CHAPTER 8

CONGESTION

A. INTRODUCTION

No one likes to be stuck in traffic. Roadway congestion is frustrating because its causes are usually out of the driver's control. Further, what seems like a "major traffic jam" to one person might be "just a little delay" to another. In either case, the consequences of excessive traffic congestion are real: aggressive driving, decreased personal safety, and, eventually, stifled community development. The environment also suffers. Stop-and-go traffic needlessly increases greenhouse gas emissions from vehicles and wastes fuel. Congestion also wastes people's personal and professional time.

Understanding where and why traffic congestion is happening is an important step toward reducing it. The Pioneer Valley Congestion Management Process (CMP) identifies the major traffic congestion spots in the 43 cities and towns of our region. This information is essential in advancing future transportation improvements that will reduce traffic congestion and improve the overall safety and efficiency of our transportation network.

The CMP is an integrated planning activity. It supports the Metropolitan Planning Organization (MPO) planning process for regional transportation infrastructure, maintenance, and operating investments. In addition, CMP activities and information are valuable to planning at the municipal level for non-federal transportation investments, as well as for decision-making about land use, environmental protection, housing and community development.

CMP activities are iterative. They are intended to identify existing deficiencies in the regional transportation system through ongoing monitoring and analysis of key performance measures. These performance measures themselves may evolve as a region's transportation capacities, needs, and shortcomings change.

CMP activities are comprehensive. They involve multiple agencies at all levels of government and stakeholders in communities large and small.

PVPC developed a vision to provide a framework for the development of the CMP.

VISION

The Pioneer Valley Congestion Management Process identifies, evaluates, monitors, and implements transportation performance measures that enhance the safety and efficiency of the movement of people, goods, and information.

1. Regulatory Context

The current transportation reauthorization bill Moving Ahead for Progress in the 21st Century (MAP-21) retains the CMP requirement of the Safe Accountable Flexible Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU) of 2005. In addition, MAP-21 features a new federal emphasis on performance measurement.

CMP activities are a continuation of the predecessor Congestion Management System (CMS) process established by the 1991 federal Intermodal Surface Transportation Efficiency Act (ISTEA). PVPC has continuously engaged in congestion monitoring and analysis consistent with federal guidance in support of the MPO process.

The CMP builds on the seven original steps of the original CMS guidance and adds an eighth step identified in bold below.

- Develop congestion management objectives;
- Identify areas of application;
- Define system or network of interest;
- Develop performance measures;
- Institute system performance monitoring plan;
- Identify and evaluate strategies;
- Implement selected strategies and manage transportation system;
- Monitor strategy effectiveness.

2. CMP Development Process

The CMP builds on previous versions completed for the Pioneer Valley Metropolitan Planning Organization. Consistent with Federal Highway Administration (FHWA) guidance, the CMP process for the Pioneer Valley has been broadened to better incorporate assessment of the congestion impacts and benefits experienced by transit, cyclists, and pedestrians. This necessitated a significant review and expansion of performance measures. PVPC therefore took this opportunity to engage in a public and agency review of CMP performance measures. Steps included:

- Generate draft performance measures for all transportation modes;
- Engage agency participants and stakeholders in review of draft measures;
- Identify performance measures and timeframe for availability;
- Develop implementation measures and timeframe for action;

- Data collection and analysis;
- Public review of preliminary findings.

3. Performance and Implementation Measures

The goal of the CMP is to identify, evaluate, and implement transportation performance and implementation measures that enhance the safety and efficiency of the movement of people, goods, and information throughout the Pioneer Valley. In order to achieve this goal PVPC identified the performance measures necessary to obtain the data needed to fulfill this goal. Performance measures included in the CMP are summarized in Table 8-1. The status of each performance measure is based on the availability of existing data. Ongoing performance measures have data which is currently collected by the PVPC or available from partner agencies. Immediate performance measure data is not currently available but is anticipated to be available in the near future. Future performance measure data is also not available but is highly desirable for use in future CMP activities.

