WATERBURY AREA
TRANSIT STUDY

Market Analysis

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Waterbury Area Transit Study: Market Analysis

Introduction

This document represents a summary of all of the work that took place in Phase 1 of the Waterbury Area Transit Study from October 2014 through February 2015. It is entitled Market Analysis, though it goes beyond the scope of a typical market analysis. The first section summarizes ridership trends that were covered extensively in a prior document published by COGCNV[1] in 2014. The second section considers transfer patterns in detail, setting the stage for future analysis of bus operations and the potential impacts of alternatives to the current pulse schedule. The third section considers how well the Waterbury bus system serves its market by comparing it to a group of peer agencies selected from across the country. The fourth section presents information about current bus riders obtained through an on-board survey, include their usage patterns and improvements to the system that they would like to see. The fifth section presents the results of public outreach efforts and stakeholder interviews, offering further perspectives of riders, community leaders, officals, and representatives of important institutions. The final section comprises the core of what is normally included in a market analysis: maps and analysis of residential density, demographic characteristics, employment density and work trip flows.

Ridership Analysis

In the Fall of 2013, COGCNV conducted a comprehensive passenger count on the Waterbury bus system. The results of these counts were published in a document entitled *Waterbury Regional Bus Ridership Study 2013* (available online at http://nvcogct.org/sites/default/files/Waterbury-Regional-Bus-Ridership-Study-2013.pdf). This document presents a brief summary of the high-level results of those counts, specifically the ridership trends by route for weekday, Saturday and Sunday service, and ridership totals by route for weekday evening and Saturday evening service (since there is only one round of counts for these relatively new services, which began operating in 2011). Following the route-level totals, a list of the top bus stops is presented for weekday and Saturday service and an analysis of productivity by time of day, comparing peak and off-peak productivity for weekday service and weekday vs. Saturday productivity.

Ridership by Route

The tables in this section are taken directly from the *Waterbury Regional Bus Ridership Study 2013*. The first table is a simple list of routes in operation when the ridership counts were taken, showing the route number, name, days of operation, whether there is evening service, and which municipalities are served. Tables 2 through 4 present route-level ridership totals for the 2013 counts and earlier counts.

[1] COGCNV was merged with the Valley Council of Governments on January 1, 2015 to form NVCOG.

Table 1. CT Transit—Waterbury Bus Routes: 2014

Service Type	Route Number	Route Name	Days of Operation	Evening Service	Municipalities Served
Fixed Route	11	Overlook/Willow	All	Yes	Waterbury
	12	Hill Street	All	Yes[1]	Waterbury
	13	Oakville/Fairmount	All	Yes[1]	Waterbury, Watertown
	15	Bucks Hill/Farmcrest	All	Yes[1]	Waterbury
	16	Bucks Hill/Montoe	All	Yes[1]	Waterbury
	17	Thomaston Ave/Waterville	Weekdays, Saturday	No	Waterbury
	18	Long Hill/Berkeley	All	Yes[1]	Waterbury
	20	Walnut Street	All	Yes[1]	Waterbury
	22	Wolcott Street	All	Yes	Waterbury
	25	Hitchcock Lake	All	Yes[1]	Waterbury, Wolcott
	26	Fairlawn/East Main	Weekdays	No	Waterbury
	27	Merline/East Main	All	No	Waterbury
	28	Scott Road/East Main	All	Yes[1]	Waterbury
	31	East Mountain	Weekdays	No	Waterbury
	32	Hopeville/Sylvan	Weekdays	No	Waterbury
	33	Hopeville/Baldwin	All	Yes	Waterbury
	35	Town Plot/New Haven Ave	All	No	Waterbury
	36	Town Plot/Bradley	All	Yes	Waterbury
	40	Town Plot/Highland	All	Yes[1]	Waterbury
	42	Chase Parkway	All	Yes[1]	Waterbury, Middlebury
	44	Bunker Hill	All	Yes	Waterbury
	45	Watertown	All	No	Waterbury, Watertown
	N1	Naugatuck/Millville	Weekdays	No	Naugatuck
	N2	Naugatuck/New Haven Ave	Weekdays	No	Naugatuck
Tripper Route	T4	Naugatuck Shuttle	Weekdays	No	Waterbury, Naugatuck
	T47	Watertown/Straits Turnpike	Weekdays	No	Waterbury, Watertown
	T49	Watertown Industrial Park	Weekdays	No	Waterbury, Watertown
	T74	Naugatuck Industrial Park	Weekdays	No	Waterbury, Naugatuck
	T81	Cheshire Industrial Park	Weekdays	No	Waterbury, Cheshire
	T114	Beacon Falls Industrial Park	Weekdays	No	Waterbury, Beacon Falls

Source: North East Transportation Company

[1] Evening route is combined with another route. Service runs in one direction only.

Table 2. CT Transit—Waterbury Weekday Fixed Route Bus Ridership: 2001, 2009, 2013

Route Number	Route Name	Daily Weekday Ridership			Change 2009-2013		Change 2001-2013	
		2013	2009	2001	Net	Percent	Net	Percent
11	Overlook/Willow	532	345	338	187	54.2%	194	57.4%
12	Hill Street	282	260	235	22	8.5%	47	20.0%
13	Oakville/Fairmount	601	402	447	199	49.5%	154	34.5%
15	Bucks Hill/Farmcrest	453	396	391	57	14.4%	62	15.9%
16	Bucks Hill/Montoe	393	364	279	29	8.0%	114	40.9%
17	Thomaston Ave/Waterville	284	130	85	154	118.5%	199	234.1%
18	Long Hill/Berkeley	576	368	432	208	56.5%	144	33.3%
20	Walnut Street	268	249	219	19	7.6%	49	22.4%
22	Wolcott Street	856	603	510	253	42.0%	346	67.8%
25	Hitchcock Lake	527	355	302	172	48.5%	225	74.5%
26	Fairlawn/East Main	252	146	127	106	72.6%	125	98.4%
27	Merline/East Main	340	199	242	141	70.9%	98	40.5%
28	Scott Road/East Main	318	198	168	120	60.6%	150	89.3%
31	East Mountain	58	23	28	35	152.2%	30	107.1%
32	Hopeville/Sylvan	81	64	84	17	26.6%	-3	-3.6%
33	Hopeville/Baldwin	649	503	421	146	29.0%	228	54.2%
35	Town Plot/New Haven Ave	293	247	222	46	18.6%	71	32.0%
36	Town Plot/Bradley	363	289	245	74	25.6%	118	48.2%
40	Town Plot/Highland	179	167	143	12	7.2%	36	25.2%
42	Chase Parkway	584	270	188	314	116.3%	396	210.6%
44	Bunker Hill	383	322	226	61	18.9%	157	69.5%
45	Watertown	332	258	232	74	28.7%	100	43.1%
N1	Naugatuck/Millville	22	16	9	6	37.5%	13	144.4%
N2	Naugatuck/New Haven Ave	7	7	7	0	0.0%	0	0.0%
Total Weekday Ridership		**8,649**	**6,181**	**5,580**	**2,468**	**39.9%**	**3,053**	**54.7%**

Source: COGCNV Bus Ridership Counts: 2001, 2009, and 2013

Table 3. CT Transit—Waterbury Saturday Bus Ridership: 2009—2013

Route Number	Route Name	Daily Ridership		Change 2009-2013	
		2013	2009	Net	Percent
11	Overlook/Willow	242	142	100	70.4%
12	Hill Street	130	-	-	-
13	Oakville/Fairmount	350	269	81	30.1%
15	Bucks Hill/Farmcrest	294	219	75	34.2%
16	Bucks Hill/Montoe	287	250	37	14.8%
17	Thomaston Ave/Waterville	30	9	21	233.3%
18	Long Hill/Berkeley	259	165	94	57.0%
20	Walnut Street	206	117	89	76.1%
22	Wolcott Street	852	431	421	97.7%
25	Hitchcock Lake	325	181	144	79.6%
27/28*	East Main	468	265	203	76.6%
33	Hopeville/Baldwin	330	216	114	52.8%
35	Town Plot/New Haven Ave	177	167	10	6.0%
36	Town Plot/Bradley	250	117	133	113.7%
42/40*	Chase Parkway/Town Plot	144	152	-8	-5.3%
44	Bunker Hill	235	161	74	46.0%
45	Watertown	205	140	65	46.4%
Totals		**4,795**	**3,001**	**1,794**	**59.8%**

** Route has changed significantly since 2009*

- Saturday service on 12—Hill Street began in 2011

Source: COGCNV Bus Ridership Counts: 2013

Table 4. CT Transit—Waterbury Sunday Bus Ridership: 2009—2013

Route Number	Route Name	Daily Ridership		Change 2009-2013	
		2013	2009	Net	Percent
11	Overlook/Willow	98	63	35	55.6%
12	Hill Street	50	-	-	-
13	Oakville/Fairmount	212	131	81	61.8%
15	Bucks Hill/Farmcrest	156	121	35	28.9%
16	Bucks Hill/Montoe	225	144	81	56.3%
18	Long Hill/Berkeley	121	68	53	77.9%
20	Walnut Street	82	73	9	12.3%
22	Wolcott Street	433	282	151	53.5%
25	Hitchcock Lake	151	82	69	84.1%
27/28*	East Main	187	111	76	68.5%
33	Hopeville/Baldwin	129	88	41	46.6%
35	Town Plot/New Haven Ave	75	50	25	50.0%
36	Town Plot/Bradley	95	66	29	43.9%
42/40*	Chase Parkway/Town Plot	57	54	3	5.6%
44	Bunker Hill	108	77	31	40.3%
45	Watertown	78	57	21	36.8%
Totals		**2,257**	**1,467**	**790**	**53.9%**

** Route has changed significantly since 2009*

- Sunday service on 12—Hill Street began in 2011

Source: COGCNV Bus Ridership Counts: 2013

Table 5 shows the ridership totals for the evening bus routes on weekdays and Saturdays. Five of the evening routes operate on the same alignments as the regular weekday routes (11, 22, 33, 36, and 44), but the other five routes are combinations of regular weekday routes, operating outbound (away from the Green) along one route alignment and inbound (back toward the Green) along another route alignment. These combinations allow for greater coverage with fewer resources, though they offer inferior service because each part of the combination gets only half the amount of service compared to regular weekday operations.

Table 5. Waterbury Weekday and Saturday Evening Bus Ridership: 2013

Route Number	Route Name	Evening Ridership	
		Weekday	Saturday
11	Overlook/Willow	88	80
13/12	Oakville/Hill Street	121	105
16/15	North Main Street	95	106
20/18	Walnut/Long Hill	73	59
22	Wolcott Street	170	157
28/25	East Main Street	140	130
33	Hopeville/Baldwin	69	73
36	Town Plot/Bradley	62	61
42/40	Chase Parkway/Highland	69	18
44	Bunker Hill	98	62
Totals		985	851

Source: COGCNV Bus Ridership Counts: 2013

Ridership on virtually all of the Waterbury routes has grown substantially between 2009 and 2013 and evening service has proved itself to be viable. The increasing demand for service has led to some crowding and reliability problems. Accommodating present and future demand and ensuring that resources are deployed in the most effective way is one of the key goals of the Waterbury Area Transit Study.

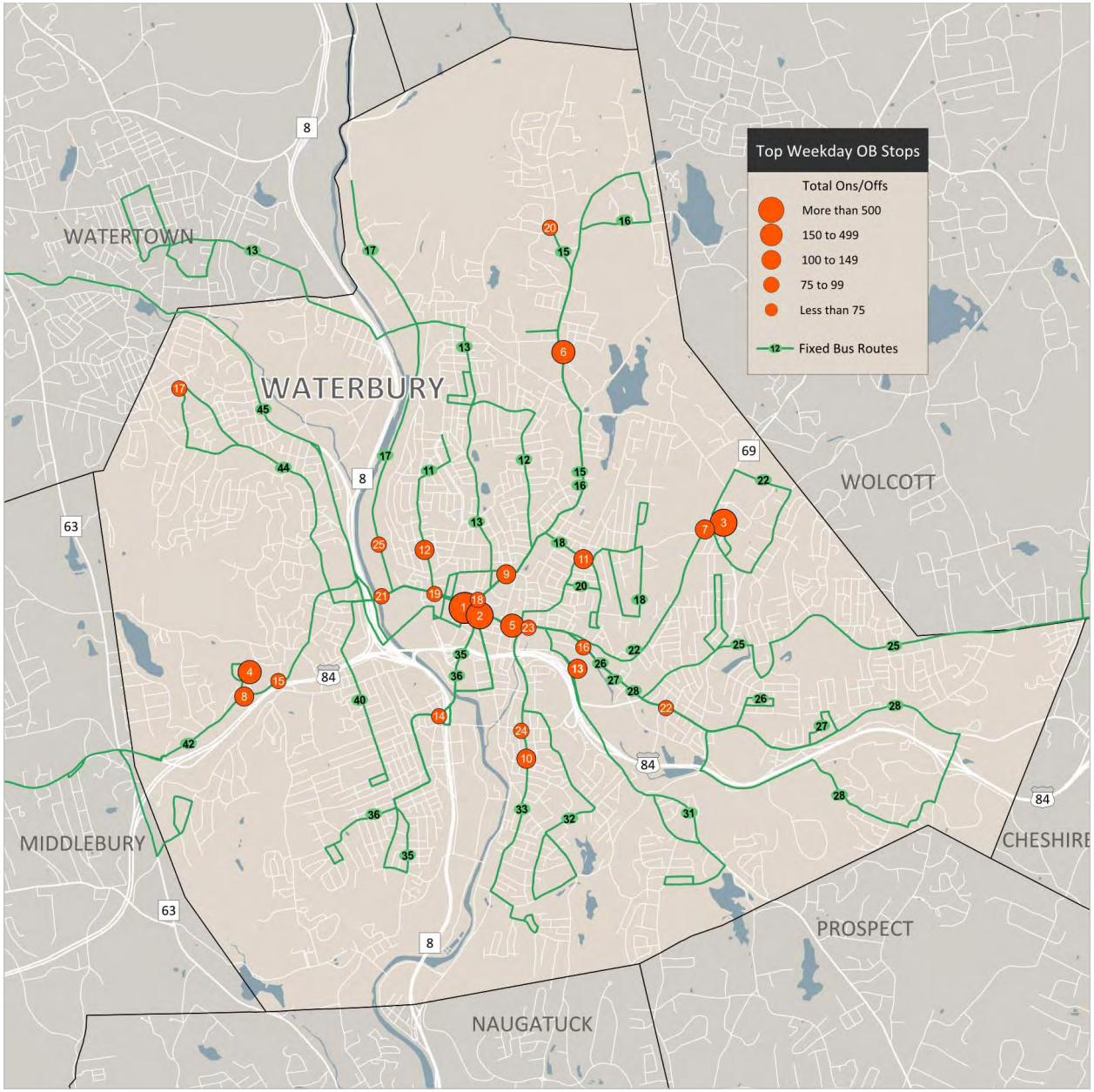
Top Bus Stops

Figures 1 through 3, also drawn from the *Waterbury Regional Bus Ridership Study 2013*, show the busiest 25 bus stops in the system for weekday inbound, weekday outbound, and Saturday service. The results for Sunday service (not included here) are very similar to Saturday, except with figures that are about half of the Saturday totals.

The stop activity shown in the ranked listing and represented by filled circles on the map include both boardings and alightings at the stops. Outbound stops other than Exchange Place consist mostly of alightings, while inbound stops other than Exchange Place consist mostly of boardings.

Exchange Place is by far the busiest stop in the system, both because of the large number of passengers making transfers there and also because of the many riders with destinations in the downtown area (see section below on Transfer Patterns for more discussion). Other important stops include the Walmart on Wolcott Street, Naugatuck Valley Community College (NVCC), St. Mary's Hospital, and the Brass Mill Center Mall (especially on Saturdays), but none of these generate even 10% of the activity at Exchange Place.

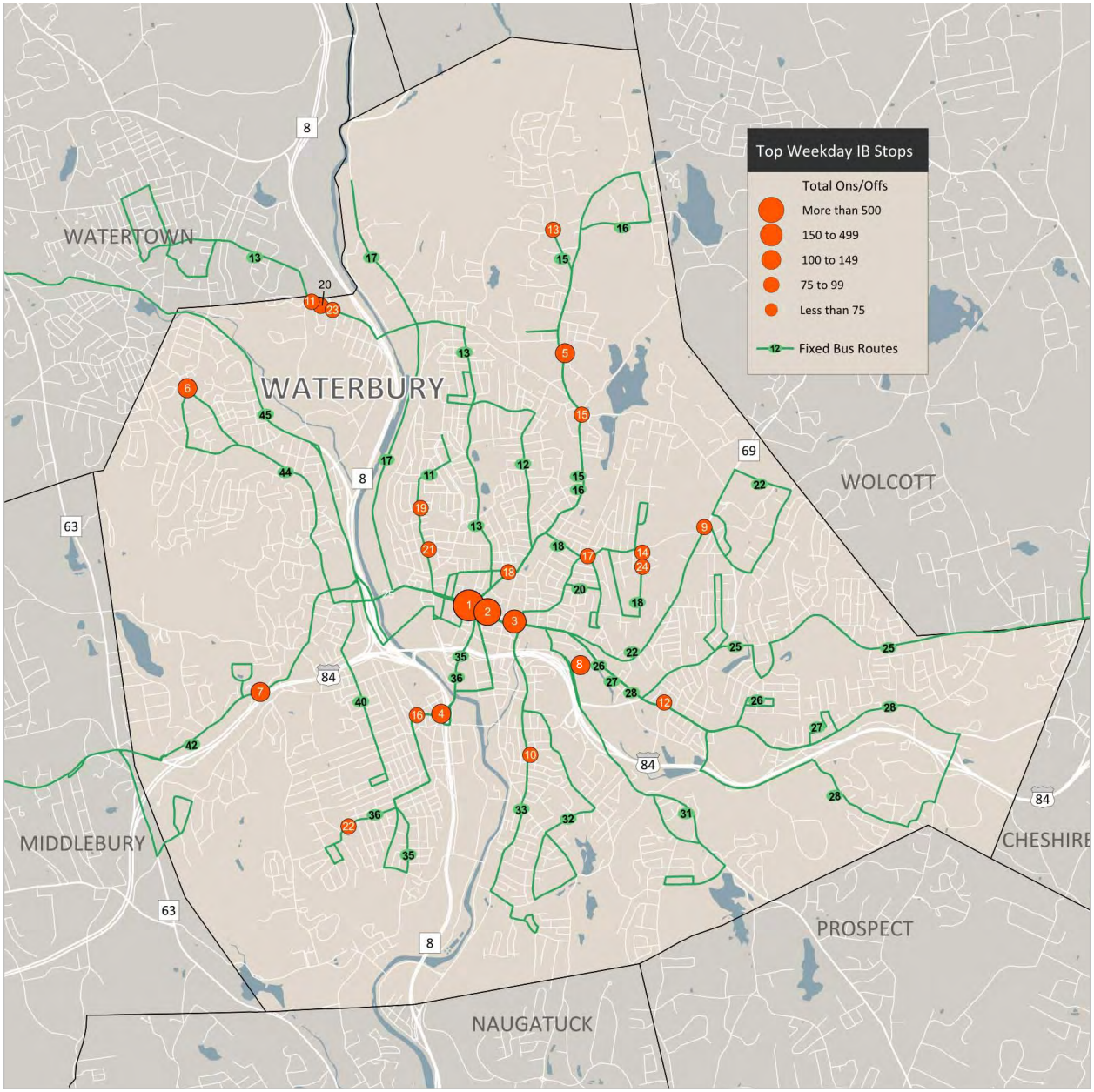
Figure 1. CT Transit—Waterbury Busiest Weekday Outbound Bus Stops: 2013



Rank	Location	Stop Activity Total Ons/Offs
1.	Exchange Place	3,362
2.	East Main St. at Brook St.	491
3.	Walmart at Wolcott St.	181
4.	NVCC at Ekstrom Hall	122
5.	East Main St. at St. Mary's Hospital	116
6.	North Main St. at Valentino Dr.	107
7.	Wolcott St. at Stillson Rd.	83
8.	Chase Parkway at NVCC Driveway	82
9.	North Main St. at Grove St.	81
10.	Baldwin St. at Rye St.	80
11.	Walnut St. at East Farm St.	80
12.	Willow St. at Hillside Ave.	79
13.	Brass Mill Center Mall	77
14.	Bank St. at 868 Bank St.	73
15.	Chase Parkway at West Main St.	66
16.	East Main St. at Mall Entrance	65
17.	Whitewood Rd. at Angel Dr.	65
18.	North Main St. at West Main St.	63
19.	West Main St. at Willow St.	61
20.	Farmcrest Dr. at Bucks Hill Rd.	58
21.	West Main St. at Thomaston Ave.	57
22.	East Main St. at Idylwood Ave.	53
23.	East Main St. at 330 East Main St.	52
24.	Baldwin St. at Washington St.	51
25.	Thomaston Ave. at Dept. of Labor	48

Source: COGCNV Bus Ridership Counts 2013

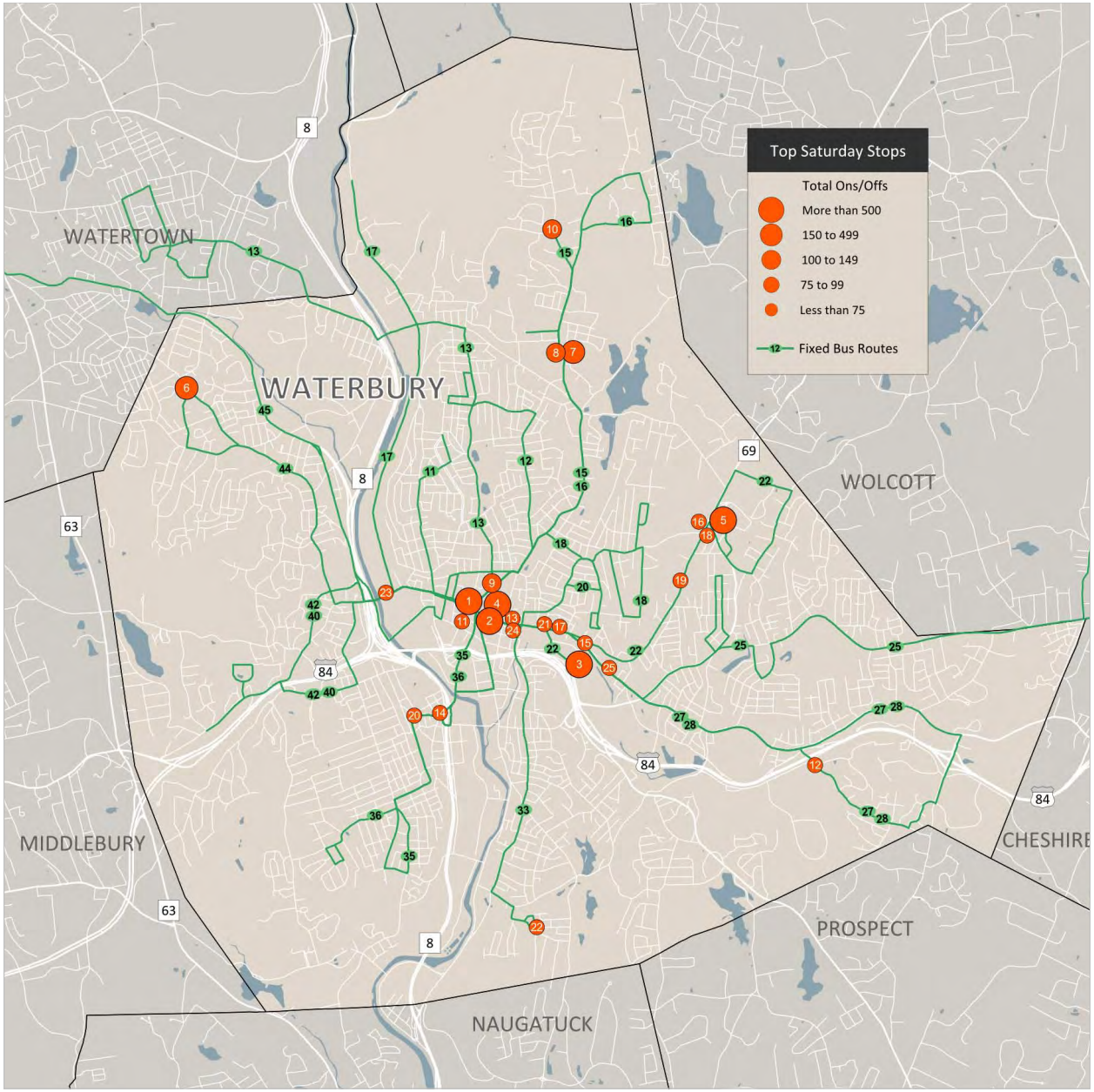
Figure 2. CT Transit—Waterbury Busiest Weekday Inbound Bus Stops: 2013



Rank	Location	Stop Activity Total Ons/Offs
1.	Exchange Place	2,860
2.	East Main St. at Phoenix Ave.	435
3.	East Main St. at Maple Ave.	132
4.	Congress Ave. at Bank St.	95
5.	North Main St. at Waterbury Plaza	88
6.	Whitewood Rd. at Angel Dr.	85
7.	Chase Parkway at NVCC Driveway	78
8.	Brass Mill Center Mall	75
9.	Wolcott St. at K-Mart Plaza	74
10.	Baldwin St. at Rye St.	70
11.	Sunnyside Ave. at Northridge Dr.	68
12.	East Main St. at Albion St.	67
13.	Farmcrest Dr. at Bucks Hill Rd.	65
14.	Berkeley Ave. at 42 Berkeley Ave.	65
15.	North Main St. at Lakewood	60
16.	Congress Ave. at Poplar Place	56
17.	Walnut St. at North Walnut St.	56
18.	North Main St. at Grove St.	56
19.	Willow St. at Plaza Ave.	52
20.	Colonial Ave. at Lester Dr.	52
21.	Willow St. at Hillside Ave.	51
22.	Bradley Ave. at Wesley St.	51
23.	Colonial Ave. at Dorchester Ave.	48
24.	Berkeley Ave. at Berkeley Heights	48
25.	West Main St. at Thomaston Ave.	46

Source: COGCNV Bus Ridership Counts 2013

Figure 3. CT Transit—Waterbury Busiest Saturday Bus Stops: 2013



Rank	Location	Stop Activity Total Ons/Offs
1.	Exchange Place	2,892
2.	East Main St. at Brook St.	344
3.	Brass Mill Center Mall	286
4.	East Main St. at Phoenix Ave.	261
5.	Walmart at Wolcott St.	211
6.	Whitewood Rd. at Angel Dr.	107
7.	North Main St. at Valentino Dr.	104
8.	North Main St. at Waterbury Plaza	87
9.	Cooke St. at North Main St.	80
10.	Farmcrest Dr. at Bucks Hill Rd.	79
11.	Leavenworth St. at Grand St.	72
12.	Scott Rd. at Schraffts Dr.	62
13.	Congress Ave. at Bank St.	61
14.	East Main St. at Maple Ave.	61
15.	East Main St. at Brass Mill Dr.	59
16.	Wolcott St. at K-Mart Plaza	57
17.	East Main St. at Williams St.	53
18.	Wolcott St. at Stillson Rd.	50
19.	Wolcott St. at Mattatuck Plaza	49
20.	Congress Ave at Poplar St.	48
21.	Jersey St. at Spring Brook Rd.	47
22.	East Main St. at Welton St.	47
23.	West Main St. at Thomaston Ave.	46
24.	East Main St. at St. Mary's Hospital	45
25.	East Main St. at Mall Entrance	43

Source: COGCNV Bus Ridership Counts 2013

Ridership by Time of Day

In addition to ridership totals, it is useful to consider ridership and productivity (passengers per revenue hour) by time of day. The Waterbury bus system has essentially flat service, other than the Tripper routes that are specifically operated for commuters. For most of the local routes, the same level of service is operated in the midday as is operated in the morning and afternoon peak periods. The exceptions are Route 11 Overlook/Willow, which has 30-minute service in the peaks and hourly service in the midday; Route 12 Hill Street which has a gap in service from 9:00 a.m. to 11:30 a.m.; and Route 42 Chase Parkway, which has additional peak period trips associated with Post University.

