing capacity is calculated. In West Warwick, it is estimated that 19 trips could be served using existing latent capacity (7 trips through slack capacity, and 12 additional trips if Flex Service were converted to MOD). Out of the latent demand of 98 trips, that leaves 79 trips.

Table A- 4: Step 4: Latent Demand Met with Existing Capacity

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	7 Weekday Trips
Step 3: Net Flex Capacity	12 Weekday Trips
Step 4: Latent Demand Met with Existing Capacity	19 Weekday Trips
Step 5: Shifts Needed	
Step 6: Estimate Cost	

Step 5: Shifts Needed

The next step is to calculate the number of weekday shifts needed to serve remaining latent demand. This can be calculated using the systemwide average of 17.6 trips served per 8-hour shift (2.2 trips/vehicle revenue hour x 8 vehicle revenue hours = 17.6). In order to serve the 79 trips not met by latent capacity, it would require just under 4.5 shifts to serve. Since we don't assume fractions of shifts, we round up to 5 shifts required.

Table A- 5: Step 5: Vehicle Revenue Hours Needed

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	7 Weekday Trips
Step 3: Net Flex Capacity	12 Weekday Trips
Step 4: Latent Demand Met with Existing Capacity	19 Weekday Trips
Step 5: Shifts Needed	5 Shifts
Step 6: Estimate Cost	

Step 6: Estimate Cost

Once the estimated number of weekday revenue hours needed to serve in-zone latent demand is established, cost can be estimated. With the average demand response cost of $166,664 per year per weekday shift (8 vehicle revenue hours x $83/revenue hour x 251 weekdays = $166,664), the number of weekday shifts identified in step 5 is multiplied by the average cost per year. In the case of West Warwick, that cost is $833,320 (5 weekday shifts x $166,664 = $833,320). Note that totals may not be exact due to rounding.

Table A- 6: Step 6: Estimate Cost

Step	West Warwick Example
Step 1: Latent Demand	98 Weekday Trips
Step 2: Demand Response Slack	7 Weekday Trips
Step 3: Net Flex Capacity	12 Weekday Trips
Step 4: Latent Demand Met with Existing Capacity	19 Weekday Trips
Step 5: Shifts Needed	5 Shifts
Step 6: Estimate Cost	$833,320