Table 8-1 – CMP Performance Measures

Performance Measure	Status
Monitor on-time performance, ridership, and customer satisfaction for all transit and paratransit services of the Pioneer Valley Region	Ongoing
Develop regional route Congestion Ratio, Delay per Mile, and Congestion Index through collection of travel time data.	Ongoing
Inventory and monitor pavement conditions for all federally aid eligible roadways.	Ongoing
Increase awareness and availability of park-and-ride lots in the Pioneer Valley region.	Ongoing
Monitor and update the inventory of bicycle lanes and trails in the region.	Ongoing
Increase the percentage of bicycle rack utilization on buses.	Ongoing
Increase customer satisfaction levels of the bus terminal and shelters.	Ongoing
Increase and inventory the number of municipal bicycle racks in the region.	Ongoing
Identify regional auto/transit mode split.	Future
Identify systemwide transportation alternatives and monitor, update, and increase the number of intermodal transfer points.	Future
Decrease the number of structurally deficient and functionally obsolete bridges.	Ongoing
Identify safe alternate heavy vehicle routes in the region.	Ongoing
Map travel time contours to show distance traveled in 15 minute intervals.	Ongoing
Identify off-ramps that are operating at above capacity.	Immediate
Increase efficiency of rail systemwide.	Immediate
Improve LOS on major intermodal connector routes to the National Highway System.	Future
Monitor and update the percentage of areas without broadband access.	Ongoing
Increase the number of ITS based cameras, variable message boards, and detection units in the PVPC	Ongoing
Continue to utilize car based GPS travel time data collection.	Ongoing
Identify and monitor the number of closed-loop traffic signal systems in the Pioneer Valley.	Immediate
Improve access to advance information on ongoing construction activity.	Immediate
Develop an inventory of traffic signals with video detection capability.	Immediate
Data sharing with regional public and private partners.	Ongoing
Provide more advance information for transit riders on anticipated vehicle arrival time.	Ongoing
Monitor the average incident response time	Future
Monitor Peak hour loading vs. vehicle rated capacities (load factors).	Ongoing
Monitor transit vehicle crash rate and identify high crash locations	Ongoing
Monitor PVTA customer satisfaction related to safety throughout the PVTA system.	Ongoing
Monitor the EPDO ranking at intersections in the region	Ongoing
Monitor the percent of the Federal Aid Eligible Roadway Network rated in “Poor” condition.	Ongoing
Identify communities in the Pioneer Valley with a Safe Route to School Program.	Ongoing
Annual totals of fatalities and injuries caused by motor vehicle crashes.	Ongoing
Develop Transit Severity Ranking based on the information available from the PVTA AVL	Immediately

4. Recurring and Non-Recurring Congestion

There are two types of congestion: recurring and non-recurring. Recurring congestion can be expected to occur at the same time every weekday as a result of high volumes of commuter traffic traveling on roadways that are at or near their carrying capacity. Non-recurring congestion occurs as a result of an unexpected or non-typical event. Some causes of non-recurring congestion include: vehicular crashes, vehicle breakdowns, roadway construction, inclimate weather, and additional traffic resulting from special events.

Previous versions of the Pioneer Valley CMP only included the impacts of recurring congestion. In the past, travel time data that was thought to have been influenced by unexpected events such as roadway improvement projects or vehicle breakdowns was not used. The CMP now incorporates all regional travel time data regardless of the cause of congestion or its perceived severity. A number of new performance measures have also been developed to include the impacts of non-recurring congestion in the CMP.

5. CMP Corridors

The CMP corridors are the basis for all data collection and analysis. When developing the corridors, PVPC staff utilized data and results from previous CMP reports, past congestion relief studies, and general knowledge of the region. This information was used to develop the CMP corridor map of 76 unique corridors that are presented in Figure 8-1.

It is difficult to ensure that every congested roadway in the region is being monitored. While CMP activities are both interactive and comprehensive, the availability of resources and data guides the assessment of congestion in the region. As technology continues to advance, data will become more readily available allowing more corridors to be analyzed in the CMP. PVPC will consider adding corridors at the request of a communities' chief elected official. If requested to do so, PVPC will perform 3 days of travel time data collection. If the data verifies congestion, PVPC will consider adding the corridor. Likewise, PVPC can discontinue a corridor if the corridor is not congested.

a) Travel Time Data Collection

Travel time data collection on the 73 CMP corridors is facilitated by a four-year data collection cycle. A data collection year is scheduled to correspond with an average academic school year beginning in early September and ending in late May. Data collection is restricted by factors to include but not limited to inclement weather, federally observed holidays, and school vacations. The data is collected for each corridor on multiple days and in

both directions during the AM and PM peak hours (7:00 AM - 9:00 AM and 4:00 PM - 6:00 PM). Drivers are instructed to travel with the flow of traffic but not exceed the posted speed limit for each 2 hour data collection period.