Peak vs. Off-peak Productivity

Table 6 on the next page compares weekday peak ridership and productivity to weekday midday ridership and productivity. In general, productivities are quite high for most of the routes, reflecting a high level of demand in spite of a low level of service supplied. Many routes have productivities exceeding 50 passengers per hour, which would be considered excellent performance even in major metropolitan bus systems. In several cases, the midday productivity is even higher than the peak period productivity, most notably on routes 11, 15, 16, 17, 42, and 44. As noted above, routes 11 and 42 have lower levels of service in the midday than in the peaks, so with sustained demand throughout the day, the midday productivity ends up exceeding the peak period productivity. The North Main Street routes (15 and 16) have higher ridership in the midday than in the peaks in spite of fewer revenue hours being operated. Route 17 has an irregular schedule since it mainly consists of buses heading to and from the Green from the North East Transportation (NET) garage on Thomaston Ave. as they start and end their runs.

Low productivity is restricted to the two Naugatuck routes and routes 31 and 32 which serve the Washington Hill area in the southeastern sector of Waterbury. Several routes would be grouped in the "moderate" range for productivity, including routes 12, 40, and 45.

Weekday vs. Saturday Productivity

Table 7 compares weekday ridership and productivity to Saturday ridership and productivity. Only routes that operate on Saturday are shown on this table. A general rule of thumb in the transit industry is that Saturday ridership tends to be around half of weekday ridership, and that is roughly true for most of the Waterbury routes. It is notably untrue for Route 22 Wolcott Street, which has Saturday ridership almost exactly equal to weekday ridership and productivity that is even higher, due to a slightly lower level of service. Two of the Saturday routes are each combinations of two different weekday routes: Routes 27/28 and 42/40. The weekday statistics shown in Table 7 for these two combo routes represent the sum of the two component routes. Productivity on Route 27/28 is higher on Saturday than it is during weekday service for those two independent routes because of the lower total amount of service operated on Saturday on the combination route. Other than routes 22 and 27/28, the Saturday productivity for most routes is lower than the weekday productivity, as would be expected. It should be noted that while Route 42 is one of the stronger services on weekdays, Saturday demand in the West Main Street/Chase Parkway corridor appears to be much lower. Sunday productivity, not shown in these tables, is generally lower than that on Saturday. Fewer routes operate on Sunday, making the system less comparable to the weekday and Saturday networks.

Table 6: Weekday Fixed-Route Productivity by Time Period

Route Number	Route Name	Peak Period Ridership 2013	Peak Period Revenue Hours	Passengers per Rev. Hour	Midday Ridership 2013	Midday Revenue Hours	Passengers per Rev. Hour
11	Overlook/Willow	319	6.2	51.2	231	3.9	59.7
12	Hill Street	194	5.7	34.2	97	4.1	23.8
13	Oakville/Fairmount	351	5.4	65.2	274	6.4	42.7
15	Bucks Hill/Farmcrest	231	3.4	67.6	255	2.9	86.9
16	Bucks Hill/Montoe	186	3.3	57.2	221	3.0	74.5
17	Thomaston Ave/Waterville	100	3.8	26.1	183	3.5	52.3
18	Long Hill/Berkeley	338	6.5	52.0	238	6.0	40.0
20	Walnut Street	156	3.4	46.1	117	2.9	40.3
22	Wolcott Street	412	7.4	55.6	458	9.3	49.1
25	Hitchcock Lake	312	6.2	50.1	231	6.5	35.5
26	Fairlawn/East Main	169	3.4	50.0	95	2.8	34.5
27	Merline/East Main	201	3.3	61.8	144	3.0	48.0
28	Scott Road/East Main	206	3.4	60.3	118	2.3	51.7
31	East Mountain	34	2.8	12.2	31	1.4	21.6
32	Hopville/Sylvan	75	3.0	25.0	36	2.2	16.2
33	Hopeville/Baldwin	351	6.6	52.9	312	5.9	52.6
35	Town Plot/New Haven Ave	171	3.2	53.2	156	3.0	52.0
36	Town Plot/Bradley	263	3.4	78.1	181	2.9	61.7
40	Town Plot/Highland	111	3.3	34.2	78	3.0	26.0
42	Chase Parkway	274	5.6	48.9	318	4.4	72.8
44	Bunker Hill	207	3.3	62.1	206	2.9	70.2
45	Watertown	197	6.1	32.2	170	6.4	26.5
N1	Naugatuck/Millville	3	0.7	4.5	19	3.3	5.7
N2	Naugatuck/New Haven Ave	2	1.2	1.7	21	2.7	7.9
	Fixed Route Total	**4,863**	**100.5**	**48.4**	**4,190**	**94.7**	**51.3**

Table 7: Weekday vs. Saturday Fixed-Route Productivity

		Weekday			Saturday		
Route Number	Route Name	Ridership 2013	Revenue Hours Per Day	Passengers per Rev. Hour	Ridership 2013	Revenue Hours Per Day	Passengers Per Rev. Hour
11	Overlook/Willow	532	10.5	50.7	242	6.5	37.2
12	Hill Street	282	9.3	30.5	130	6.0	21.7
13	Oakville/Fairmount	601	12.5	48.1	350	9.0	38.9
15	Bucks Hill/Farmcrest	453	6.5	69.7	294	6.5	45.2
16	Bucks Hill/Montoe	393	6.3	62.9	287	6.3	45.9
17	Thomaston Ave/Waterville	284	6.6	43.1	30	2.0	15.0
18	Long Hill/Berkeley	576	13.0	44.3	259	6.5	39.8
20	Walnut Street	268	6.5	41.2	206	6.5	31.7
22	Wolcott Street	856	12.5	68.5	852	11.0	77.5
25	Hitchcock Lake	527	15.0	35.1	325	9.0	36.1
27/28	East Main Street	658	11.6	56.8	468	6.3	74.9
33	Hopeville/Baldwin	649	12.8	50.9	330	6.8	48.9
35	Town Plot/New Haven Ave	293	6.3	46.9	177	6.3	28.3
36	Town Plot/Bradley	363	6.5	55.8	250	6.5	38.5
42/40	Chase Parkway/Highland	763	14.8	51.4	144	6.3	23.0
44	Bunker Hill	383	6.3	61.3	235	6.0	39.2
45	Watertown	332	13.0	25.5	205	13.0	15.8
	Total	**8,213**	**169.8**	**48.4**	**4,784**	**120.3**	**39.8**

Transfer Patterns

The Waterbury bus system is designed as a pulse system, in which all routes (with only a few exceptions) come together at a central point (The Green) at common times, either on the hour or the half-hour or both. This design is intended to facilitate transfers among the routes and is common among radial transit systems with relatively low-frequency service. In addition, routes in Waterbury are heavily interlined; that is, a bus will approach The Green as one route (inbound) and leave The Green as a different route (outbound). For these interlined pairs, passengers who just stay on the bus at The Green are effectively making a transfer between routes.

An important part of the Waterbury Area Transit Study is to analyze the effectiveness of the pulse system and consider alternative operating schemes. In order to judge the importance of transfers relative to total ridership, the tables in this section were prepared to identify route pairs with high rates of transfers.

Methodology

To initiate this analysis, the study team obtained one full week's worth of data from the fareboxes on CT Transit buses in Waterbury. North East Transportation provided a full record of transactions for the period from November 17, 2014 to November 24, 2014, including paper transfers issued and received, and period pass transactions. Each paper transfer received indicated the original bus route on which the transfer was issued and the second bus route on which the transfer was used to board. For period pass riders (monthly passes, etc.), transfers must be imputed from a transaction register. The pass transaction register was sorted by date, pass/ID number and time so that consecutive transactions for a single pass could be identified. Given CT Transit's two-hour transfer policy, any two consecutive transactions for a single pass that occurred within a two-hour window were considered a transfer.

For the November 2014 week analyzed, the average weekday (excluding evening service) number of paper transfers issued was 1,978. Of these, 311 (16%) were used on the same route from which the transfer was issued, presumably for the return trip. The average number of pass transfers was 885, of which 154 (17%) were for two consecutive transactions on the same route. Of course, for pass users, the two-hour policy is not meaningful, since the passes have unlimited use. On Saturday, 1,126 paper transfers were used and 381 pass transactions qualified as transfers. The full tabulation of transfer totals is shown in Table 8 below:

Table 8: Transfer Totals

Time period	Paper Transfers	Pass Transfers	Through Riders	Total Transfers	Total Riders	Percent of Riders
Weekday	1,978	885	418	3,281	8,649	38%
Weekday Evening	208	87	61	356	985	36%
Saturday	1,126	381	277	1,784	4,795	37%
Saturday Evening	238	57	28	323	851	38%
Sunday	645	184	137	966	2,257	43%

Across all time periods except Sunday, there is a very consistent proportion of passengers who are making transfers, at 37% plus or minus 1%. On Sundays, the proportion is a bit higher at 43%. If the "return trip" transfers were removed from the tabulation, the proportion of transferring passengers would be closer to 32% for most time periods. Even this lower percentage, though, represents a relatively high proportion of riders who make transfers. For reference, the proportion for the system in Burlington, VT, which also operates on a pulse schedule, is only 14%.

Certain routes have higher proportions of transfers than others. For weekday service, more than 50% of the boardings on the following routes are transfers (including "return trips"): 16, 35, 47, 49, 81, and 114. The last four of these are Tripper routes, indicating that many riders reach these peak-period shuttles to employment sites via the regular local bus system. On Saturdays, routes 16, 35 and 45 acquire more than 50% of their riders via transfer, and on Sunday, routes 11, 12, 35, 44, 27/28 and 40/42 all have more than 50% of boardings via transfer.

Highest Transfer Pairs

Because of the CT Transit fare policy that allows transfers to the same route as the original boarding (which is called a Two-Hour Pass at the same price as the base fare, $1.50), many of the highest transfer totals are from one route to the same route. Putting these aside for the moment, the highest transfer totals between different routes (in both directions) are shown in Table 9.

Table 9: Highest Transfer Pairs

Time Period	Bidirectional Route Pair	Transfers	Time Period	Bidirectional Route Pair	Transfers
Weekday	16-36*	112	Weekday Evening	16/15-36*	25
	22-45*	78		11-40/42	25
	15-35*	69		13/12-22	11
	26-44*	50			
	13-22	49			
	13-25*	48			
	11-27*	46			
	32-42*	36			
	22-33	35			
	11-22	32			
Saturday	11-27/28*	108	Saturday Evening	16/15-33	16
	22-45*	82		16/15-36*	15
	15-35*	66		13/12-22	14
	33-44*	34			
	16-36*	28			
	12-18	25			
Sunday	11-27/28*	43			
	16-36*	34			
	13-22	33			
	15-35*	28			
	22-45*	27			
	13-27/28	23			
	20-40/42*	22		*Route pair already interlined	

Almost all of the route pairs with the highest transfer totals are routes that are already interlined; thus, these passengers are just staying on the bus at The Green when the vehicle switches from one route to the other. Most of the cases where the routes are not already interlined involve Route 22 Wolcott, which is not surprising given that it is the highest ridership route in the system.

The overall high degree of transferring, combined with the relatively limited set of transfer pairs with significant (more than 20) total transfers, reflects the fact that transfers among the Waterbury routes are spread over the whole system with a many-to-many pattern. These small numbers of transfers among many routes add up to account for the majority of transfers in the system. The higher ridership routes tend to have more transfers in absolute numbers. The routes with the greatest percentage of transfers, excluding through-riders and "return trip" transfers are routes 16 (35%), 26 (37%), 35 (37%) and 40 (35%). A full set of transfer tables is provided in the appendix.

Analysis of Boardings at The Green

According to the comprehensive ridership counts taken by COGCNV in Autumn 2013, there are 4,569 boardings at the stops along The Green on a typical weekday. This includes daytime and evening service. The transfer analysis, based on November 2014 data from the farebox, shows a maximum of 2,568 transfer boardings at The Green. This figure excludes through riders on interlined routes and passengers who are boarding the same route that they "transferred" from. This figure is qualified as a "maximum" because it assumes that all transfers that occur between different routes occur at The Green. Since many routes overlap or meet in other areas of the city, it is likely that at least some of these transfers are occurring at other bus stops not on The Green. It is also the case that if someone comes to downtown Waterbury on one route, does some errands and then takes another route within the 2-hour window, it would be counted as a transfer, but it is not really a transfer for our purposes.

Thus, the maximum percentage of weekday boardings at The Green which are transfers between routes is 56%. It should be noted that in the on-board passenger survey conducted as part of this study, 85% of respondents say that they have destinations in downtown Waterbury around The Green, implying that only 15% come to The Green to transfer. However, this question was asked in general terms, not about the specific trips that the passengers were taking that day. These passengers likely interpreted the question to mean "do you ever have destinations in downtown Waterbury near The Green" and thus the overwhelming majority answered yes. It is almost certainly the case that these passengers sometimes have destinations near The Green and other times only come to The Green to transfer to another route. Therefore, while about 15% of riders may never, or only rarely, have destinations near The Green, on a given day, another group of passengers who sometimes have destinations near The Green are using it only as a transfer point.

Considering 56% as the maximum percentage, and 15% as a minimum, (really below a reasonable lower bound given what we know about the overall transfer rate in the system), the real transfer rate is likely to be in the range of 40-45% after pulling out passengers whose trips count as a transfer in our technical definition, but would not look like a transfer if we were observing them at The Green; that is, a traditional transfer, in which a passenger alights from one bus and goes directly to a different bus to board. A more precise estimate would require additional data collection, including direct observation of passenger movements at The Green, which is very difficult to accomplish. The other 55%-60% of passengers boarding at The Green either live near there, work near there, or have other business in downtown Waterbury.

Operational Implications

The overall high number of transfers that occur in the Waterbury system and the large percentage of boardings at The Green that are transfers both suggest that it is important to retain a central transit station where all routes meet. The large number of destinations near The Green and the high degree of residential and employment density in downtown Waterbury within a block north, east and south of The Green, as well as transit propensity (see section below on Socioeconomic analysis), also suggest that the radial nature of the system with direct access to the downtown be preserved. Feedback from riders and drivers about poor reliability suggest that the pulse schedule itself is not absolutely essential, since many buses routinely miss the pulse because of late arrivals.

The current interlining scheme is convenient for many passengers (over 400 on a typical weekday), which suggests it should be maintained in its current form. However, it is possible that other route combinations may be attractive to larger numbers of passengers. While not every route can be interlined with the 22 Wolcott Street, during the service planning phase of the study, other route combinations will be considered.

Peer Analysis

In prior work done by Steadman Hill Consulting for the Chittenden County Transportation Authority (CCTA) in Burlington, VT, the bus system in Waterbury was included among a group of 23 peer agencies to allow CCTA to measure its performance, costs, funding, and fares against peer benchmarks. This same group of peers can serve equally well for the system in Waterbury.

The charts on the following pages illustrate a comparison between CT Transit Waterbury and the 23 peer systems, as well as the average of all of the peer systems. It is important to note that the majority of the data shown on the graphs is derived from the 2012 National Transit Database (NTD), which was the most recent data available when this analysis was performed. According to North East Transportation, the submission for CT Transit Waterbury to NTD also includes data for NET's service in Meriden and Wallingford, thus, to some extent diluting the performance of Waterbury services with the weaker services in those two towns.

Indeed, comparing the productivities in the following charts with the figures listed above in various tables indicates a significant difference in performance. The 27.9 passengers per hour shown below is significantly less than the 48.4 passengers per hour for weekday service and the 38.9 passengers per hour for Saturday service shown in Table 7. Some of this difference is due to the inclusion of Meriden and Wallingford. Some of it is because Table 7 does not show evening or Sunday productivities, which are less than weekday and Saturday productivity. Some of it is because the tables in this document are based on the October 2013 ridership counts, and October tends to be the highest ridership month of the year, while the NTD submission is based on farebox counts taken over the entire fiscal year. Some of it is due to differences in the way revenue hours are tallied in the NET submission to NTD compared to the calculations in Tables 6 and 7. Finally, some of it may be to systematic undercounting of passengers at the farebox, if some passengers board at the rear door, or if fareboxes malfunction and do not record all boardings.

With all of that said, it is still instructive to compare the Waterbury data to its peers and see that the Waterbury system generally performs better than the peer average, with higher productivity, better cost effectiveness, and a lower operating subsidy per trip.

Definition of Peer Group

The peer group consists of 23 agencies from across the country, but most of them from the northern and eastern parts of the US. There is one agency from the west coast (Everett, WA) and one from the mountain states (Fort Collins, CO), but all of the rest of the peers are from the northeast or the upper midwest.

The peers were chosen based on several metrics, including service area population, annual ridership, the number of revenue hours operated, and the presence of significant educational institutions within the service area. The list of peer agencies is shown below and the comparison of Waterbury to its peers along the first three metrics is presented in Figures 4 through 6.

Table 10: Peer Agencies

Short Name	Agency	City	State
Transfort	Transfort	Fort Collins	CO
Norwalk	Norwalk Transit District	Norwalk	CT
Peoria	Greater Peoria Mass Transit District	Peoria	IL
Springfield	Springfield Mass Transit District	Springfield	IL
Bloomington	Bloomington Public Transportation Corp.	Bloomington	IN
Fort Wayne	Fort Wayne Public Transportation Corp.	Fort Wayne	IN
South Bend	South Bend Public Transportation Corp.	South Bend	IN
Merrimack	Merrimack Valley Regional Transit Authority	Haverhill	MA
Lowell	Lowell Regional Transit Authority	Lowell	MA
Worcester	Worcester Regional Transit Authority	Worcester	MA
Portland	Greater Portland Transit District	Portland	ME
Kalamazoo	Kalamazoo Metro Transit System	Kalamazoo	MI
Duluth	Duluth Transit Authority	Duluth	MN
St. Cloud	St. Cloud Metropolitan Transit Commission	St. Cloud	MN
Tompkins	Tompkins Consolidated Area Transit	Ithaca	NY
Broome	Broome County Dept of Public Transportation	Vestal	NY
Youngstown	Western Reserve Transit Authority	Youngstown	OH
Reading	Berks Area Reading Transportation Authority	Reading	PA
Blacksburg	Blacksburg Transit	Blacksburg	VA
Charlottesville	Charlottesville Area Transit	Charlottesville	VA
CCTA	Chittenden County Transportation Authority	Burlington	VT
Everett	Everett Transit	Everett	WA
Charleston	Kanawha Valley Regional Transportation Auth.	Charleston	WV