B. REGIONAL ROADWAY CONGESTION SEVERITY

The PVPC reviewed each of the ongoing performance measures with respect to their impacts on congestion severity. In previous versions of the CMP, congestion severity was defined solely by the total delay and congestion ratio calculated for each CMP corridor. As new performance measures are integrated into the CMP it becomes more difficult to quantify congestion as each corridor has a number of different factors that contribute to congestion.

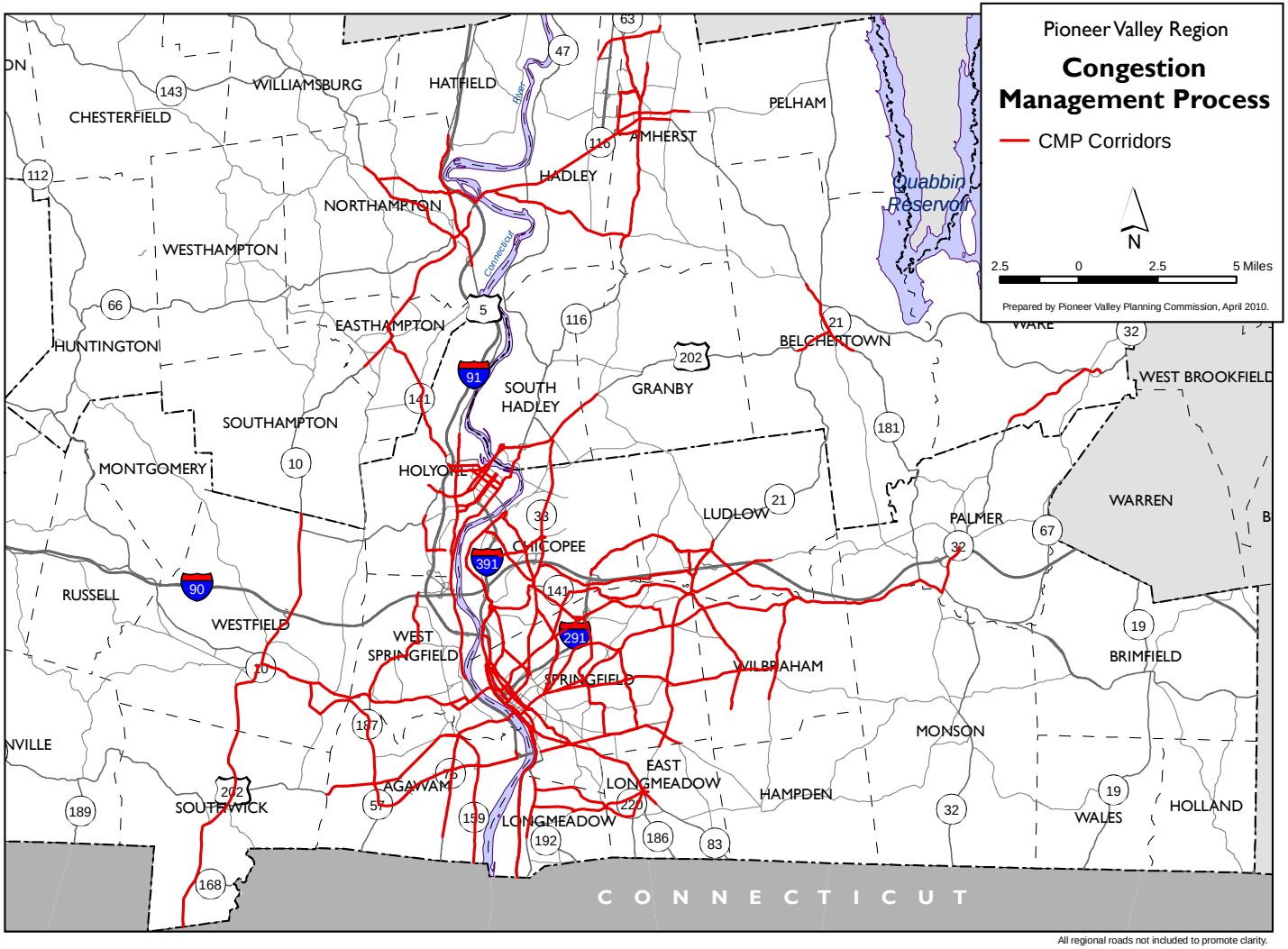
A Regional Congestion Severity formula was developed to assist in our goal of developing an objective driven, performance based congestion management process that incorporates both recurring and non-recurring congestion. This formula is intended to be a dynamic metric that can be modified to incorporate Immediate and Future performance measures as data becomes available. A number of variations of this formula were tested. Each variation attempted to incorporate a variety of performance measures that considered the impacts of a variety of transportation modes on regional congestion. The current version of the formula includes data from six performance measures and integrates the impacts of non-recurring congestion, roadway geometry, and bridge conditions in addition to travel time data.