Figure 4: Service Area Population

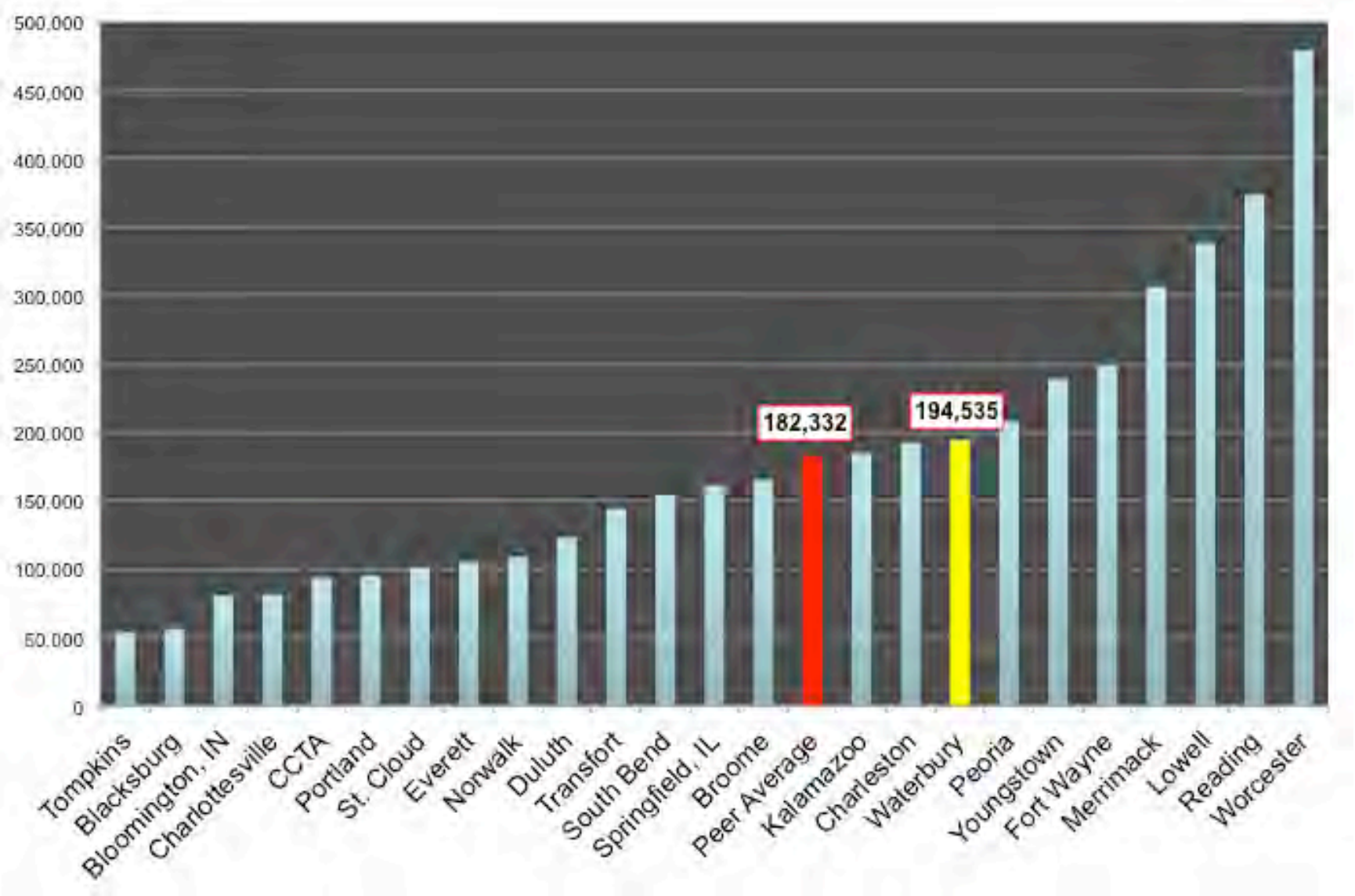


Figure 5: Annual System Ridership

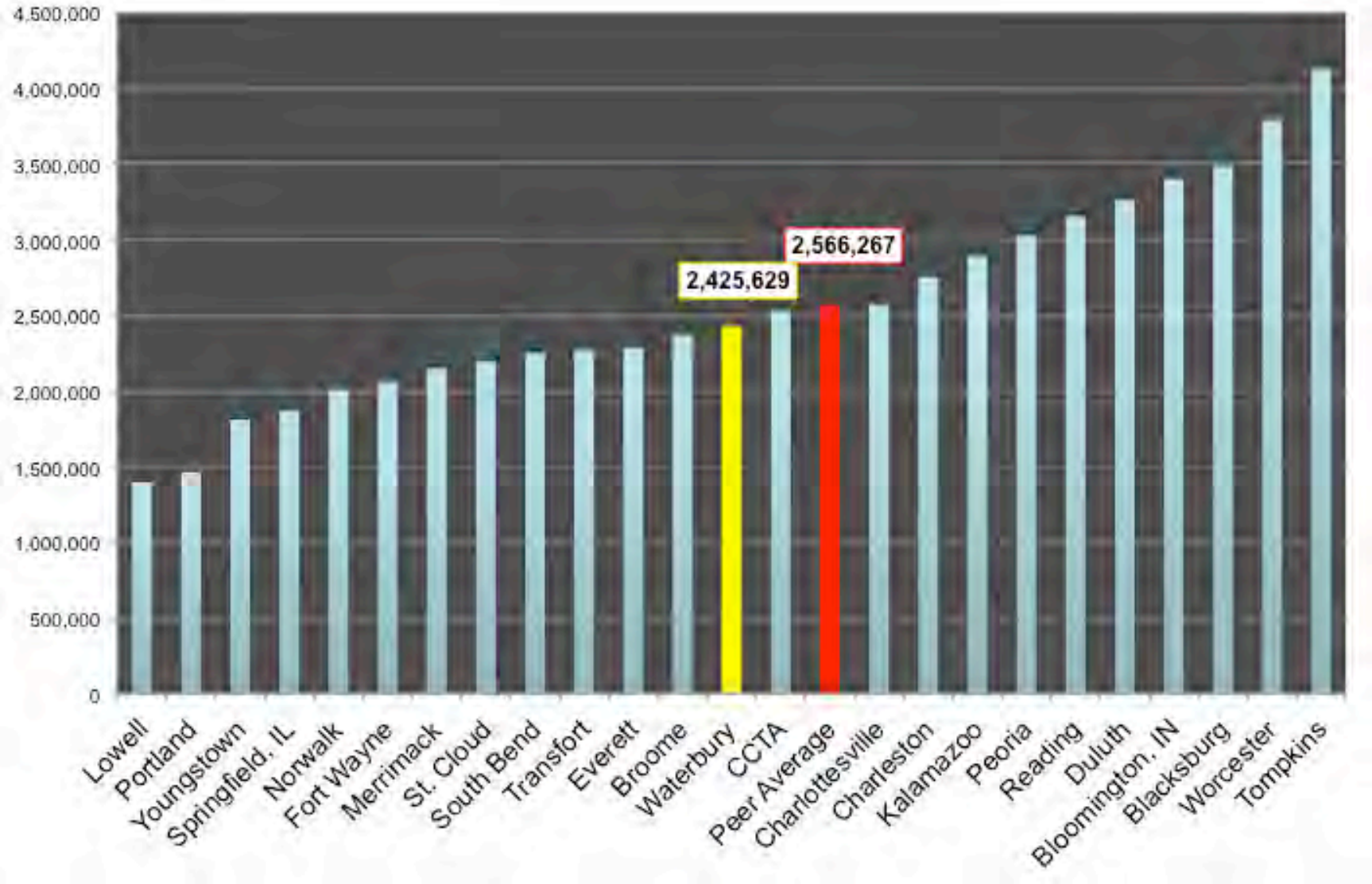
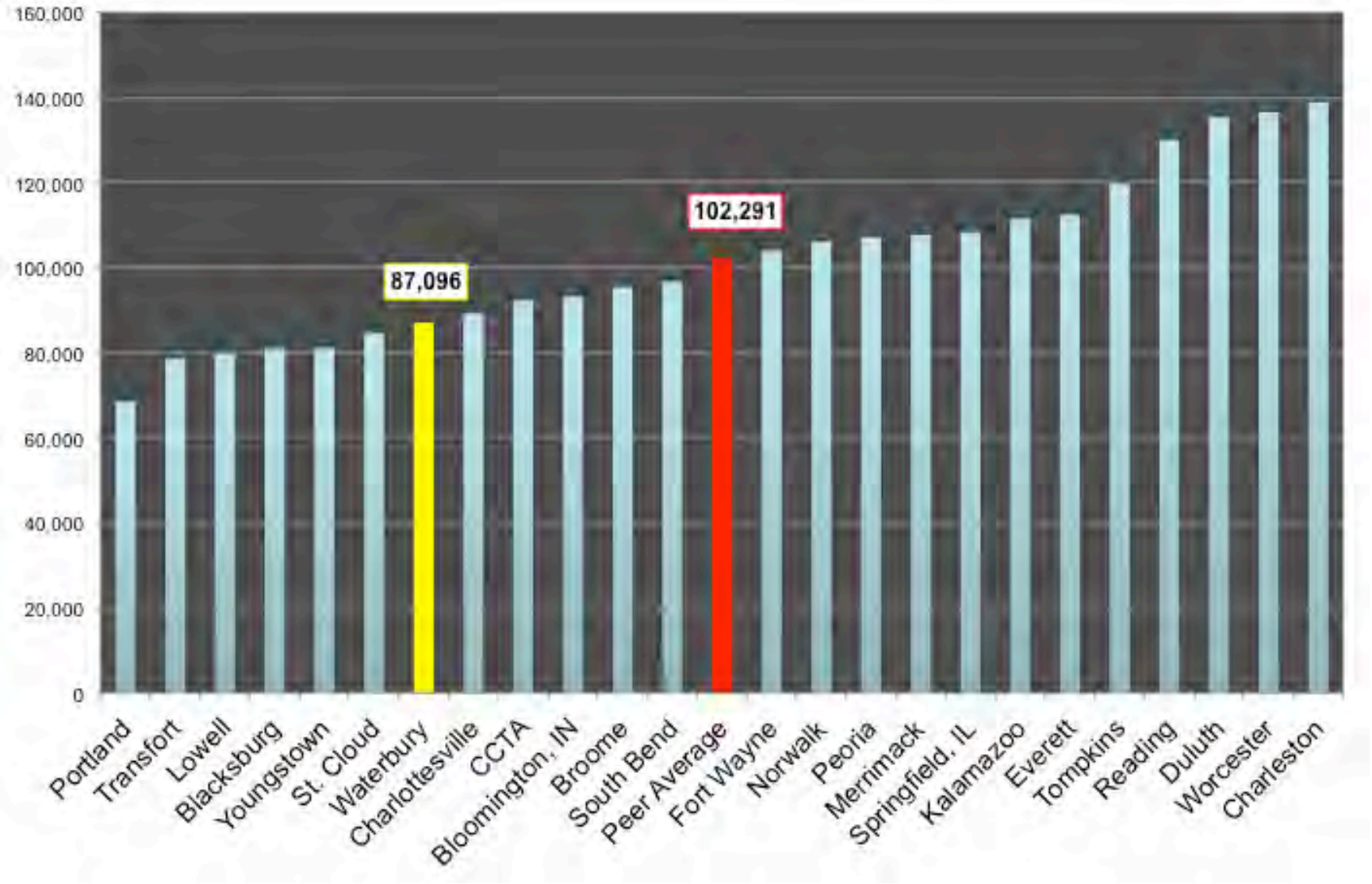


Figure 6: Annual Vehicle Revenue Hours



Productivity

Among the peer agencies, the average productivity, in terms of boardings per vehicle revenue hour, is 25.1, as shown in Figure 7. The figure for the Waterbury system in the NTD is 27.9, significantly above the peer average, but as discussed above, that figure understates the productivity of the regular fixed route system in Waterbury because the NTD figures include Meriden and Wallingford, as well as other factors. Using the productivity calculated from the 2013 ridership counts, the Waterbury local routes would be near the top of the peer systems, perhaps outranked only by Blacksburg, VA, which has a huge amount of ridership related to Virginia Tech. Figure 8 displays another measure of productivity: boardings per vehicle revenue mile. By this measure, the Waterbury system performs even better compared to the peer average.

Cost Efficiency

The Waterbury bus system is relatively cost efficient compared to its peers. Figure 9 and 10 show the cost of supplying service on the basis of mileage and vehicle hours. The Waterbury cost per vehicle mile (Figure 9) is slightly higher than the peer average, but the cost per vehicle revenue hour is about 6% lower than the peer average. This difference indicates that the average speed of service in Waterbury is lower than that of its peers, likely due both to the high number of boardings on Waterbury bus routes and the traffic congestion in the downtown area of Waterbury.

Figures 11 and 12 display the cost effectiveness of bus service in Waterbury. Figure 10 shows the gross operating cost per passenger boarding, which is essentially the answer to the question: "how much does it cost to transport the average bus rider?" Waterbury's cost is 15% lower than the peer average, and almost 50% lower than some of the highest cost agencies. This cost effectiveness is due both to the low cost per unit of service supplied and the high productivity of Waterbury's routes.

Figure 12 incorporates fare revenue into the calculation to show the operating subsidy per passenger. This graph answers the question: "how much do the taxpayers pay every time someone boards a bus in Waterbury?" The subsidy in Waterbury is 25% lower than the peer average. Only six agencies have lower subsidies, and the highest subsidies are again nearly twice the level in Waterbury.

Fares

One of the reasons the Waterbury system performs much better than its peers in terms of operating subsidy is that its fares are higher. As shown on Figures 13 and 14, the base cash fare of $1.50 is above the peer average ($1.25), and the monthly pass fare of $54 is the third highest among the 24 agencies. It should be noted that fares are set by CT Transit on a statewide basis.

Funding

Most of the peers are funded with a combination of federal, state, local, and directly generated (fare) revenue. As shown in Figure 15, the Waterbury system receives 80% of its operating funds from the State, as opposed to the peer average of 34%. The only agency close to it is also in Connecticut. This reflects the policy in Connecticut by which the State is legally responsible for 100% of the operating deficit of all fixed route services for all Connecticut transit properties. Because of that policy, Waterbury, like Stamford, New Haven, Hartford, and New Britain contribute no local dollars to fund transit operations. Figure 16 demonstrates that among the peer agencies, the Waterbury system

is one of only two agencies that receive zero local funding. Most agencies derive between 15% and 30% of their funding from local municipalities, with the peer average at 23%. The agencies that had the lowest levels of state funding generally have the highest levels of local funding, and vice versa. The City of Waterbury, like many other localities in Connecticut and elsewhere, provide local funding for infrastructure and maintenance, which are not reflected in the figures from the NTD.

ITS

The final component of the peer analysis is a summary of ITS investment in real-time passenger information and automatic vehicle location. Seven of the peers currently have this technology and three others are in the process of implementing it. About half of the peers (including Waterbury) have no immediate plans for implementation. As will be discussed elsewhere, real-time information can be a significant benefit to current riders and help new riders overcome a significant hurdle to trying the bus system.