$$\text{Regional Congestion Severity} = \text{AVG}\left(\text{Inverse Ranking of: } \text{Travel Time Index} + \text{Travel Time Delay} + \text{Congestion Ratio}\right) + 5 \times \left(\frac{\#\text{ High Crash Locations}}{\text{Length of Corridor}}\right) + \left(3 \times \text{Structurally Deficient Bridge Total}\right) + \left(2 \times \text{Functionally Obsolete Bridge Total}\right)$$

1. Methodology

Currently, there are a total of 73 CMP corridors with available travel time data. Travel time data for each CMP corridor was ranked based on the inverse value of each of the travel time performance measures. The ranking scheme ranges from 1 to 73 with a value of 73 indicating the highest level of congestion and 1 indicating the lowest level of congestion. A weighted average was performed of the inverse rankings of each performance measures and the average values were again inversely ranked. Priority on corridors that had the same rank was given to the corridor with the higher Travel Time Index. This total was added to the number of high crash locations, structurally deficient bridges and functionally obsolete bridges along each of the CMP corridors. Additional information on the six performance measures currently used in the Regional Congestion Severity formula is provided below.

Figure 8-1 – CMP Corridors



- Travel Time Index is the ratio of the average peak travel time to a free-flow travel time. Index values can be described as an indicator of the length of extra travel time spent during a trip. A travel time index of 1.0 represents free-flow travel conditions in which there are no delays. Any congestion increases the travel time index.
- Travel Time Delay is defined as the difference between the second worst and second best travel time in seconds per mile.
- Travel Time Congestion Ratio is defined as the second worst travel time divided by the second best travel time.
- High Crash Locations as defined in the Top 100 High Crash Intersections in the Pioneer Valley Region report were plotted along each of the CMP corridors. The number of high crash locations was divided by the distance of the corridor in miles, thus placing a greater emphasis on the concentration of crashes rather than total experience. This figure was then multiplied by a factor of 5 to increase its weight in the regional congestion severity formula.
- Structurally deficient and functionally obsolete bridges occasionally require vehicles to travel alternate routes, create bottlenecks due to lane elimination or lack of exclusive turning lanes, and influence driver confidence resulting in deceleration. Each structurally deficient bridge and functionally obsolete bridge located within a corridor was multiplied by the value of 3 and 2 respectively.