Figure 7: Boardings per Vehicle Revenue Hour

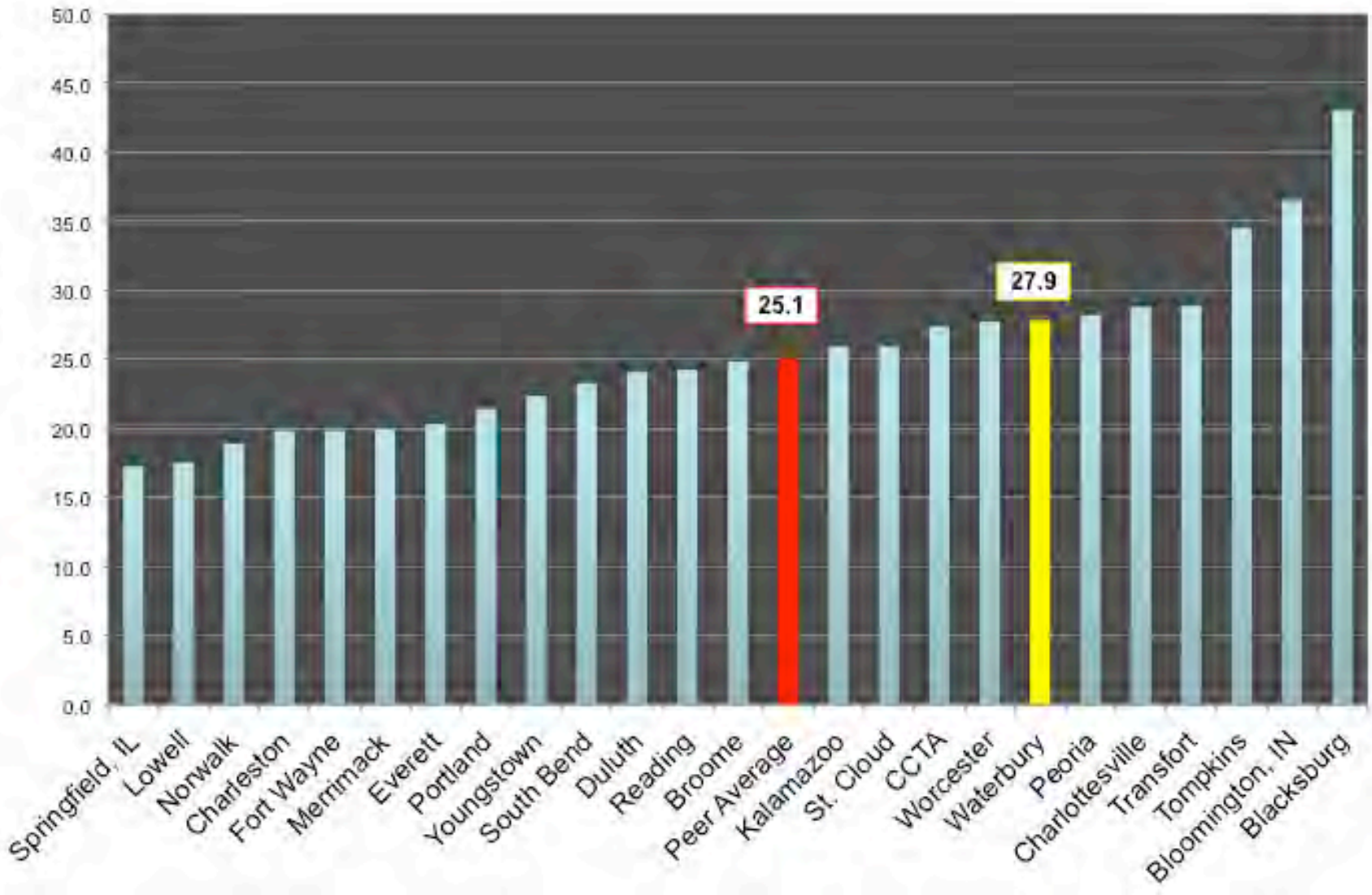


Figure 8: Boardings per Vehicle Revenue Mile

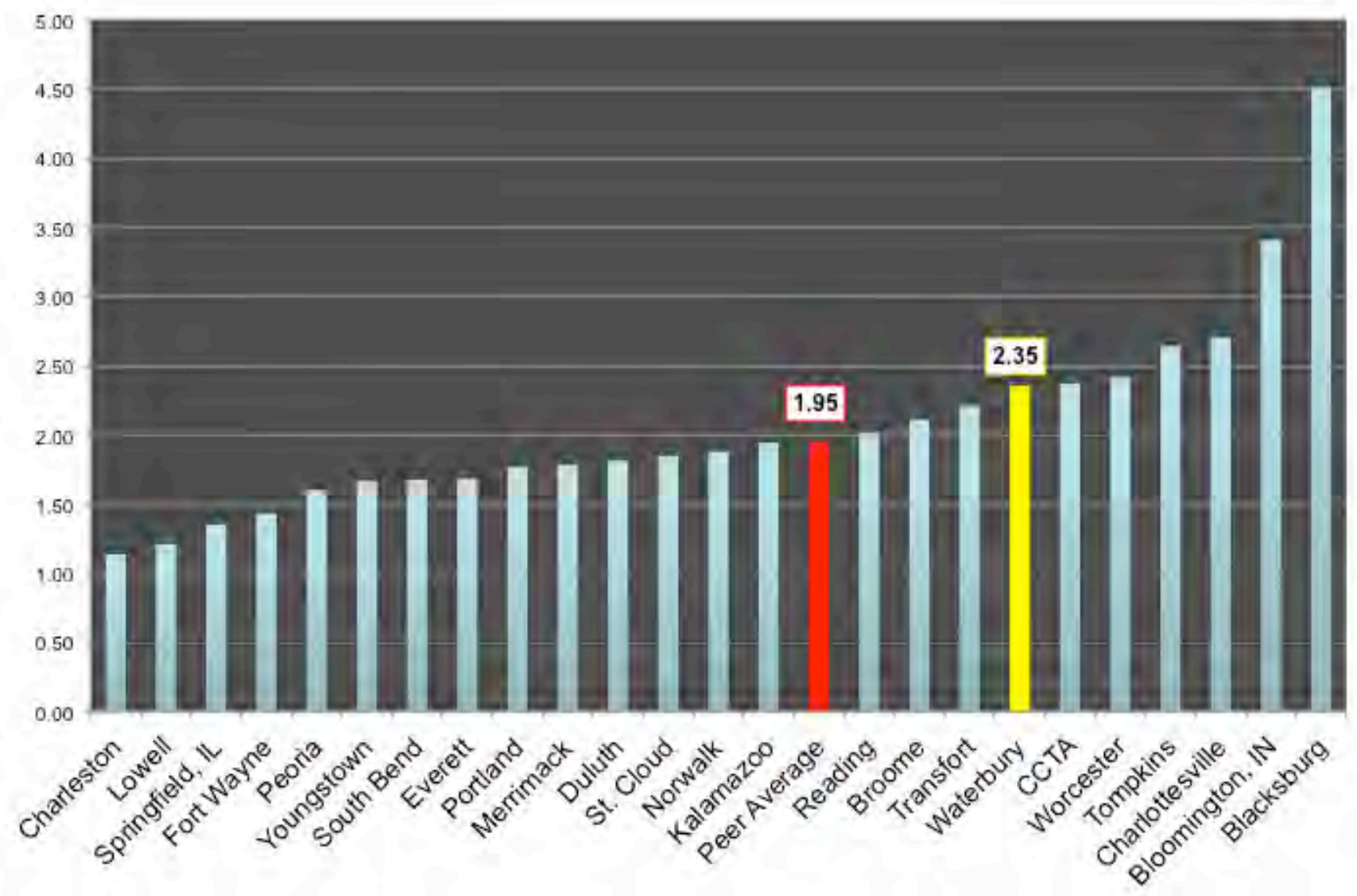


Figure 9: Cost per Vehicle Revenue Mile

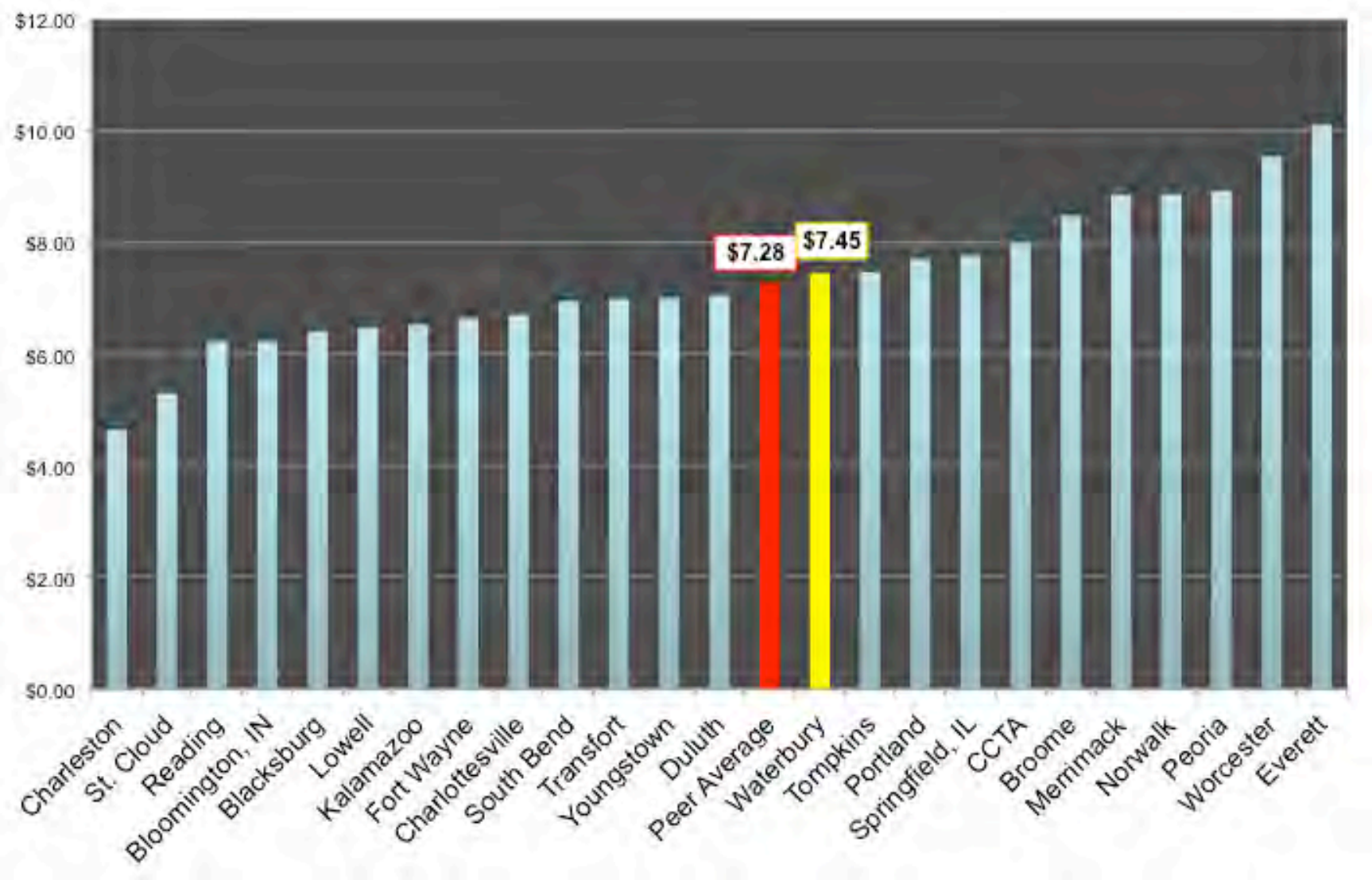


Figure 10: Cost per Vehicle Revenue Hour

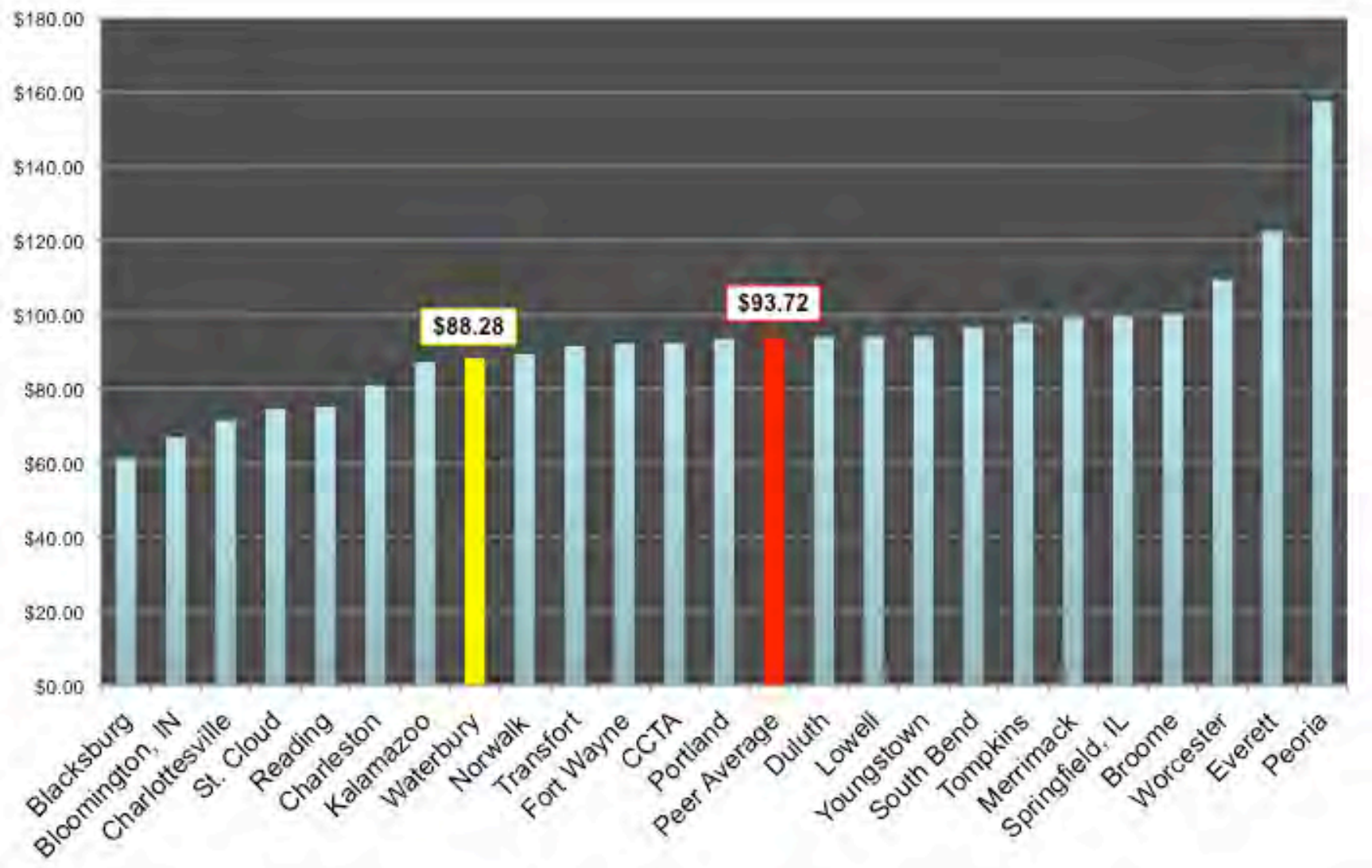


Figure 11: Cost per Passenger

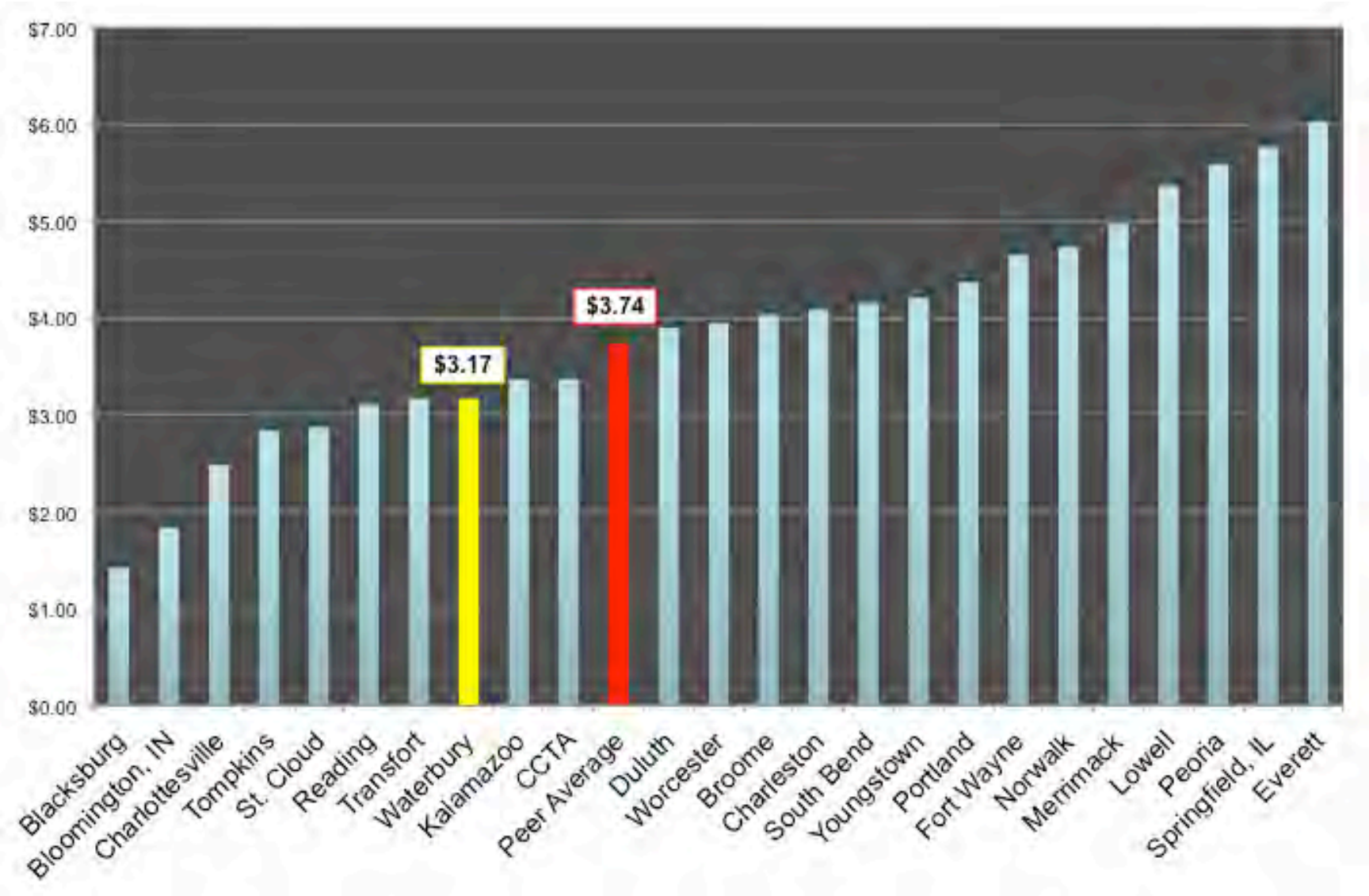


Figure 12: Operating Subsidy per Passenger

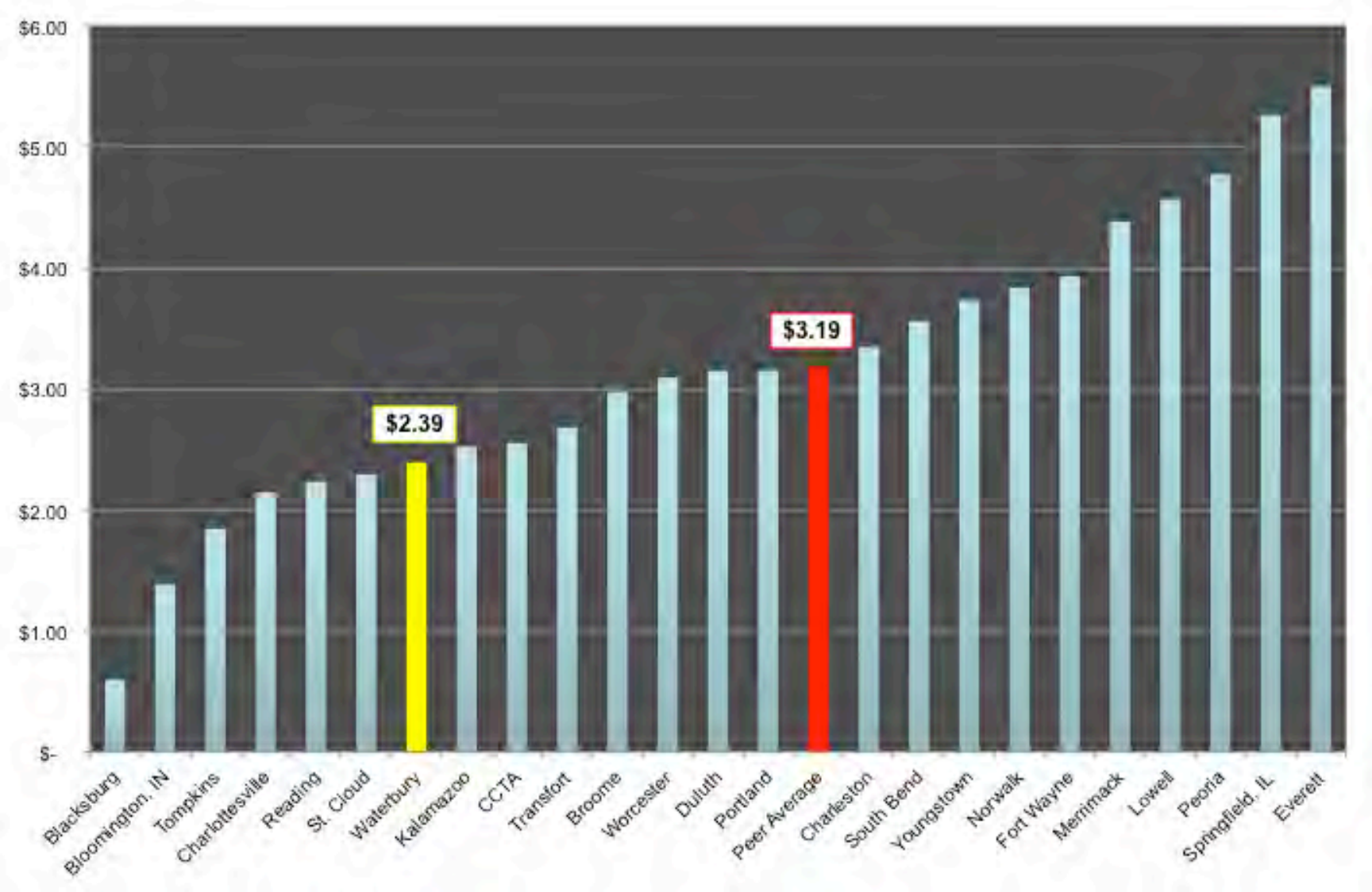


Figure 13: Base Fare

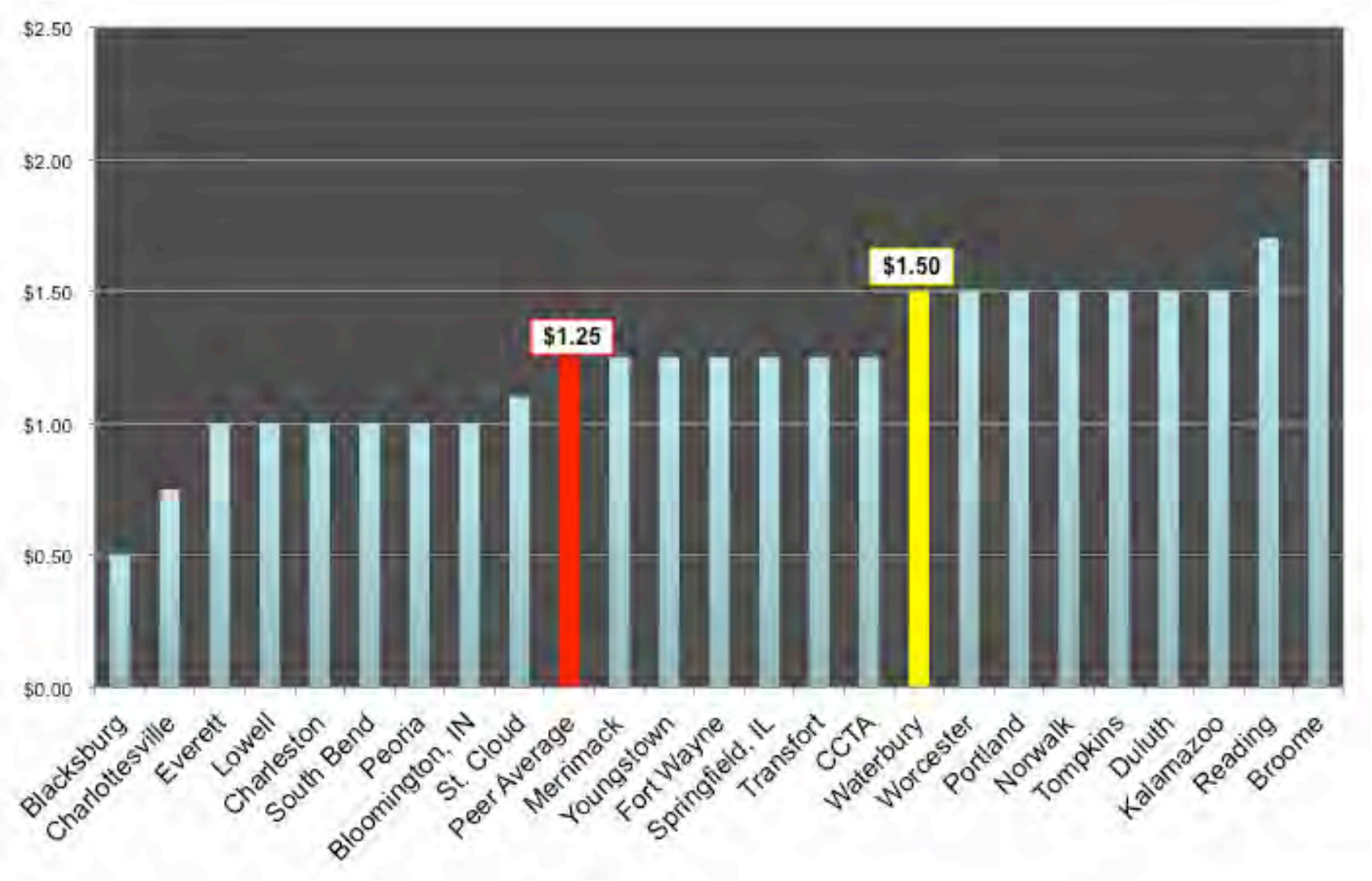


Figure 14: Monthly Pass Fare

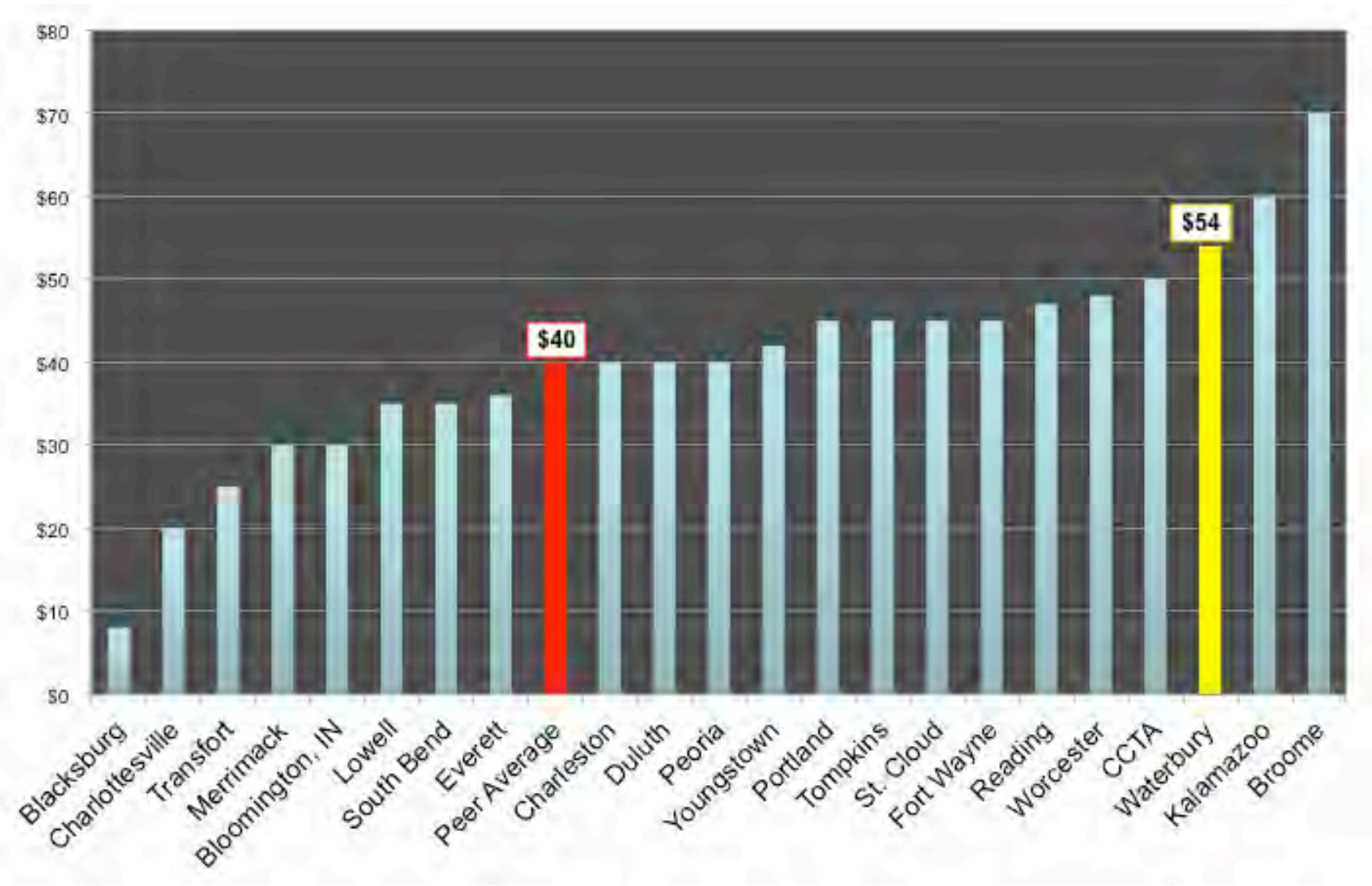


Figure 15: State Funds as a Percentage of Operating Funds

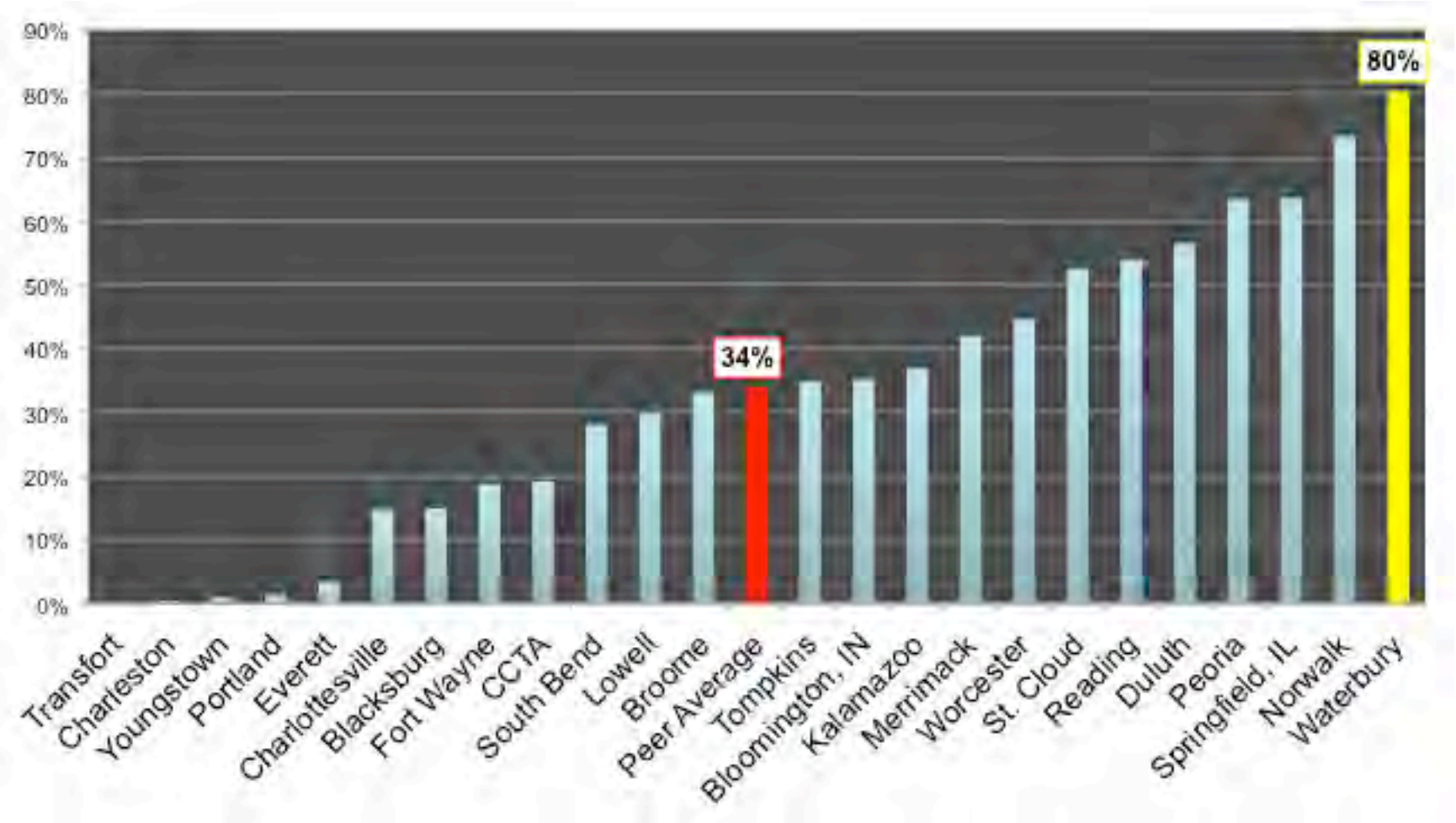
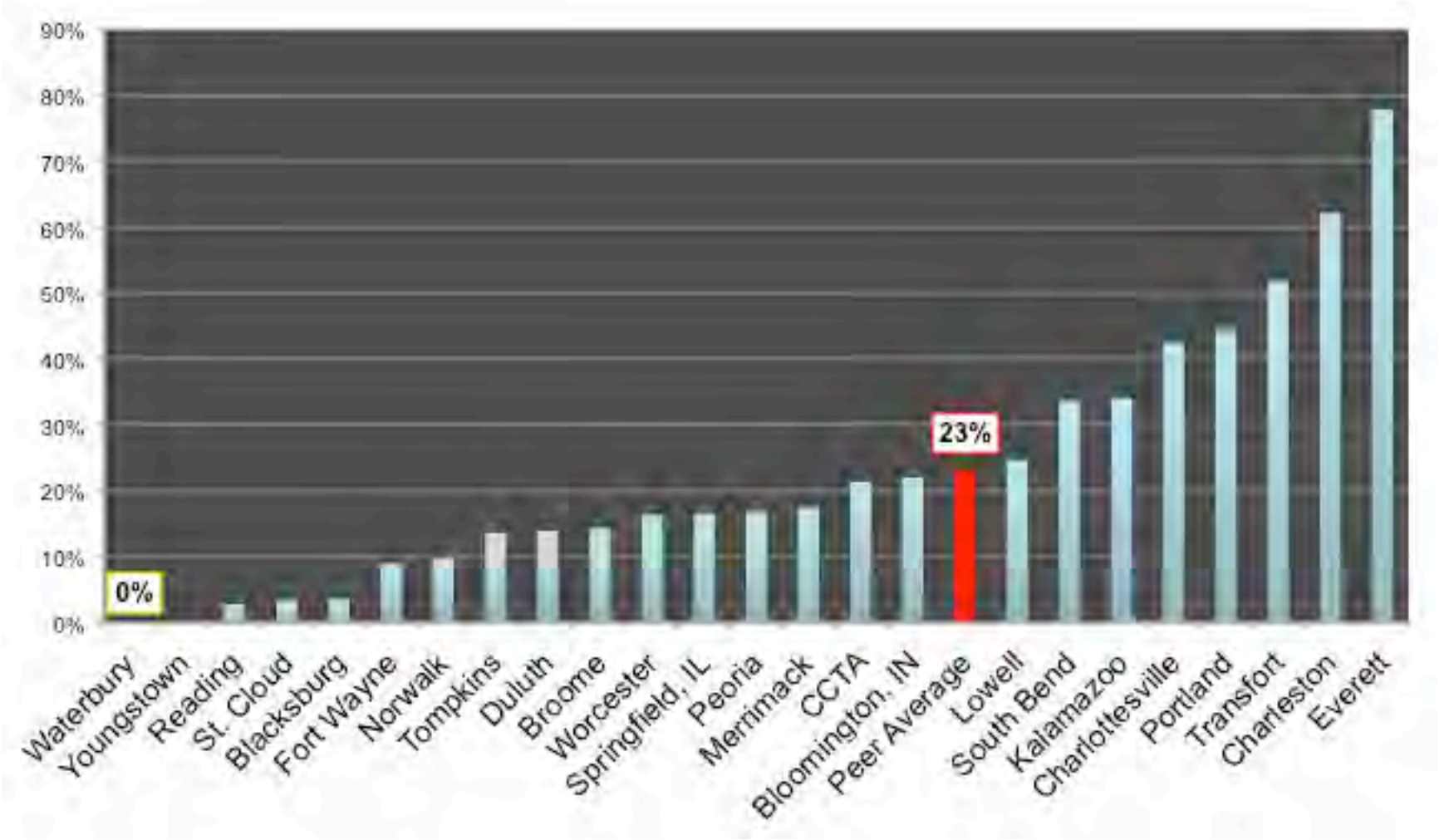


Figure 16: Local Funds as a Percentage of Operating Funds



On-board Survey Results

During December 2014, the WATS study team surveyed approximately 8.5% of the weekday ridership on CT Transit Waterbury routes (764 completed surveys from 8,939 average weekday riders), in an effort to learn more about why and how current riders use the system and what types of improvements they would most like to see. The team chose to interview passengers rather than handing out questionnaires, thereby ensuring a high response rate and a more representative sample.