2. Congestion Severity Descriptions

The values produced for each corridor by the Regional Congestion Severity formula are ranked to create a congestion severity table ranging from the most to the least congestion. For analytical and evaluative purposes, four descriptive levels of congestion were created. The corridors were grouped into 21 severely congested corridors, 17 seriously congested corridors, 23 moderately congested corridors, and 12 minimally congested corridors based on their calculated severity value. Each Level is explained below.

a) Severe Congestion

Severe congestion is characterized by a condition of heavy traffic congestion resulting in significantly slower traveling speeds, longer trip times, significant queuing and high side-street delay. Contributing factors include vehicle volume, pedestrian volumes, multi-purpose lane utilization, multi-modal utilization and availability, functionally obsolete and structurally deficient bridges, vehicle crashes and uncoordinated signalized intersections. These corridors will greatly benefit from further study to identify recommendations useful in relieving congestion. These corridors are operating above capacity and driving conditions are highly unstable.

b) Serious Congestion

Serious congestion is characterized by a condition of medium traffic congestion approaching unstable flow caused by slower travel speeds, queuing and increased levels of delay. Contributing factors include vehicle volumes, pedestrian volumes and the number of signalized and unsignalized intersections along the corridor. These corridors operate at or near capacity.

c) Moderate Congestion

Moderate congestion is characterized by a condition of stable traffic congestion and flow, non-sporadic travel speeds and reasonable trip times. Contributing factors include reasonable traffic volume and opportunities for non-recurring congestion. These corridors may have small pockets of congestion, but generally operate at posted speed limits.

d) Minimal Congestion

Minimal congestion is characterized by a condition of ideal traffic congestion operating at desired travel speeds, with reasonable trip times and little to no queuing or delay. These corridors are ideal for commuting purposes and operate at free-flow travel speeds.

3. Findings

The results of the Regional Congestion Severity formula are summarized in Tables 8-2 – 8-5 and Figure 8-2. Based on the new rankings, 21 of the 73 corridors are classified as severe, 17 as serious, 23 corridors as moderate, and 12 corridors as minimal. The regional congestion severity rank has been color coded for map readability. The rankings have been defined as follows; Severe Congestion is color coded red, Serious Congestion is color coded orange, Moderate Congestion is color coded yellow, and Minimal Congestion is color coded green. The column tilted Previous Rank is the Rank for each corridor based on the 2010 CMP update.

Of the 15 corridors ranked as Severe Congestion in 2010, 8 of the corridors are still listed as severe, but 3 of the 15 are now ranked as serious congestion and 4 are ranked as moderate Congestion. This is likely a result of now having updated travel time data for all 73 corridors (6 previously un-scored corridors are now classified as having severe congestion) and completed transportation improvement projects.

Table 8-2 – Corridors with Severe Congestion

Severity Rank	Previous Rank	Corridor	Community	Route Name	Congestion Severity Total
1	12	84	Springfield/Chicopee	St, James St from State St to Broadway (Chicopee)	77.78
2	NA	78	Springfield Chicopee	Beginning Main St at Center St (Chicopee City Line) travel southbound on Main St ending at State St	74.02
3	13	25	Springfield	Sumner Ave - Longhill Road to East Longmeadow TL	73.43
4	1	69	Holyoke	AM Run Hampden St. from Route 202 Rotary to I-91, PM Run Dwight Street from I-91 to Route 202 Rotary	73.21
5	NA	58	Ware	Beginning at the intersection of Route 32 (Palmer Road) and Bacon Road traveling northbound to Route 9 (Main St), continuing eastbound ending at the intersection of Route 9 and Knox Ave	72.67
6	2	75	Chicopee	Chicopee St from Florence St to Front St, Front St to Cabot St, Cabot St to Exchange St, Exchange St to Center St, Center St to Front St Front to Grove St, Grove St to Main St, Main St to East Main St ending at Maple St.	71.06
7	NA	70	Holyoke	Beginning at the intersection of Dwight St and Linden St traveling southbound on Dwight St ending at the intersection of Dwight St and South Main St	70.67
8	11	79	Springfield	E. Columbus Ave - From Bruno Street to Liberty Street	65.88
9	6	74	Chicopee	McKinstry St. from Arcade St to Granby Rd, Granby Rd to Westover Rd ending at Bernice St	65.82
10	23	12	Springfield	Rt 21(Parker St) - N. Branch PKWY to East St.	63.22
11	26	31	Westfield	Rt. 20 - E. Mountain Rd. to Elm St.	62.01
12	NA	83	Springfield	Dickinson St, Maple St, and Chestnut St from the X to Dover St Dwight St, Maple St, and Dickinson St from Dover St ending at the X	60.83
13	NA	68	Holyoke South Hadley	Beginning at the intersection of Main Street (Holyoke) and Route 5 (Ingleside St) travel eastbound on Main St to Race St to Canal St northbound on Route 116 (Vietnam Veterans Memorial Bridge) to Bridge St (South Hadley) Lamb St. (Route 116) ending at the intersection of Lamb St and Gaylord St	59.47
14	15	77	Springfield	Liberty St - From West Columbus Ave to Amory St, Armory St north to Atwater Ter	57.67
15	NA	57	South Hadley Granby	Beginning at the exit to the Route 202 Rotary and Purple Heart Dr traveling eastbound on Route 202 (Granby Rd) into Granby ending at the Five Corners (Pleasant/Amherst St intersection)	57.01
16	18	80	Springfield	W. Columbus Ave - From Clinton Street to South Street	55.33
17	8	66	Agawam	Route 75 from Long Brook Estates to Colony Road	54.33
18	NA	61	Ludlow	Beginning at the intersection of Chapin St and Holyoke St traveling eastbound on Chapin St through Ludlow into Wilbraham on Cottage Street ending at the intersection of Cottage St and Boston Road (Wilbraham)	54.33
19	54	11	Longmeadow	Route 5 - Mill Rd. to I-91	53.67
20	47	41	Hadley/Northampton	Bay Rd. - From Atkins corner to Route 9	53.00
21	28	8	E. Longmeadow / Springfield	Rt. 83, Springfield st. - Sumner Ave.. to Quaryhill Rd.	51.61

Table 8-3 – Corridors with Serious Congestion

Severity Rank	Previous Rank	Corridor	Community	Route Name	Congestion Severity Total
22	5	42	Holyoke	Maple Street from Lyman to Route 5 via South Street	49.60
23	20	67	Amherst	Snell Street from Route 116 north to University Drive, East on Mass Ave, South on N Pleasant St., North on East Pleasant ending at Eastmen Lane.	49.00
24	19	52	Springfield	Bay St. from Boston Rd to State St.	48.88
25	NA	7	Chicopee	I-291, Burnett Rd - Exit 5 to Holyoke St (Ludlow) to Chapin to Fuller to West Ave.	48.33
26	4	71	Holyoke	Appleton Street from Dwight to North Canal Street	48.24
27	NA	65	Agawam	Beginning on Route 159 (Main Street) from Ct Stateline traveling northbound on Route 159 to Springfield Street ending at the intersection of Springfield St and Columbus St.	46.67
28	NA	63	Longmeadow East Longmeadow	Beginning at the intersection Converse St and Route 5 (Longmeadow St) traveling Eastbound to Dwight Street southbound on Dwight St to Chestnut St (East Longmeadow) travel eastbound on Chestnut St to Shaker Rd then northbound on Shaker Rd to Elm St ending at the intersection of Elm St and Taylor St.	46.33
29	34	23	Springfield	Rt. 20A - From East St to Page, Page to Paco to Boston Road, Start and end @ St. James and Carew	46.18
30	50	36	Wilbraham	Main St - Tinkham Rd/Main to Cottage/Boston Rd	46.00
31	39	15	Northampton	Rt. 9 - Florence St. to Day Ave	44.00
32	40	14	Hadley/Northampton	Bridge St at Route 9 to Damon Road -Damon Rd to Bridge/Main to Rt. 9 Aqua Vita	41.67
33	17	18	Springfield	Main St., Locust St., Belmont Ave. - State/Main to Belmont (The X)	41.67
34	14	22	Springfield	Roosevelt Av. - Sumner to East St.	41.44
35	29	21	Springfield/Chicopee	Liberty St - From I-291(Go thru rotary) to Broadway (Chicopee) to I-90 Exit 5	41.00
36	NA	55	Springfield	Beginning at the intersection of Parker St and the North Branch Parkway traveling southbound on Parker St to Cooley St continue southbound on Cooley St ending at the East Longmeadow T.L.	40.88
37	NA	62	Chicopee Ludlow	Beginning at the intersection of Fuller Rd and Route 33 Memorial Dr eastbound on Fuller Rd to Shawinigan Drive to West Ave ending at the intersection of West Ave and Center Street (Ludlow)	40.31
38	51	20	West Springfield/ Springfield/Chicopee	North Boulevard to South Boulevard to Rotary to Plainfield Street to Carew Street ending at East Main Street (Chicopee)	40.18