The sample was developed by selecting morning portions of driver runs that covered all Waterbury routes. The survey began at the start of service (roughly 6:00 a.m.) and continued through early afternoon (roughly 2:00 p.m.). Regular local routes and Tripper routes were all included. No surveys were collected on the low-ridership Route 31, East Mountain, and thus it is not listed below.

Response Rates

The survey results were weighted to represent the ridership by route as tabulated in the 2013 ridership counts. The number of completed surveys by route, route ridership, and the corresponding weight factors are shown below.

Table 11: Survey Response and Weight Factors

Route	Route name	Surveys	Riders	Weight Factor
11	Overlook/Willow	38	532	14.0
12	Hill Street	24	282	11.8
13	Oakville/Fairmount	41	601	14.7
15	Bucks Hill/Farmcrest	50	453	9.1
16	Bucks Hill/Montoe	19	393	20.7
17	Thomaston Ave/Waterville	16	284	17.8
18	Long Hill/Berkeley	45	576	12.8
20	Walnut Street	21	268	12.8
22	Wolcott Street	70	856	12.2
25	Hitchcock Lane	61	527	8.6
26	E Main St/Fairlawn	20	252	12.6
27	E Main St/Meriline	15	340	22.7
28	E Main St/Scott Rd	15	318	21.2
32	Hopeville/Sylvan	11	81	7.4
33	Hopeville/Baldwin	69	649	9.4
35	Town Plot/New Haven	30	293	9.8
36	Town Plot/Bradley	24	363	15.1
40	Town Plot/Highland	15	179	11.9
42	Chase Parkway	51	584	11.5
44	Bunker Hill	57	383	6.7
45	Watertown	34	332	9.8

T4	Naugatuck Shuttle	1	17	17.0
T47	Watertown/Straits Tpke	14	26	1.9
T49	Watertown Industrial Pk	4	42	10.5
T74	Naugatuck Industrial Pk	6	83	13.8
T81	Cheshire Industrial Pk	4	69	17.3
T114	Beacon Falls Ind. Pk	4	127	31.8
N1N2	Naugatuck	4	29	7.3
	TOTALS	764	8,939	11.7

Usage Information

The first portion of the results have to do with the purposes, frequency, alternatives, and reasons why riders use the bus system. Surveys taken during the morning hours typically show a relatively high percentage of trips being taken for work purposes, and this survey is no exception. Shopping and social/recreational have a somewhat higher prevalence here than on some other similar systems, especially given the survey hours. These figures indicate that many riders use the bus system for all of their transportation needs. A number of riders indicated two or more purposes for their trip, suggesting that they were traveling between two of the activities listed above, or that they were answering more generally about how they use the bus system, rather than the purpose of that particular trip.

Purpose of Trip

a)	Work	42.3%
b)	School	19.5%
c)	Shopping	11.0%
d)	Social/recreational	9.6%
e)	Personal Business	4.7%
f)	Medical/Dentist	10.0%
g)	Between jobs or work-related errands	2.2%

The vast majority of riders on the bus are people who use the system daily. Of course, surveys of this type tend to overstate the presence of frequent riders, because infrequent riders are less likely to be surveyed, simply because they are not on the bus as often. Thus the full universe of people who use the system would include greater numbers of infrequent riders than what is shown here. Nonetheless, the high percentage of daily users indicates a high degree of transit dependency.

Frequency of Bus Ridership

a)	Daily	71.9%
b)	2-3 Times per Week	18.6%
c)	Once per Week	4.6%
d)	2-3 Times per Month	0.9%
e)	Once per Month	1.8%
f)	Once Every Few Months	0.1%
g)	Once per Year	0.2%
h)	First Time Riding	1.8%

With the high prevalence of work and school trips, as well as medical appointments, it seems clear that the great majority of people on the bus are traveling because they need to, not as an optional trip. Thus, as shown below, nearly three quarters of the respondents said they would continue to make the trip even if the bus were not available. With respect to alternative modes that would be used, the 30% with trips short enough to walk likely responded with that answer, while almost everyone else said they would need to get a ride. Only 10% indicated that they would be able to drive, again highlighting the high degree of transit dependency among the ridership. Many riders noted that it would be "very difficult" to make the trip if the bus were not available.

If the bus was not available, would you still make this trip?

a) Yes	72.7%
b) No	27.3%

If Yes, how would you make this trip?

a) Walk	29.7%
b) Bike	2.5%
c) Taxi	7.8%
d) Drive car	10.2%
e) Get a ride	48.6%
f) Not Sure/Other	1.2%

Could you have driven today instead of taking the bus?

Yes, I have a license and a car was available	9.5%
No, I have a license but no car was available	28.2%
No, I do not have a license or I am unable to drive	62.3%

The low percentage of riders who said they could have driven is very much in line with the percentage who indicated driving as an alternative in the previous question. The very high percentage who said they do not have a license or are otherwise unable to drive is a bit surprising. It may be a case of people with no prospect of affording a car not bothering to get a driver's license.

As shown below, Downtown Waterbury clearly represents an important destination for current riders. To some extent, this is not surprising because the current route structure is most convenient for those with destinations near The Green. While not presupposing a conclusion to the analysis of alternative downtown solutions, this response indicates that moving the pulse point to a location not in the immediate vicinity of downtown Waterbury would have a negative impact on most riders.

Do you use the bus system to reach destinations in Downtown Waterbury near The Green?

a) Yes	84.9%
b) No	15.1%

Desired Improvements

The second group of questions sought out opinions from the riders as to what changes to bus service would be most attractive and important to them. Higher ratings indicate more interest.

As shown below, the clear winner in this comparison of potential improvements is "more passenger shelters." The fact that the survey was conducted on cold, rainy days in early December probably increased the interest in this option significantly, but it is nonetheless the case that there are few passenger shelters in the system relative to the ridership. More service on Sunday was the second most popular item, again not surprising given the high degree of transit dependency among the riders and the current low level of service offered on Sunday. Technology to provide real-time information on bus arrivals was next, again probably enhanced by the poor weather and the degree of unreliability that many riders have reported. More service on Saturdays and better frequency during the regular service day were also rated highly; these appear to be greater concerns than the evening service now offered. The comfort of the buses and the amount of early morning service appear to be satisfactory for many of the riders.

Interest in Potential Improvements (1 to 5 scale – higher rating indicates stronger interest)

a)	More frequency during the day	3.6
b)	Earlier hours in AM	3.0
c)	Later hours in PM	3.2
d)	More frequency in the evening	3.4
e)	More routes operating in the evening	3.4
f)	More service on Saturday	3.6
g)	More service on Sunday	3.9
h)	Better on time performance	3.3
i)	More passenger shelters	4.2
j)	Real-time info on bus arrivals	3.9
k)	Better, more comfortable buses	2.6

Riders were asked for specific suggestions of places that should be served by the bus system. In addition to the locations listed below, approximately 60 other locations were mentioned by fewer than five riders each. Many of the locations listed already have some service (such as Naugatuck), but that service (often tripper routes) is seen as inadequate. Hartford and New Britain are now newly accessible due to CT Fastrak. All of the locations mentioned in the survey will be considered for possible service in the planning phase of the study

Requested Service to Places Not Currently Served

Location	Requests	Location	Requests
Naugatuck	40	Watertown	11
Hartford	35	Thomaston	8
Meriden	34	New Britain	7
Bristol	19	Prospect	7
Cheshire	19	New Haven	6
Lakewood Rd	17	Southington	6
Torrington	17	Middlebury	5
Bridgeport	15	Middletown	5
Danbury	12	Straits Tpk	5
Wolcott	12		

Comments

Roughly 70 passengers offered comments on their route or the system in general. These are presented here for reference. As with the requests for new service, these comments will be considered during the planning process for route improvements.

Route	Comment
T4	Sometimes I don't feel safe
11	More reliable especially at night
12	Route 28 more frequent service
12	Needs more signs marking stops not enough bus signs and info
12	Shelters need seats especially the ones on the hourly routes
13	Fares too high
13	Need earlier #28
13	Need earlier Sunday am #13
15	#25 late West Main St
15	Chase ave in front of shopping Target no bus stop
15	Connecting bus late
15	Cook st needs more frequent service
15	Runs late
15	Transfer make it longer
18	#12 more buses, #22
18	Run earlier in the morning on the weekend
18	More service on sunday
18	The bus drivers need to come at the time on the schedules not leaving when they should be there. it causes people to be later for work, wait a little longer
20	There is no stop on Lakewood road
22	Always crowded. Run more often 1/2 hr
22	Back seats are too hard
22	Bus 22 and bus 45 to Watertown every 4:00 bus from Walmart to downtown is never on time to catch 4:30 bus and I have to stand about 5 out of 10 times- a very busy route. Need 2 buses, especially with holiday here
22	Should be more comfortable in the back
25	#22 more bus 1 more bigger bus
25	#45 late
25	33 bus is late
25	Back seat to be more comfortable
25	Bus 12 9:30-11:30
25	Extended hours in the weekend
25	Improvement on the North Main bus 15/16; it always late never on time
25	More buses bigger buses
25	Post university (800 country club rd waterbury)
26	25 Austin Rd M-F no bus. Needs 25 Austin Rd to bring her to downtown

Route	Comment
26	Buses running till 2 AMish on weekends that would keep people out of the bars from driving and boost business downtown
26	Mall more often 1 hour is too long and that route is super packed 1 hour wait no shelters customer service line needs to be on later
26	More stops (like before) coming up East Main (not having to walk all the way to green)
26	More wheelchair friendly service
28	Bus 28 should run all day like others
28	Really need more runs to and from nvcc more comfortable buses when not overly crowded
28	Reidville on weekends
33	#22 more buses
33	#28 #27 fri sat late #18
33	#32 long gap just a bench in shelters
33	Sat, Sun half-hour service
33	Baldwin every 1/2 hour #28 #22
33	Big credit to the driver
33	Bus 22 more; bus back up North Main
33	Evening jam-packed
33	Evening service
33	Missing connection from the Green #22; avoid the mall parking lot
33	Sat/Sun morning service, 2 hours gap 9-11:30 every day
33	The t81 cheshire bus I take to work leaves at 3:20 pm. All the employees get out of work at 3:30 and we have to wait 1 hr til the next bus
35	Pull string not working
36	More often
36	Needs every 1/2 hour
40	No buses on Highland Ave
42	Connections missed
42	i would like to see printed schedules for the "t" routes
42	Middlebury needs more frequent service (some waits are two hours) and ways to get out there (to Yale and so on) not enough, waiting an hour. no service to Middlebury on weekend
42	More support (seats are on slant)
44	Bus 25 picks up on time but drops off late at Green
44	Bus stop snow removal very important
44	Missing connections, Sunday till 7:00ish, during the day on the half hour
44	Prospect Rt 69 to top prospect like southington more into-and more on weekend
44	Start earlier on Sat Sun; more links to Naugatuck, Meriden earlier Sat Sun
45	More shelters; Lakewood route holiday service. 45 1/2 hrs main routes

Route	Comment
45	Needs to be on 1/2 hr
45	This route stops running @ 6 pm. i start work @ 9 pm and have to take the 44
49	Bus very crowded!

Textizen Mobile Survey

In conjunction with the on-board customer survey distributed on buses in December 2014, the study team also provided customers an opportunity to complete a short survey via their mobile phones. This survey, using the Textizen platform, included five of the most important questions from the longer, written survey and allowed for an open-ended customer comment at the end.

Notices were placed aboard buses during the survey week with invitations to engage in the mobile survey and business cards were handed to riders by surveyors in the event they were not able to engage in the full survey.

The intent of the Textizen survey was to broaden the reach and use yet another tool at the study team's disposal to reach riders (in both English and Spanish).

The survey included the following questions:

QUESTION 1: How often do you use the bus in Waterbury?
A. Daily
B. 2-3 days/wk
C. Once/wk
D. 2-3 days/mo
E. Once/mo

QUESTION 2: Why are you taking this trip today?
A. To/from work
B. School
C. Shopping
E. Errands
F. Medical appt.

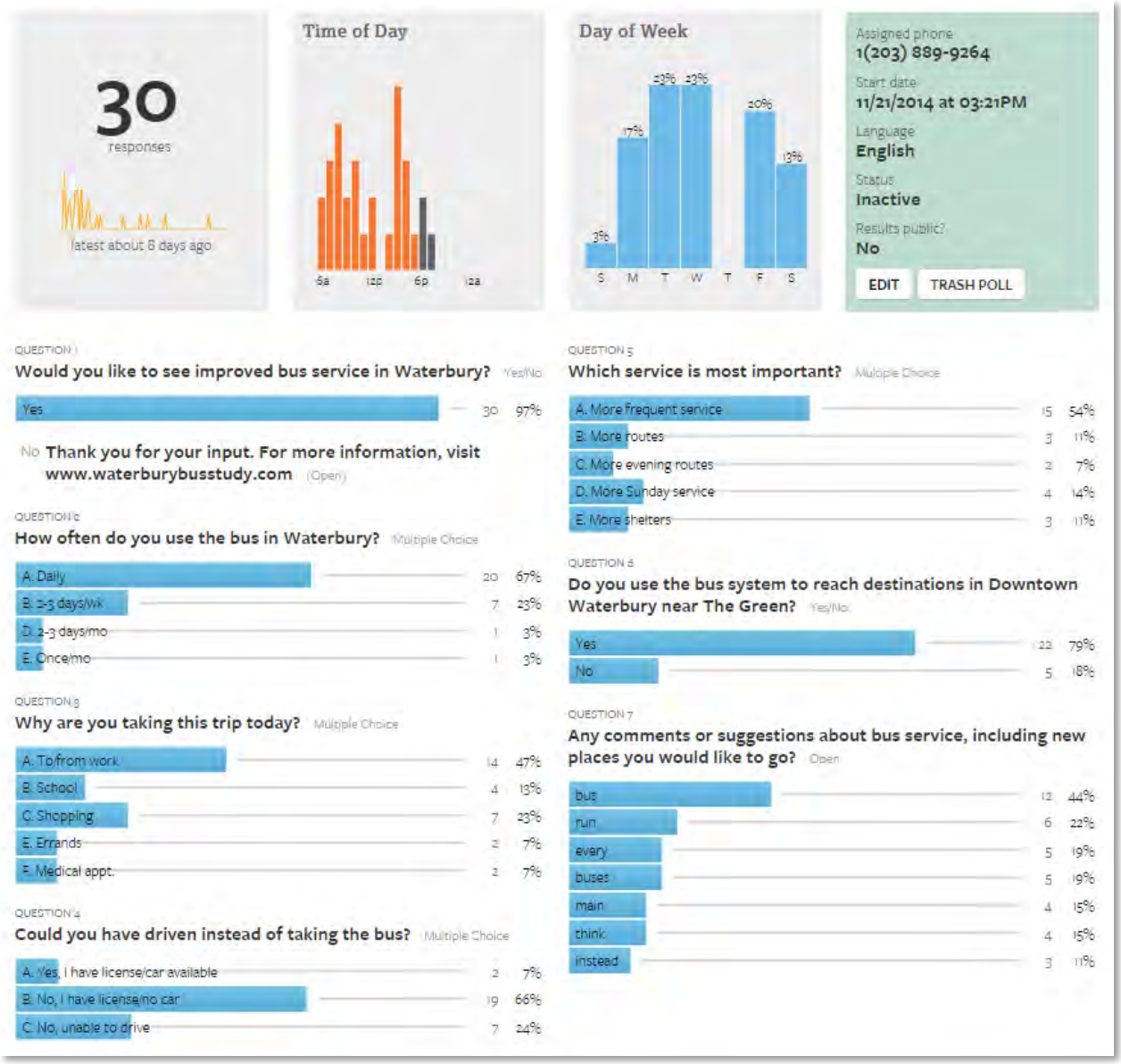
QUESTION 3: Could you have driven instead of taking the bus?
A. Yes, I have license/car available
B. No, I have license/no car
C. No, unable to drive

QUESTION 4: Which service is most important?
A. More frequent service
B. More routes
C. More evening routes
D. More Sunday service
E. More shelters

QUESTION 5: Do you use the bus system to reach destinations in Downtown Waterbury near The Green? (Yes/No)

QUESTION 6: Any comments or suggestions about bus service, including new places you would like to go? (Open answer)

Out of 30 individuals who initiated the survey, 29 completed the survey fully or partially, with the following results. Note that the leading question represented the survey "hook" prompting customers to engage in the survey.



Source: Textizen

Respondents who provided additional suggestions for bus service in question 7 offered the following:

- The 32 needs to run later and on weekends
- There are a lot of people who use the bus as a means of transportation. The buses need to run more frequently. The buses I use run every hour and they should run every 30 minutes. Especially with the colder weather approaching. This way it can minimize the crowds that are on the buses that run every hour and prevent others from having to wait for an entire hour if they miss their bus.
- When the bus I'm on gets to the green like 20 sec late the transferring bus always pulls off
- I usually take 42 bus to NVCC. Some of the bus goes inside the college some doesn't. All the students who take Bus it's really hard for them to walk all the way down to the main street in this cold. We want all the bus should go inside the college every time. And on every half an hour. Thank you.
- Farmington and Meriden and Milford from waterbury
- Need more bus service in Meriden
- More times for bus 31
- I think there should be bus routes all the way down south main street and buses should come frequently on south main at least every hour
- On time downtown to connect with other buses
- I would like to see hill Street run continuously instead of taking that 930 break and starting at 11:30 because it's very inconvenient can't get home until 12 o'clock when I leave at 9:30
- The service is outstanding.
- Out of town but near walmart in naugatuck
- Have services to Naugatuck's Industrial and Watertown ' s Industrial Parks, so people can get to and from for 2nd and 3rd shifts! Also, have the 22 Bus run every 1/2 hr., have the bus go into Shop Rite from Lakewood RD.! Finally, have the Congress Ave/ North Main St. Bus ran every 20 minutes!
- I would love for there to be more frequent services throughout the day instead of every hour. I would also love if the buses continued to run on Sunday's
- My only suggestion is instead of one bus per hour, it should be one bus per 20-30 minutes.
- CT Transit and NETC have been very accommodating in meeting the needs of all, however one issue that many would agree with is the lack of bus shelters. There are some travelers who have disabilities and are unable to stand for long periods of time at a bus stop. This issue is primarily with seating as most travelers would be wise to be prepared for inclement weather, such as myself. There are some areas in the city that do not have stops for over a mile, w
- I will like to see nite route extended. I work nite shift.
- The 45 bus should run later
- You have to do something about the north main bus. I never make my connection to my #11 bus
- I think the #25 (colonial) cuts it too close to connection for such a long route
- I think there should be more busses from Waterbury/Naugatuck
- More buses going to and from Brooklyn during the school hours. Ability to have buses held when needed to make connections
- I think adult should have their own bus and the bus drives should stop with this attitudes . rudeness & disrespectfulness

Stakeholder and Public Comments

An important part of the initial phase of the study was to engage the public and stakeholders in the planning process and to understand their perspectives and concerns. In addition to the surveys described above, a series of meetings an interviews were held with various individuals. These activities are described below.

Pop-up Meetings

On Monday, November 10, 2014 the study team conducted informal "drop-in" sessions on the Waterbury Green to engage bus riders (and, to some extent, non-riders) and solicit up-front feedback to guide the planning process. Two sessions were held, from 12:00 P.M to 1:30 P.M. and from 3:00 P.M. to 4:30 P.M. In total, team members (assisted by COGCNV staff) spoke to 91 members of the community. The study team included a Spanish speaker to ensure bilingual participation in the outreach event.

The interactions varied in length as team members informed the community of the study purpose and duration and asked for any feedback concerning the quality of bus service, on-time performance or schedule issues, and whether any destinations or hours of service are lacking to assess unmet needs. Many customers indicated that they were satisfied with the service and had no specific issues. Overall, a number of key themes emerged, summarized as follows:

- More frequent service is needed to afford greater travel flexibility and reliability
- Crowding is seen as a persistent problem (often noted in afternoons)
    - Route 22 was frequently cited as being overcrowded
- Service is needed later in the day on Sundays
- Bus service is generally available where customers need it
- On-time performance issues exist, noted in particular on the following routes:
    - Route 11
    - Route 13
    - Route 15
    - Route 16
    - Route 35
    - Route 36
    - Route 44
- Service to Lakewood Road is highly desirable
- Improved system infrastructure is needed, including more and larger bus shelters
- Bus shelters should include benches
- Bus stops and shelters need better lighting
- Winter and snow conditions are difficult for riders due to inadequate sidewalk clearing
- Route and schedule information should be more readily available at the Green and throughout the system
- Regional connections are important; travel to Meriden was noted as particularly convoluted

Stakeholders

In early 2015, NVCOG provided the study team with a list of 16 stakeholders in the region representing public agencies, neighborhood and community organizations, institutions, municipalities and business organizations. Each of these stakeholders was contacted and interviews were set up either in person or on the phone. The interviews included a discussion the role of transit in the community, priorities for services, unmet needs, and potential changes. As of this writing, 12 interviews have been completed. The findings from these interviews are summarized below.

Officials

Michael Sanders – ConnDOT Transit and Ridesharing Administrator

Mr. Sanders provided a significant amount of background information on the structure and funding of public transportation in Connecticut. He noted that HNS, the large private operator of transit service in Hartford, New Haven and Stamford, had planners and schedulers on their staff, but that North East Transportation had never requested funding for a planner position. ConnDOT attempts to centralize functions where possible, such as the production of schedule cards and the CT Transit website.

With respect to funding, ConnDOT has never transferred funding from one property to another. The funding levels for the various systems in Connecticut are primarily a result of history rather than any objective analysis of needs. The State does not have any formal service standards, but it does tend to emphasize service enhancements that address energy, the economy and the environment. Access to jobs is considered very important as well as economic development. Thus, route proposals that support these themes would be more likely to receive support from ConnDOT.

Fred Riese – Connecticut Public Transportation Commission

The Commission holds public hearing around the state and publishes an annual report. Meetings are held in Waterbury every other year, with the most recent ones occurring in 2012 and 2014. Mr. Riese provided summaries of these meetings to the study team. Some of the most salient issues to come up in these meetings were the following:

- Riders need to get to destinations around The Green
- There are 36 treatment facilities within three blocks of The Green
- Merchants near The Green feel inundated by people wanting to use their restrooms; they attribute this to bus passengers
- Straits Turnpike in Watertown is an important destination with inadequate service
- A better connection to Naugatuck is needed
- Operate a short shuttle from The Green to Brass Center Mall
- The paratransit vehicle fleet is getting old; consider use of accessible taxis
- In meetings in Torrington and Meriden, a desire for a connection to jobs in Waterbury was expressed
- Better schedule and route information is needed
- More shelters are needed throughout the system

Yvonne Smith-Isaac – Greater Waterbury Transit District

Dr. Smith-Isaac has been a member of the GWTD since 1992 and was the Chair until 2014. GWTD is an organization formed to represent nine municipalities in the Greater Waterbury area on transportation issues concerning persons with disabilities and the elderly. Dr. Smith-Isaac sees serious problems with the pulse schedule, mainly because of reliability issues that make many transfers impossible, especially for someone with mobility issues. There are also problems with driver compliance with ADA stop announcements and with employing lifts for people with walkers. She recommends further training of drivers regarding sensitivity to people with disabilities or mobility impairments.

With respect to service, she notes the overcrowding on Route 22 and suggests that service to the Mall be split into a separate route. The J Route from New Haven is also overcrowded and picks up much of the traffic on East Main Street, with emptier local buses trailing behind. More shelters are needed and a better connection to Naugatuck should be provided.