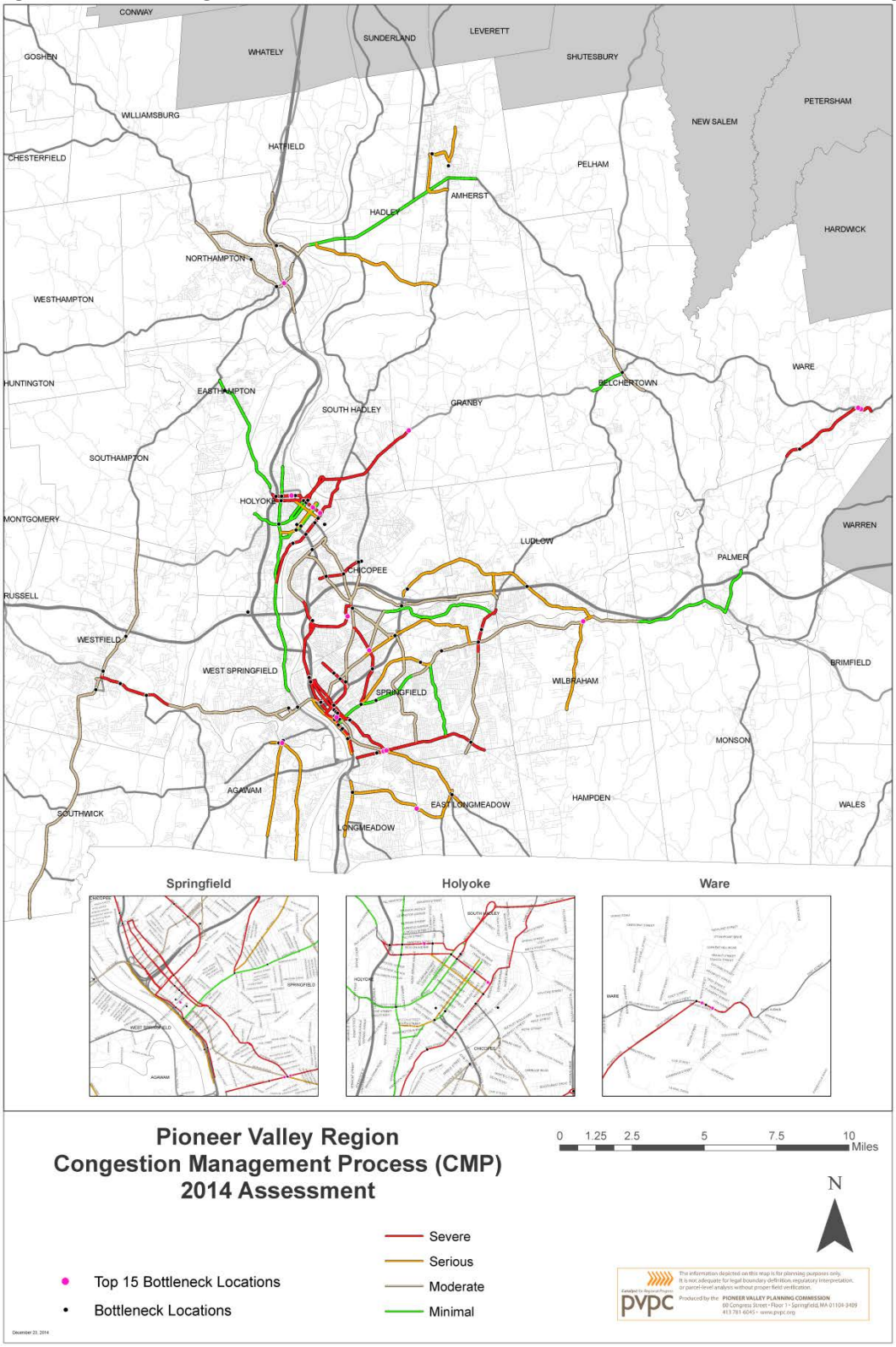
Table 8-4 – Corridors with Moderate Congestion