Catherine Awwad – Northwest Regional Workforce Investment Board

Public transportation's role in access to employment, training, and other vital workforce activities is well known. The Northwest Regional Workforce Investment Board (NRWIB) is the administrative entity that oversees and administers the Workforce Investment Act and CT Dept. of Labor funded programs in the Northwest Region Service Delivery Area. NRWIB's service area comprises 41 municipalities, including substantial activity in Waterbury and its surrounding communities.

A number of transportation services are provided by NRWIB, including contract services with North East Transportation and other provides to extend the reach of the fixed route bus network to major employment sites including industrial and office parks. Routes are designed to extend from a central location such as downtown Waterbury to surrounding communities that may not have fixed route bus services, or to employment sites that require seasonal increases in service for temporary jobs.

NRWIB notes that the addition of night services to the Waterbury system has been enormously helpful and has allowed its own deployment of transportation resources to better address unmet needs. The flexibility NRWIB provides to employers for seasonal or temporary employment transportation provides an invaluable resource to the traditional bus network, which may not be as flexible in providing levels of service for short time periods. Reaching employers outside of the fixed bus route service area expands the reach of the Waterbury system and enhances the community's access to jobs.

Funding remains a concern for NRWIB; some of its transportation services are funded at the state level through the Department of Social Services (DSS) while others are funded through the Department of Transportation (DOT). Funding through DSS is often threatened in budget cycles and would not easily transfer to DOT to ensure continuity of vital workforce transportation services.

At present, NRWIB is pleased with the collaborative nature of the Waterbury bus system and its own initiatives to expand the transit system's reach. The hub at the Waterbury Green allows for workers to access NRWIB transportation services from a convenient, central location. While the exact location of the system hub may change, the existence of a central hub will remain important.

Community Organizations

Joshua Angelus – Waterbury Neighborhood Council

The WNC is a coalition of neighborhood associations, funded through direct fundraising. Mr. Angelus spoke about redevelopment plans for downtown Waterbury and the Freight Street area. He notes that with the planned development near the train station, the center of gravity in the city will move south, and the Greenway Redevelopment Project will change the character of the southern part of downtown. He feels that the Intermodal Transportation Center that had been proposed at the train station and studied extensively over a decade ago would tie together the transportation systems and new development.

Beyond these downtown issues, Mr. Angelus said that the infrastructure for the bus system was very weak, with the lack of shelters and protection from the elements. He felt this was a huge under-investment and was very important for riders. He likes the hybrid buses and would like to see electric buses in the future. The most important function of the bus system is making sure people can get to work.

Mary Kate Gill – New Opportunities, Inc.

New Opportunities is a community action agency serving Waterbury, Meriden, Torrington and 27 surrounding towns. The organization works to assist people in need and transition from poverty by improving self-sufficiency. Constituents of New Opportunities include singe adults, parents with young children, and the elderly.

Travel for program participants is fairly generalized, including work, medical, and other personal trips. Trips within Waterbury are generally feasible from a route and schedule standpoint. Challenges emerge from hourly service constraints and long travel times, as well as missed connections at The Green. Travel to medical appointments outside of Waterbury can be challenging when transit connections do not exist.

New Opportunities mentioned confusion among many of its participants regarding the rules of 10-trip passes on the CT Transit system, including transfer policies and the difference between 10 trips and 10 days of use. Continued education and clarification of policies will be important for all users. Additionally, confusion about ADA eligibility for seniors was cited as a concern, including where and when to apply for eligibility, who to contact, etc.

A positive aspect of CT Transit service mentioned during the interview was the consistent presence of North East Transportation supervisors at the Waterbury Green.

Business Community

Carl Rosa – Main Street Waterbury

The main emphasis of Main Street Waterbury is to support a revitalization plan for the city, and according to Mr. Rosa, connectivity is a key element. He supports the concept of the Intermodal Transportation Center at the train station where local bus, intercity bus, and train service could all connect to each other. Improved pedestrian safety is important, as he feels that traffic congestion is a barrier to non-bus riders using the system. He supports transit-based development. The current system needs much better marketing and information, as tourists and non-riders have a difficult time figuring out how to use the local bus system.

Jay Sargent – Wolcott Street/Lakewood Road Business Association

Mr. Sargent is a lifelong Waterbury resident and has worked in the Lakewood Road area for 30 years. His highest priority is to see bus service on Lakewood Road connecting two major shopping areas of the city: Wolcott Street and Chase Avenue. His group has developed a detailed plan for service including stop locations and has offered property for a bus stop at his business. He has been working with the City for sidewalk connectivity in the Lakewood Road area.

He feels that the pulse point for bus service should remain at The Green where it has always been. Evening service should be increased as some businesses are open until 10:00 p.m.

John DiCarlo – Waterbury Regional Chamber of Commerce

Mr. DiCarlo stated that the strength of the core of the city is very important and that having the pulse point of the bus system at The Green represents a problem. The crowding on the sidewalks, the traffic congestion because of the buses, and the visual wall that the buses create while laying over are all disincentives to the business community for new investment in the downtown area. He noted that Waterbury has the highest rate of job creation in the state.

From the perspective of the Chamber, nighttime service has been successful and he sees overcrowding of buses as an issue on several routes. The roles of UConn-Waterbury and Post University are very important in the city. He noted that Post University was considering housing and a call center in the downtown area to support the growth in their online programs but felt that the buses around The Green were a problem.

Cathy Smith – Downtown Property Owners

A principal focus for downtown property owners and business owners is the relationship of CT Transit service to The Green and the core downtown. The confluence of buses at The Green for transfers and access to the core downtown is a key feature of the transit network in Waterbury. Property and business owners are keen to see continued revitalization of Waterbury's downtown, recognizing the role transit plays in mobility and economic development.

The hub at The Green is viewed both as a feature and a detraction, as buses converge for timed transfers on the half hour throughout the day. Activity and heavy system usage is also seen as a source of congestion on and around The Green, and efforts to locate an alternate hub site have been documented for nearly a decade. The Waterbury Area Transit Study must be conducted in coordination with other planning efforts such as Waterbury Next and other downtown development plans.

The challenge remaining is to maintain a viable transit hub downtown while looking to relieve congestion (real and perceived) around The Green and ensure that The Green itself serves as a functional, vibrant public space at the core of Waterbury's downtown. Furthermore, the CT Transit bus network must maintain functional connectivity with rail service and intercity buses.

Todd Montello – Waterbury Development Corporation

Echoing sentiments from property and business owners, the Waterbury Development Corporation reiterated the importance of The Green as a downtown focal point and civic space. Bus operations around The Green are once again viewed as a vital component of the transportation network, while at the same time seen as a source of congestion and inefficiency.

Discussion of short-term operational improvements focused on the potential for staggered bus arrivals at The Green rather than the scheduled pulse. This could reduce vehicle and pedestrian congestion while also addressing on-time performance and improving reliability. Safety also represents a significant concern, including pedestrian crossings around The Green and access to and from bus stops.

Relocation of the transit hub will involve inevitable trade-offs when considering parcels and their development potential. Parking requirements will also be weighed against transit potential, particularly as new residential units are created in the core downtown.

Another focus for WDC is ensuring and improving bus access to brownfield corridors to encourage redevelopment. Access to job providers- existing and potential, through redevelopment- is a core function of the transit network. Additionally, supporting shopping and other businesses through improved mobility and access can help address issues such as food deserts, where insufficient options exist for residents to purchase healthy foods and groceries.

Institutions

John Goldbeck – Porter & Chester Institute

Porter & Chester Institute is a for-profit technical school located on Sylvan Lake Road in Watertown. Enrollment at the school ranges from 300-500 students, 40% of whom come from Waterbury. Students also attend from other surrounding towns including Naugatuck, Torrington, and Thomaston. About two-thirds of Porter & Chester's students attend day classes while the remaining third attend night sessions.

While some students do take local buses to the campus, the distance from bus stops and the lack of evening service to this part of Watertown limits the extent to which transit is a viable option. Additionally, many students travel with tool boxes and other equipment, making bus trips a challenge. Those who do travel by bus now tend to be those who do not own or have access to a car. The nearest bus route to the campus is Route 13 on Sunnyside Avenue or Buckingham Street. Some students are able to walk to and from the bus, but the nearest stops are not sufficiently convenient to the campus given terrain, lack of sidewalks, and distance.

Porter & Chester is supportive of bus service in the area and would welcome expanded access to its campus, particularly for night students. Students typically arrive for evening sessions by 6:15 p.m. and conclude by 10:55 p.m. Classes are held only on weekdays.

James Troup – Naugatuck Valley Community College

CT Transit bus service to the Naugatuck Valley Community College campus (East and West) on Chase Parkway is popular and well-used among students and staff. In fact, crowding on Route 42 buses is a recurring issue for riders, particularly at peak hours such as around 5:30 p.m. An extra bus around 5:40 p.m would help alleviate crowding and reduce wait/travel times for students unable to board the 5:45 p.m. eastbound trip.

NVCC has seen great success with its UPass program, whereby student fees fund transit passes for all students. These are used frequently and also encourage students to use transit for trips other than to/from the campus. One issue expressed by the NVCC administration and students is that bus

drivers do not check student IDs, prompting concerns about fraudulent sharing of passes to non-students.

Students interviewed expressed concern about schedule reliability and missed connections at The Green. The timed pulse point creates a scramble and when connections are missed, wait times and overall travel times increase.

NVCC will continue to encourage students waiting for eastbound 42 buses to board in the westbound direction from campus rather than crossing Chase Parkway. CT Transit already permits this option, noted in the public timetables, without requiring two fares. At the same time, NVCC is seeking safety improvements on Chase Parkway such as a new signal and safer pedestrian crossings. NVCC prefers that buses enter the campus to pick up and drop off riders away from Chase Parkway, both for convenience and safety. Currently, a bit more than half of the daily trips serving NVCC serve the campus directly.

Finally, NVCC is very interested in pursuing transit/bus connectivity between its Waterbury and Danbury campuses. While not an issue directly related to CT Transit Waterbury, it speaks to the importance of intercity connections and links between local and regional services (e.g., in downtown Waterbury).

Socioeconomic Analysis

An essential preparatory step in any bus service planning project is an analysis of the residential, demographic, and employment patterns in a region, as well as tabulations of travel flows and an accounting of key trip generators. This section presents a series of maps that portray these patterns and considers the compatibility of the current route structure with the facts on the ground.

Residential and Demographic Data

Demographic data were compiled and analyzed for the greater Waterbury region. These data include household density and the share of populations with historically high transit patronage (people with disabilities, people living in poverty, seniors, youth, and households without a vehicle available). The senior, disability, low income, and vehicle availability data were aggregated and summarized in an index of transit propensity.

The most basic measure of suitability for fixed route transit service is residential household density. The *Transit Capacity and Quality of Service Manual* published by the Transportation Research Board states that 3 households per acre is a standard minimum density for supporting regular bus service. In practice, this density is roughly equivalent to quarter acre zoning (because of the space taken up by streets and sidewalks). Density of less than 3 households per acre can support some bus service, but the lower the density, the more appropriate the area becomes for demand-response service or a hybrid such as route deviation service.

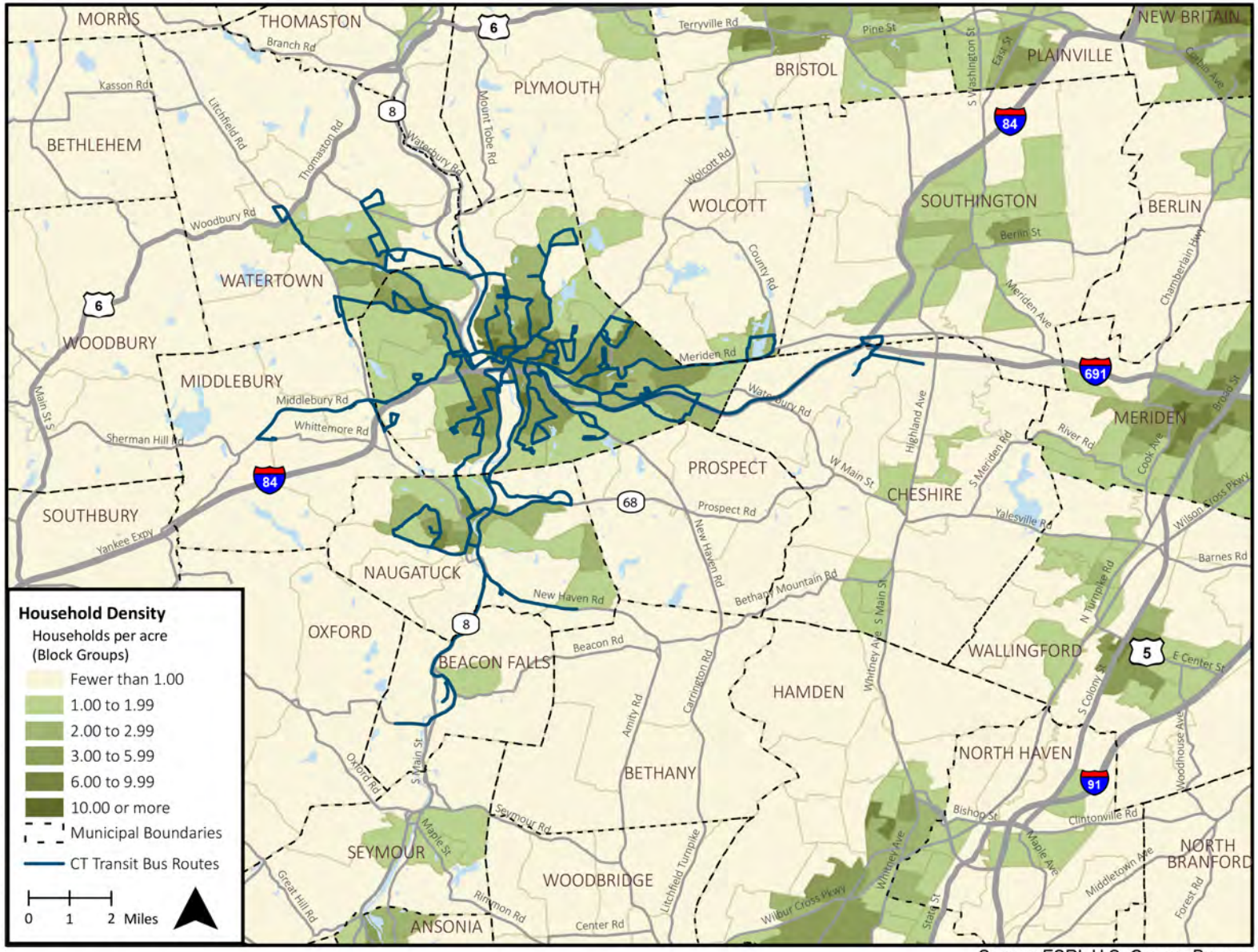
Figure 17 shows the residential household density for the greater Waterbury region, with the current bus routes overlaid. All areas in Waterbury and immediately surrounding towns that have densities greater than 3 households per acre already have bus service, and many areas with lower densities also have bus connections. The routes that extend farther from Waterbury that appear to serve very low density areas—into Beacon Falls, Cheshire, and Watertown, for example—are Tripper routes that provide express service to industrial parks with a limited number of trips timed to meet shift changes. Meriden and Wallingford have small areas with high density, but these are served by bus routes that are not part of the present study. Southington has moderate density and no current local bus service, though it will be served by CT Fastrak via a park-and-ride lot.

Figure 18 shows the residential household density within the central portion of the city of Waterbury. Density is highest in the area immediately north of The Green, at more than 10 households per acre. Other high density areas include the Willow Plaza neighborhood, the Crownbrook and New PAC neighborhoods, the W.O.W. neighborhood north of Wolcott Street, Bouley Manor and sections of Fairlawn, Woodtick Road, the central portion of Town Plot, and a section of Washington Hill near Madison Street. Most of the rest of Waterbury where the current routes run has densities of at least 3 households per acre.

Following the two density maps is a series of figures showing the prevalence of populations with characteristics that make them more likely to need and use public transportation. Each of these maps shows the percentage of the population that has a particular characteristic, and also indicates with a dark red dot the absolute number of those individuals within a given Census Tract or Census Block Group. The data source for all of these maps is the American Community Survey, conducted by the Census Bureau on an ongoing basis.

Figure 17:

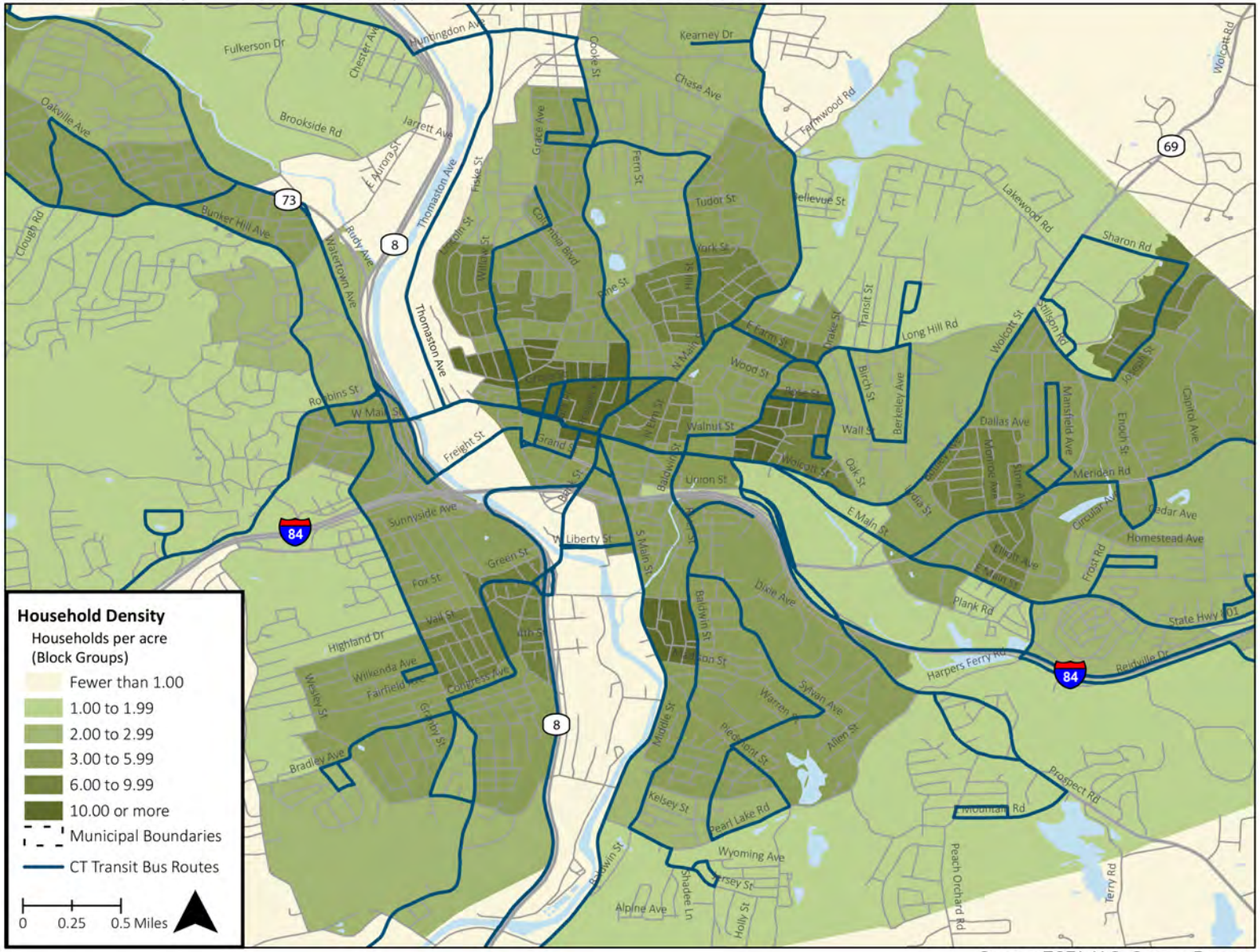
Household Density (ACS 2008-2012 Five-Year Estimates)



Source: ESRI, U.S. Census Bureau

Figure 18:

Household Density in Central Waterbury (ACS 2008-2012 Five-Year Estimates)



Source: ESRI, U.S. Census Bureau

Figure 19 shows locations with high percentages of people with disabilities. The Census gathers information about various types of disabilities, but this map shows only people with visual or ambulatory disabilities. The central section of Waterbury has the highest concentrations of people with these disabilities (over 20%), and Tract 3501 in downtown Waterbury has over 1,150 such individuals. Many other sections of Waterbury have moderately high percentages of people with disabilities (10% to 20%), as does the northwestern section of Southington. Naugatuck has several tracts with more than 400 disabled individuals, but in none of these is the percentage of residents who have disabilities higher than 10%.

Concentrations of people living below the federal poverty line are shown in Figure 20. Census Block Groups with 10% or more residents living in poverty are clustered in the more urbanized areas with most of downtown Waterbury and the northern part of Washington Hill having over 50% of the population with incomes below the federal poverty line. Local buses serve most of these Block Groups, however, parts of Naugatuck, Bethany, Southington, and Seymour have lower income populations without access to local bus service.

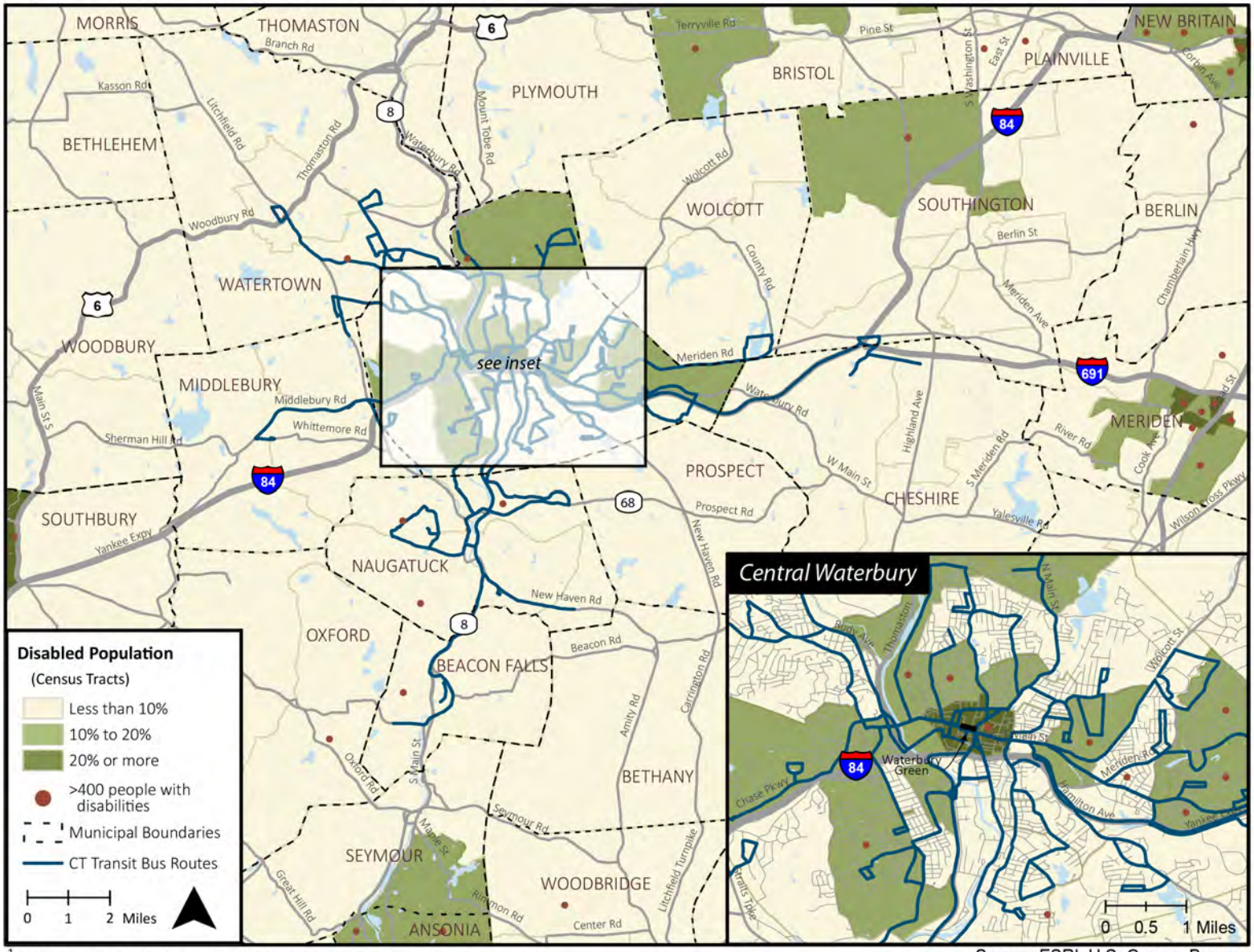
Compared to the poverty map, concentrations of seniors (people over age 65) are more widespread, with most towns in the region having at least one Block Group with at least 15% of the population being over age 65. Figure 21 also displays housing and social service agencies that are oriented to seniors, many of which are within the city of Waterbury. Most of these facilities are directly on or in close proximity to a local bus route. The highest concentrations of seniors are again within the downtown area of Waterbury, but the towns of Southington and Naugatuck also have Block Groups with more than 35% of the residents being senior citizens.

Figure 22 shows the concentration of youth (age 5-17) in the region. Most Block Groups have between 15% and 24% of the population in this age range. In this case, downtown Waterbury is the exception in that it has very low percentages of children. Other neighborhoods in Waterbury make up for this, with the northernmost section of Brooklyn and the eastern portion of the East End having the highest concentrations of youth. Most of the transportation needs of this age group are taken care of by their parents, and so concentrations of youth are somewhat less important as in indicator for transit need than some of the other demographic measures.

Perhaps the most important indicator of transit need is the lack of an automobile. Figure 23 shows the percentage of households by Block Group that have zero vehicles. In most of the region outside of Waterbury, less than 10% of the households have no vehicles. Indeed, for 100 of the block groups, less than 1% of the households are without vehicles, and in another 130, between 1% and 5% have no vehicle. (There are 453 Block Groups in the study area total.) Naugatuck, Cheshire, Watertown and Southington have some Block Groups with moderate concentrations of auto-less households, but by far the greatest concentrations are in Waterbury and especially in the downtown area where some Block Groups have up to 70% of the residents without access to an automobile. All of these Block Groups with the highest concentrations are well served by the bus system. The northernmost sections of the city have moderate concentrations that are not currently served.

Figure 19:

Population with a Disability[1] (ACS 2008-2012 Five-Year Estimates)

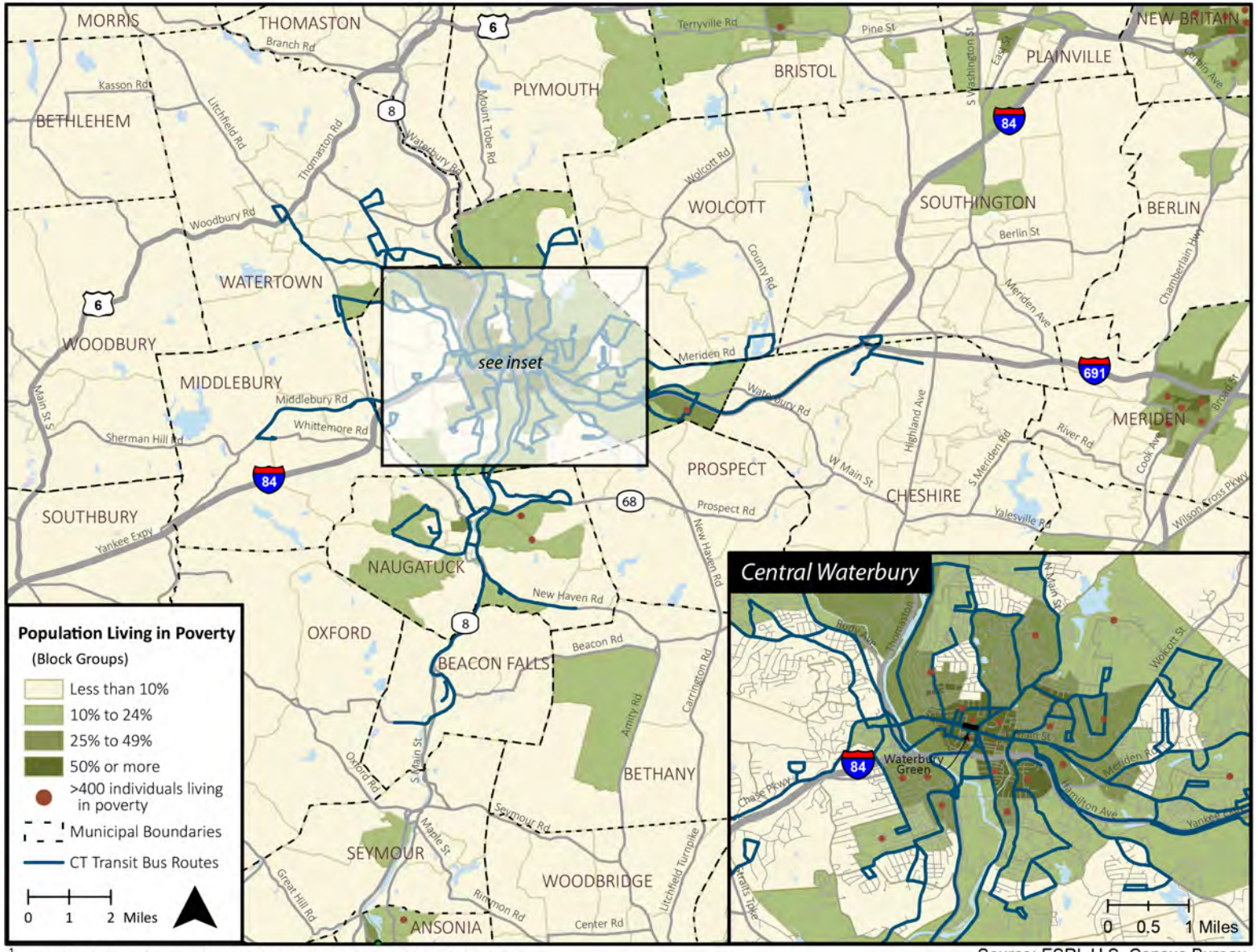


[1]Only vision and ambulatory disabilities were included.

Source: ESRI, U.S. Census Bureau

Figure 20:

Population Living in Poverty[1] (ACS 2008-2012 Five-Year Estimates)

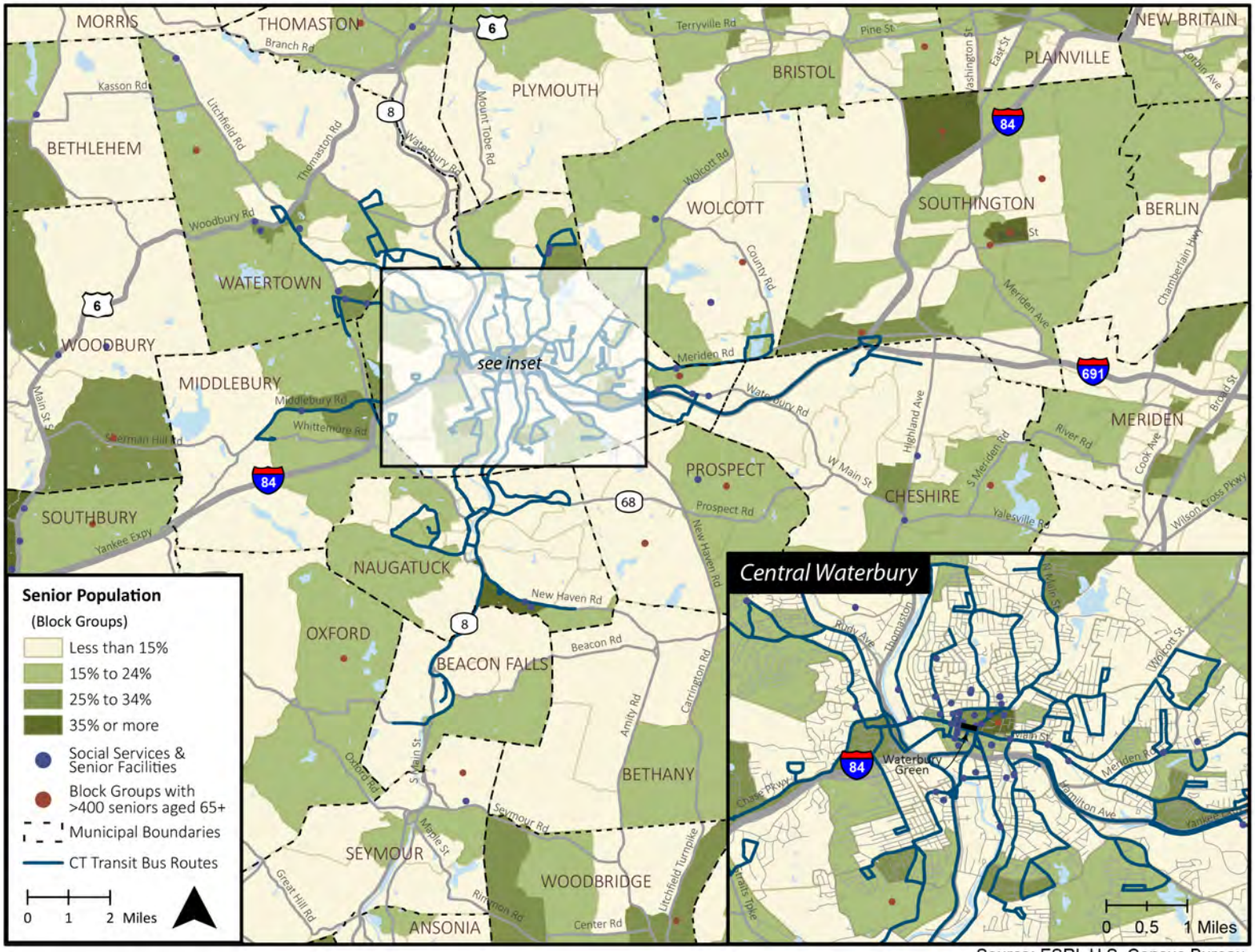


[1]Poverty is defined by all persons with an income ratio of less than 1.00.

Source: ESRI, U.S. Census Bureau

Figure 21:

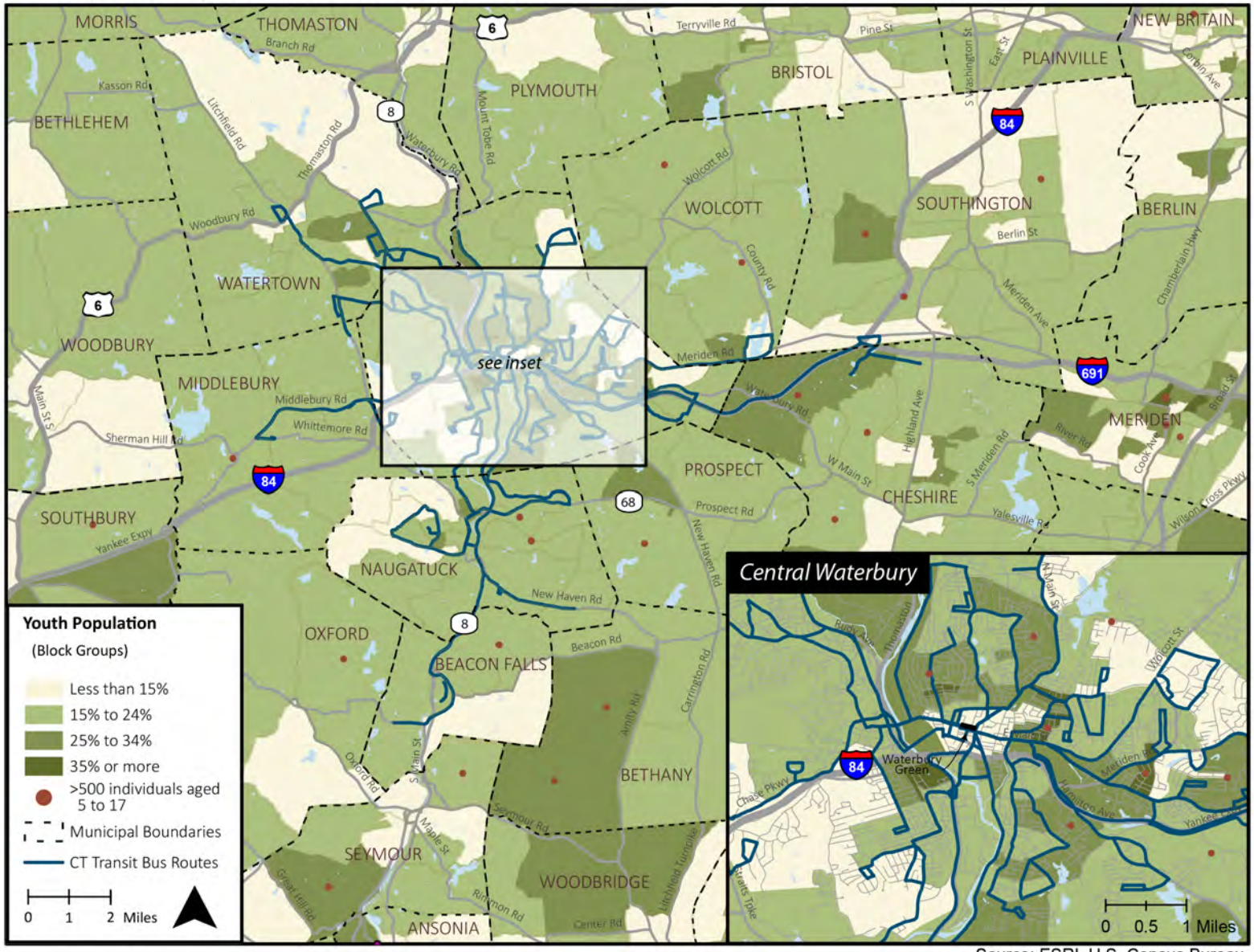
Seniors Aged 65+ (ACS 2008-2012 Five-Year Estimates)



Source: ESRI, U.S. Census Bureau

Figure 22:

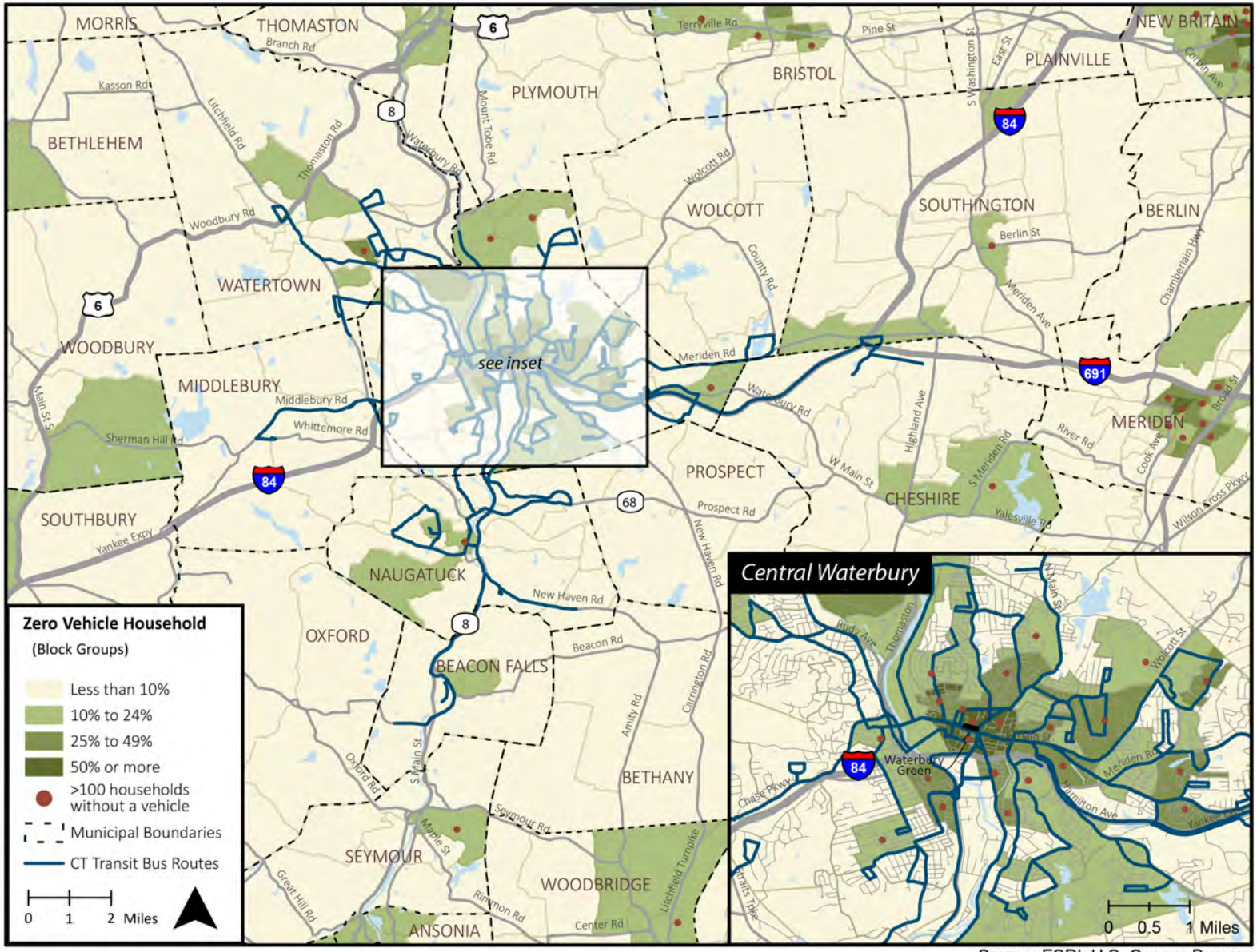
Youth Aged 5 to 17 (ACS 2008-2012 Five-Year Estimates)



Source: ESRI, U.S. Census Bureau

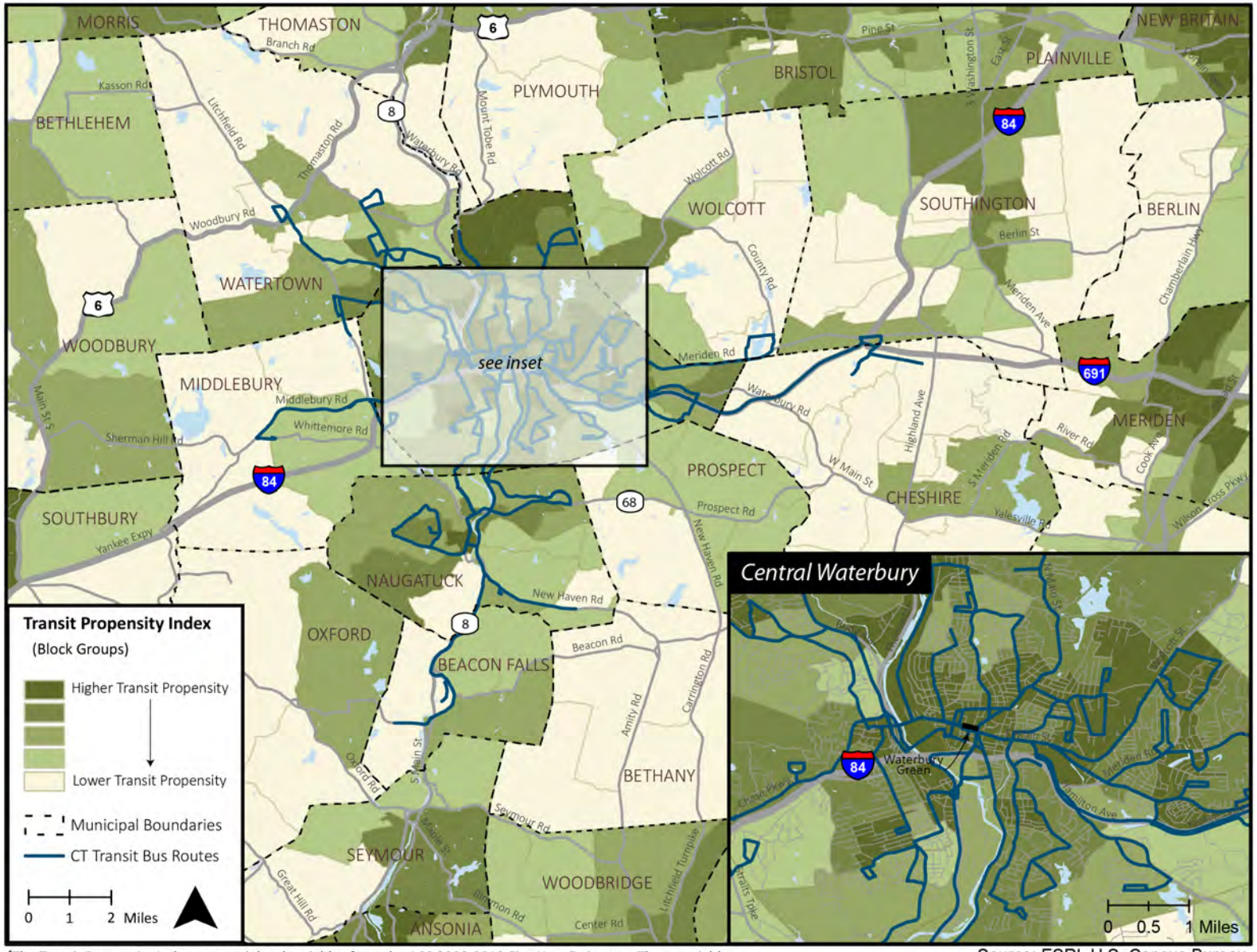
Figure 23:

Households without a Vehicle (ACS 2008-2012 Five-Year Estimates)



Source: ESRI, U.S. Census Bureau

Figure 24:
Transit Propensity Index[1]



[1]The Transit Propensity Index uses weighted variables from the ACS 2008-2012 Five-Year Estimates. These variables include zero-car households, population in poverty, disabled population, and seniors aged 65 and over.

Source: ESRI, U.S. Census Bureau

The final map in the demographic series, Figure 24, combines all of the transit indicator characteristics except youth into a single "Transit Propensity Index". It can be seen that almost the entirety of central Waterbury falls into the higher ranges of transit propensity, and that all of these areas are well served by the current bus routes, with the exception of Lakewood Road. The northernmost stretches of Waterbury have high propensity, but not direct service. Sections of Naugatuck and Southington have moderately high transit propensity and limited or no bus service. The portions of Watertown with the highest propensity are already served, as is also true for Naugatuck.

Employment Data

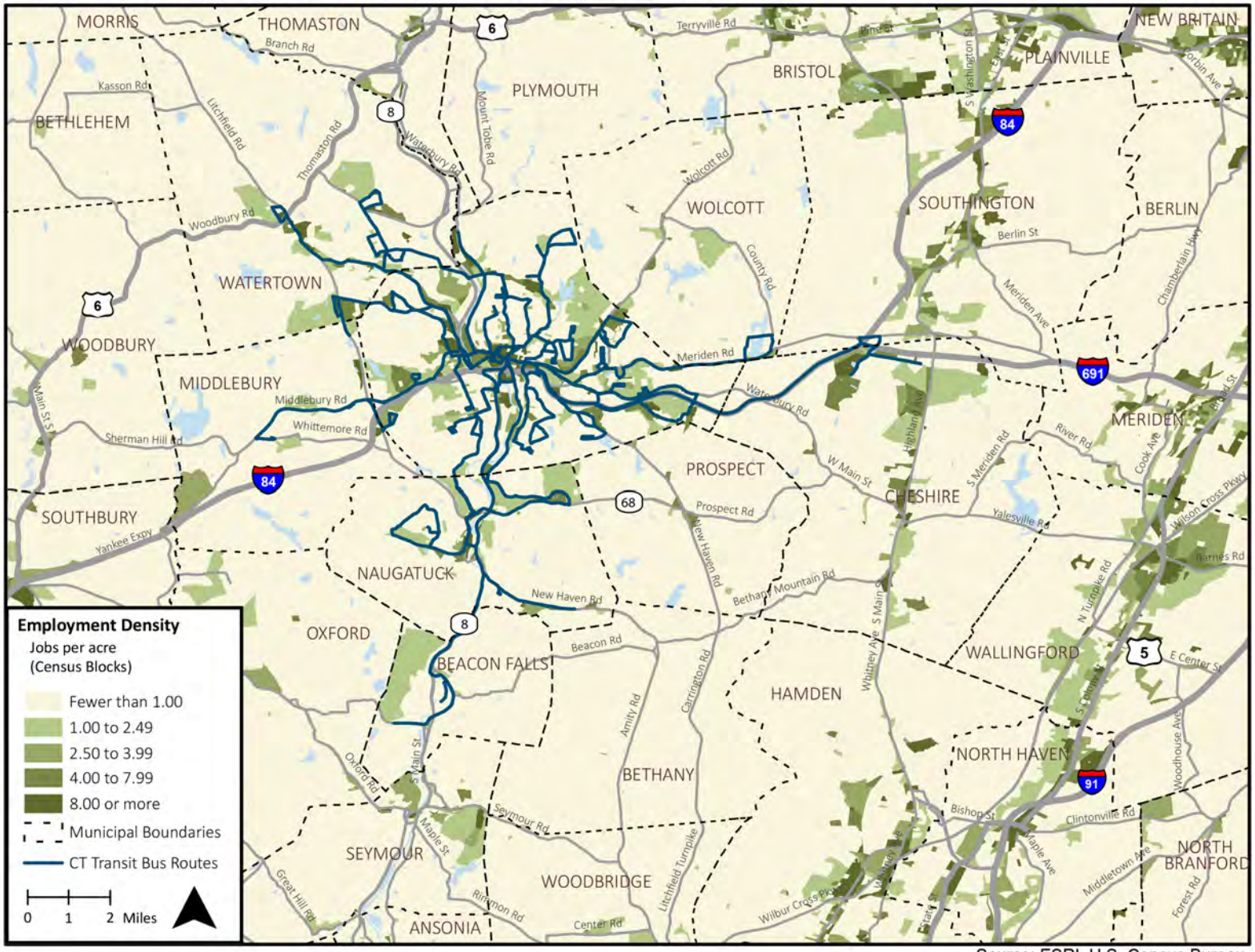
As shown above on page 33, some 42% of respondents to the on-board passenger survey say that they use the bus system for trips to work. Thus, when considering how well a bus system serves an area, both the residential and the destination ends of the trips must be examined.

Figures 25 and 26 show employment density for the greater Waterbury region and for the central portion of Waterbury, respectively. As with residential density, the *Transit Capacity and Quality of Service Manual* defines a relevant threshold for employment density that can support fixed route bus service: 4 jobs per acre. The regional map shows that most of the area has very low job density, and that the Census Blocks with higher densities are located mostly in Waterbury and along distinct employment corridors such as US 5 from North Haven through Wallingford and Meriden and the Main Street/Highland Ave corridor through Cheshire and into Southington. The Cheshire Industrial Park also shows up prominently on the map. While the Waterbury bus system does not serve the center of Cheshire, it does link to almost all of the Blocks with at least 4.0 jobs per acre.

More detailed employment patterns in central Waterbury can be seen in Figure 26. As would be expected, the highest employment densities are in the downtown area, with other concentrations along Watertown Ave on the west side of the river, along Wolcott Street, and along Chase Avenue. Chase Ave itself has no bus service, but the North Main Street routes provide access to Waterbury Plaza, which is the source of most of the employment in that area.

Figure 25:

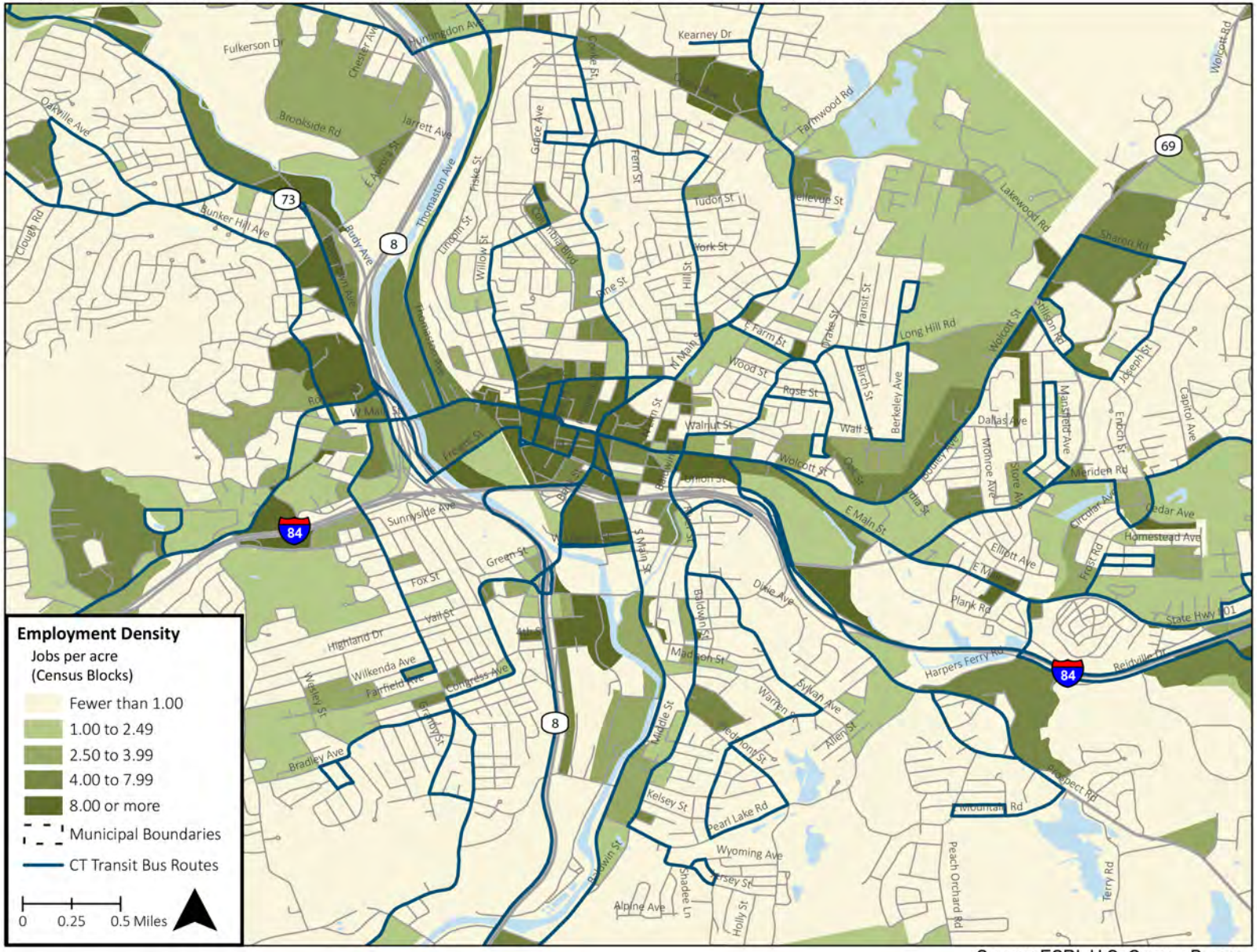
Employment Density (Longitudinal Employer-Household Dynamic, 2011)



Source: ESRI, U.S. Census Bureau

Figure 26:

Employment Density in Central Waterbury (Longitudinal Employer-Household Dynamic, 2011)



Source: ESRI, U.S. Census Bureau

Work Trip Flows

The Longitudinal Employer-Household Dynamics (LEHD) database that was the source for the employment density data in the previous two maps can also provide information on work trip flows by matching up the residential addresses of workers (from the Social Security database) and the employment addresses of those same workers (from state unemployment reports). This analysis can be performed at many levels of geography, but for the purpose of this document, town-level flows are presented. This information can be used to judge which new employment connections to other cities and towns are most important for Waterbury residents and workers.

According to the 2011 data from LEHD (the most recent available), 13,462 Waterbury residents also worked at jobs in Waterbury, accounting for some 32% of the jobs in the city. Table 12 below shows the top 25 workplace destinations outside of Waterbury for Waterbury residents. Table 13 shows the top 25 towns in which Waterbury workers reside.

Table 12: Place of Employment for Waterbury Residents (2011)

Rank	Work City/Town	Residents	% of Total
1	Watertown	1,774	4.1%
2	Cheshire	1,740	4.0%
3	Hartford	1,257	2.9%
4	Naugatuck	1,158	2.7%
5	Danbury	989	2.3%
6	Meriden	896	2.1%
7	New Haven	880	2.0%
8	Southington	826	1.9%
9	Southbury	756	1.7%
10	Wallingford	746	1.7%
11	Bristol	706	1.6%
12	Middlebury	629	1.4%
13	Torrington	620	1.4%
14	Wolcott	609	1.4%
15	Farmington	576	1.3%
16	Bridgeport	556	1.3%
17	Stratford	541	1.2%
18	Beacon Falls	534	1.2%
19	Thomaston	497	1.1%
20	Prospect	453	1.0%
21	North Haven	446	1.0%
22	New Britain	442	1.0%
23	Norwalk	429	1.0%
24	Milford	427	1.0%
25	Stamford	376	0.9%

Table 13: Place of Residence for Waterbury Workers (2011)

Rank	Home City/Town	Residents	% of Total
1	Watertown	2,473	6.0%
2	Naugatuck	1,817	4.4%
3	Wolcott	1,789	4.3%
4	Bristol	953	2.3%
5	Southington	903	2.2%
6	Prospect	877	2.1%
7	Torrington	792	1.9%
8	Cheshire	791	1.9%
9	Meriden	788	1.9%
10	Middlebury	750	1.8%
11	Thomaston	627	1.5%
12	Plymouth	570	1.4%
13	Southbury	567	1.4%
14	New Haven	522	1.3%
15	Hamden	517	1.2%
16	Woodbury	463	1.1%
17	Wallingford	459	1.1%
18	Bridgeport	430	1.0%
19	Danbury	397	1.0%
20	New Britain	370	0.9%
21	Hartford	368	0.9%
22	Litchfield	303	0.7%
23	West Haven	280	0.7%
24	New Milford	268	0.6%
25	Milford	259	0.6%

The top towns in each of the tables are not surprising, with Watertown having the greatest employment connection to Waterbury in both directions. Naugatuck is also important in both directions, but Wolcott, with relatively less employment than the other towns, is more of a bedroom community than a destination for work trips.

Of the top eight workplace destinations for Waterbury residents, (those generating more than 800 work trips) with the implementation of CT Fastrak, only Danbury and Meriden will have no bus connection from Waterbury. Southington will have very limited accessibility, as there will be service on CT Transit Route 928 from Waterbury to the Plantsville Park & Ride, but not access to the main employment areas in Southington.

For commuters to Waterbury, of the top eight residential source towns, Wolcott, Bristol, Southington, Prospect and Torrington have no direct bus access. With CT Fastrak, Bristol residents may be able to accomplish commuting trips to Waterbury, but only with a circuitous trip including a transfer in Plainville. Although there is a bus connection between Waterbury and Naugatuck, it is designed to serve workplaces in Naugatuck rather than a commuting trip into Waterbury.

Given these statistics, it would seem that there is more "work to do" in creating bus connections to serve commuting from surrounding towns into Waterbury. However, given the high automobile ownership levels in those towns and the high degree of poverty in Waterbury, the more appropriate emphasis, and the one that has been followed for years in the design of the current system, is to ensure that Waterbury residents have access to jobs wherever those jobs may be.

Conclusion

The bus system in Waterbury is an essential component of the local economy. It transports thousands of people to their jobs, to school, to shopping areas and to many other destinations. Ridership has grown dramatically over the past few years, leading to overcrowding on some routes as well as reliability problems. A high percentage of riders on the system make transfers between routes, though many of these transfers are "invisible" because most routes are interlined at The Green and riders are allowed to remain on board from one route to the next. Compared to its peer agencies, the Waterbury system "does more with less" having highly productive and cost effective service.

Most riders in Waterbury are dependent on the service for most or all of their transportation needs. The improvements to the system that riders most wanted to see were more shelters throughout the system, better service on Sunday, and real-time information on bus arrivals. Naugatuck, Hartford, and Meriden were the places most often cited as locations needing better connections from Waterbury.

Stakeholders and public offered a wide range of perspectives on how to improve the system. Many in the business community felt that the pulse point either needed to be moved from The Green, or that schedules needed to be changed so that all bus routes did not converge at The Green at the same time. Many community organizations felt that service needed new investment to improve reliability, relieve crowding, and reduce waiting times. Better facilities were also a priority, including more shelters and restroom facilities in the downtown area.

The current route network is reasonably well aligned with the patterns of residential and employment density, and with areas of greatest transit need due to demographic characteristics such as income, age, disability, and automobile ownership. Certain gaps were identified in the analysis, as well as commuting links between towns that are not currently served.

The next phase of the study will consider short-term operational changes that can make the system more efficient and reliable and begin to look at alternatives to the current pulse schedule at The Green. Later phases of the study will consider longer-term growth plans for the system to address gaps in service and make the bus network an even more vital component of the revitalization of Waterbury.

Appendix: Transfer Tables

On the following pages, the detailed results of the transfer analysis are presented.

Average Weekday Transfers (not including evening service)

From\To	11	12	13	15	16	17	18	20	22	25	26	27	28	29	31	32	33	35	36	40	41	42	44	45	47	49	71	74	81	114	Total
11	29	3	7	5	9	6	4	4	15	7	8	23	7	0	4	1	11	7	3	3	0	14	7	3	0	1	0	2	1	7	**191**
12	5	19	4	3	4	5	4	2	8	8	4	5	1	1	1	0	15	2	2	1	0	6	7	5	3	0	0	1	6	4	**126**
13	8	4	27	4	9	6	7	1	31	29	3	4	1	0	0	0	8	7	5	3	0	18	8	8	2	3	0	1	4	5	**206**
15	7	12	6	21	18	3	6	2	13	6	3	4	0	0	0	0	4	28	6	1	0	10	7	1	0	0	1	1	1	3	**164**
16	6	5	3	18	18	1	8	2	10	6	4	2	1	0	1	1	5	5	19	0	0	6	5	3	0	1	0	0	1	1	**132**
17	1	4	3	1	1	7	2	2	3	3	1	1	4	0	0	0	4	3	3	1	0	0	2	2	1	0	0	0	0	0	**49**
18	2	4	3	5	5	4	41	3	11	1	3	3	3	0	0	0	3	3	3	2	0	11	5	2	1	2	0	0	6	15	**141**
20	6	2	5	0	5	7	8	16	14	5	3	2	2	0	1	1	4	4	1	14	0	8	8	4	0	2	0	1	1	5	**129**
22	17	12	18	2	13	5	8	4	62	10	4	6	3	0	1	3	13	13	7	5	0	13	9	37	2	1	0	5	1	1	**275**
25	7	4	19	3	8	5	5	3	13	32	4	3	1	0	0	3	2	5	2	2	0	15	8	6	2	2	1	1	2	0	**158**
26	4	2	3	2	3	4	2	1	5	4	4	4	2	0	0	1	1	1	1	2	0	8	15	1	1	1	0	0	1	0	**73**
27	23	3	3	1	3	2	4	1	5	3	3	9	6	0	0	0	5	3	2	1	0	6	3	3	0	1	0	1	1	3	**95**
28	6	1	4	1	3	3	4	2	6	3	2	2	7	0	0	1	1	3	3	2	0	9	2	0	0	0	0	0	0	0	**65**
29	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**2**
31	8	1	0	0	0	1	3	1	2	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	**21**
32	1	1	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	32	0	1	0	1	0	0	1	2	**45**
33	11	18	9	6	9	11	9	4	22	8	5	5	4	0	1	4	52	8	6	6	0	8	9	6	1	2	1	0	4	7	**236**
35	5	3	3	41	7	3	8	1	13	8	5	3	5	0	1	0	5	18	12	2	0	6	9	3	0	1	0	0	3	1	**166**
36	8	2	6	7	93	3	6	2	18	5	4	8	2	1	1	1	3	9	22	5	0	7	8	2	0	2	0	0	1	2	**228**
40	4	4	3	4	4	3	2	17	5	2	5	4	2	0	0	0	5	2	3	11	0	3	5	2	0	0	0	0	1	1	**92**
42	10	9	8	6	4	1	13	3	10	10	8	5	10	0	2	4	9	4	7	3	0	16	5	4	0	0	0	0	0	0	**151**
44	4	5	2	5	5	3	6	2	10	2	35	2	3	0	0	2	6	2	6	4	0	5	30	4	0	0	0	3	6	1	**153**
45	6	4	4	1	4	1	3	0	41	7	2	4	0	1	0	1	6	5	1	2	0	9	4	10	0	0	0	0	1	0	**117**
47	1	2	0	0	1	0	0	0	1	1	1	1	2	0	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	**14**
48	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**3**
49	1	0	1	0	0	0	0	0	3	3	0	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	**13**
71	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	**3**
74	1	0	1	1	1	0	0	0	4	1	1	1	1	0	0	0	1	0	1	1	0	3	0	1	0	0	0	7	0	0	**26**
81	2	1	3	1	1	1	4	0	1	3	3	2	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	2	0	**31**
114	7	2	3	4	1	0	4	5	0	1	2	5	2	0	0	0	4	3	2	3	0	5	1	0	0	0	0	0	1	5	**60**
CT Transit	8	4	8	2	6	3	6	1	8	2	4	3	4	0	2	0	8	9	2	2	0	4	5	3	1	3	0	4	1	6	**109**
2728	0	0	1	2	1	1	1	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	0	0	0	0	0	0	0	0	**11**
4042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	199	132	157	146	237	90	168	79	335	172	122	113	73	3	16	24	180	148	124	80	0	226	164	112	14	23	3	29	47	69	**3285**

Note: CT Transit includes other CT Transit routes (such as the J route) that could have transfers with Waterbury routes.

Average Saturday Transfers (not including evening service)

From\To	11	12	13	15	16	17	18	20	22	25	33	35	36	40	44	45	2728	4042	Total
11	17	3	2	0	12	0	2	2	11	17	4	5	3	0	3	11	52	1	**145**
12	1	6	4	5	5	0	22	0	5	2	8	0	1	2	3	1	1	1	**67**
13	4	0	16	2	11	4	0	3	15	17	5	5	8	2	10	8	15	0	**125**
15	0	8	3	23	14	3	0	3	5	8	1	16	9	0	7	0	6	1	**107**
16	3	1	2	17	21	0	1	6	14	4	12	12	24	0	3	2	7	2	**131**
17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	**5**
18	0	3	2	2	5	2	10	0	4	5	0	2	3	0	3	1	3	2	**47**
20	1	4	2	0	5	0	6	13	7	6	4	3	1	0	5	16	7	12	**92**
22	2	9	8	4	9	2	8	6	45	11	4	9	15	0	3	36	5	4	**180**
25	1	2	6	1	5	0	4	1	6	13	2	3	3	0	7	1	1	1	**57**
33	2	4	4	2	6	2	3	6	18	5	26	2	12	0	20	16	9	3	**140**
35	1	2	2	50	4	2	4	0	4	0	0	14	7	0	3	1	5	3	**102**
36	0	5	3	4	16	2	6	2	16	8	2	11	13	0	2	6	19	3	**118**
40	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	**4**
44	1	1	1	4	3	0	5	1	10	7	14	1	4	0	22	4	9	1	**88**
45	0	3	7	3	13	1	7	1	46	6	0	6	1	0	6	10	6	6	**122**
CT Transit	0	2	3	1	2	1	6	0	2	0	0	1	3	0	1	2	0	0	**24**
2728	56	7	9	3	11	6	1	3	5	4	11	5	8	0	3	5	20	4	**161**
4042	0	1	1	4	1	0	2	19	8	0	7	2	2	0	1	4	3	8	**63**
	89	61	75	125	147	25	87	66	221	113	100	97	117	4	102	125	172	52	**1778**

Average Sunday Transfers

From\To	11	12	13	15	16	18	20	22	25	33	35	36	44	45	2728	4042	Total
11	4	0	5	2	7	1	0	12	5	1	3	1	3	3	22	2	**71**
12	2	3	1	1	1	5	0	3	2	2	0	0	0	0	2	1	**23**
13	5	1	15	2	6	2	0	20	6	0	1	0	2	3	19	3	**85**
15	3	1	2	14	13	5	2	12	1	4	19	1	0	0	8	2	**87**
16	4	0	1	7	14	3	1	3	1	0	0	8	3	0	10	3	**58**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
18	4	4	1	4	2	4	0	7	4	1	1	0	3	2	3	2	**42**
20	1	0	4	0	1	0	0	6	1	0	0	1	1	2	4	16	**37**
22	3	9	13	5	15	1	1	31	4	2	9	1	13	9	5	7	**128**
25	1	6	2	2	3	2	0	1	2	0	0	1	2	0	1	1	**24**
33	4	0	2	1	5	1	2	14	3	12	1	0	14	3	9	2	**73**
35	1	1	0	9	0	1	0	4	0	4	3	1	1	0	3	1	**29**
36	1	0	6	8	26	0	0	15	3	0	6	7	2	1	14	5	**94**
44	4	0	0	2	2	3	0	3	2	14	2	4	9	1	9	1	**56**
45	0	1	2	0	2	1	0	18	3	0	1	0	1	3	6	3	**41**
CT Transit	2	2	0	3	3	0	0	3	0	0	1	1	1	0	4	1	**21**
2728	21	2	4	2	3	1	0	5	0	0	1	0	0	1	14	4	**58**
4042	1	1	1	5	0	0	6	7	1	2	2	0	4	0	1	8	**39**
	61	31	59	67	103	30	12	164	38	42	50	26	59	28	134	62	**966**

Average Weekday Evening Transfers

From/To	911	922	933	936	944	91312	91615	92018	92825	94240	Total
11	1	1	0	0	1	0	0	0	1	0	**4**
12	0	0	0	0	0	1	0	0	1	0	**2**
13	0	0	0	0	0	4	0	0	1	0	**5**
15	0	1	1	0	0	0	3	0	1	0	**6**
16	0	0	0	1	1	0	3	0	0	0	**5**
17	0	0	0	0	0	0	0	0	1	0	**1**
18	0	1	0	0	0	1	1	1	1	0	**5**
20	0	1	0	0	1	1	0	3	1	0	**7**
22	1	6	0	1	0	4	1	0	1	0	**14**
25	0	1	0	1	0	1	1	0	2	0	**6**
26	0	0	0	0	1	0	0	0	1	0	**2**
27	0	0	0	0	0	0	0	0	1	0	**1**
28	0	0	0	0	0	1	0	1	1	0	**3**
31	0	0	1	0	0	0	0	0	0	0	**1**
33	0	0	2	0	0	0	0	0	1	0	**3**
35	0	1	0	0	0	1	1	0	0	0	**3**
36	0	0	0	1	0	1	2	1	1	0	**6**
40	0	0	0	0	0	1	0	0	1	0	**2**
42	0	0	0	0	0	2	1	0	0	0	**3**
44	0	1	1	0	3	1	0	0	0	0	**6**
45	2	3	0	1	1	4	2	0	1	0	**14**
74	0	0	0	0	0	0	0	0	0	0	**0**
81	0	0	0	0	0	0	0	0	1	0	**1**
114	0	0	0	0	0	0	0	0	0	0	**0**
CT Transit	0	1	1	0	0	1	1	1	4	1	**10**
911	1	1	2	0	0	0	0	1	1	3	**9**
922	9	7	2	3	8	10	7	2	5	0	**53**
933	1	1	1	0	2	2	2	2	2	0	**13**
936	2	1	1	3	0	4	9	0	4	0	**24**
944	1	0	4	1	0	2	1	4	1	0	**14**
2728	0	0	0	0	0	0	0	0	0	0	**0**
4042	0	0	0	0	0	0	0	1	2	0	**3**
91312	0	1	0	0	0	0	0	7	3	0	**11**
91615	1	1	2	16	1	2	5	2	2	0	**32**
92018	2	2	1	0	1	9	2	1	2	0	**20**
92825	2	2	2	1	3	5	3	3	3	0	**24**
94240	22	5	0	0	2	5	4	1	8	0	**47**
	45	39	22	29	25	64	50	32	59	5	**370**

Average Saturday Evening Transfers

From\To	911	922	933	936	944	91312	91615	92018	92825	94240	Total
11	0	1	0	0	0	0	0	0	2	0	**3**
12	1	1	0	0	0	0	0	0	0	0	**2**
13	0	3	0	0	0	5	1	0	0	0	**9**
15	0	0	0	2	0	1	6	1	2	0	**12**
16	0	0	0	0	1	0	2	0	0	0	**3**
17	0	0	0	0	0	0	0	0	0	0	**0**
18	0	0	0	0	0	0	0	0	0	0	**0**
20	0	1	0	0	1	3	1	0	0	0	**6**
22	2	5	2	2	4	2	5	2	1	2	**27**
25	1	1	0	0	0	2	0	0	4	0	**8**
33	0	2	3	0	0	0	0	0	0	0	**5**
35	0	0	0	0	1	0	0	1	2	0	**4**
36	0	3	0	4	0	0	2	0	0	0	**9**
44	0	4	5	1	4	1	3	2	0	0	**20**
45	0	2	0	0	0	0	0	0	2	0	**4**
CT Transit	2	0	0	3	0	1	4	0	0	0	**10**
911	0	0	1	1	0	0	0	4	1	2	**9**
922	8	15	0	0	7	13	3	2	4	4	**56**
933	1	8	3	1	2	2	10	0	0	0	**27**
936	0	0	0	1	1	2	0	0	3	0	**7**
944	1	1	4	9	2	0	1	2	0	1	**21**
2728	1	1	0	0	0	0	1	0	3	0	**6**
4042	0	1	1	0	0	0	0	0	1	0	**3**
91312	0	1	1	0	0	2	2	2	2	0	**10**
Total	17	50	20	24	23	34	41	16	27	9	**261**