Severity Rank	Previous Rank	Corridor	Community	Route Name	Congestion Severity Total
39	16	51	Northampton	Route 5 Exit 18 to MassHighway District 2 Building	39.85
40	46	39	Belchertown	Route 9/181 Federal St from Bay to Route 181n at Jensen Road (Belchertown)	39.00
41	7	72	Chicopee	Chicopee St from Willamansett Bridge to Yelle St, Yelle St to Montgomery Street, Montgomery St to Memorial Dr (Route 33)	37.21
42	42	49	Springfield/Wilbraham	Rt. 20 / Boston Raod - All of Boston Road	36.88
43	36	33	Westfield/Southwick	Rt. 10/202 - CT Line to Washington St. (Law Offices)	36.00
44	3	30	Westfield	Rt 10/202/, N. Elm St. from Southampton T.L. to Main St.	34.68
45	21	73	Chicopee	Grattan St from Chicopee St (Route 116) to Memorial Dr (Route 33)	34.67
46	22	28	West Springfield	Rt. 20 - East Mountain Road to Elm Street to Park Street to North End Rotary.	33.04
47	33	86	Springfield/Chicopee	East Main St (Chicopee) to Worcester St (Springfield) to Main St (Indian Orchard) to River Rd ending at Weston St.	32.67
48	10	9	Holyoke	Laurel St to Brown St to South St to High Street ending at Lyman St.	32.09
49	27	85	Springfield	Bradley Rd from Sumner Ave to Boston Rd	31.85
50	41	50	Easthampton	Route 141 from Route 10 to I-91	31.67
51	NA	59	Belchertown	Beginning at the intersection of Route 202 (State St) and Underwood St traveling eastbound and then northbound on Route 202 (Maple St and Main St) ending at the intersection of Route 202 (North Main St) and Sargent St	30.33
52	9	44	Holyoke	Jarvis St/ Beech St. - from George Frost Dr to Rt 202 Rotary and back up Linden St to Georg Frost Dr	29.67
53	35	27	West Springfield / Holyoke	Rt. 5 - E. elm St to Providence Hospital	28.98
54	44	53	Palmer	Route 32 from High St. to Route 20 to Boston Rd.	27.67
55	32	24	Springfield	State St. - Columbust Ave. to Boston rd	26.84
56	24	37	Holyoke	Rt. 5 - River Terrace to Providence Hospital	26.77
57	49	56	Hadley	Route 9 from Aquavita Rd to Belchertown Road (Amherst)	26.67
58	30	82	Springfield	Springfield Street from Center at Chicopee to Chestnut to Main to Bernie end at West Street	24.00
59	25	2	Agawam	Springfield St - Mill Street (Agawam) to Memorial Ave (West Springfield) to Main St (Springfield)	23.57
60	57	48	West Springfield	Dewey, Pease, Morgan, Birnie - Dewey/Rt 20 to Birnie/Prospect	23.33
61	NA	54	Springfield	Beginning at the Intersection of Wilbraham Rd and State St traveling eastbound on Wilbraham Rd, Wilbraham Rd turns into Springfield St (Wilbraham) ending at the intersection of Springfield St and Main St	22.98

Table 8-5 – Corridors with Minimal Congestion

Severity Rank	Previous Rank	Corridor	Community	Route Name	Congestion Severity Total
62	NA	64	Longmeadow East Longmeadow	Beginning at the intersection of Bliss St and Route 5 (Longmeadow St) traveling eastbound on Bliss St to Williams St eastbound on Williams St to Maple St (East Longmeadow) eastbound on Maple St to Pleasant Street ending at the intersection of Pleasant St and Taylor St.	20.67
63	NA	19	Springfield Longmeadow	I-91 Exit 12 to CT Exit 49	19.67
64	38	40	Chicopee	Memorial Dr. Rt. 33 - From Rout 202 to I-90	19.67
65	31	35	Wilbraham	Stony Hill Rd. - Tinkham Rd to River Rd to Route 21	18.47
66	53	16	Northampton/Easthampton	Rt. 10 - Donais St. to Route 9	17.33
67	55	1	Agawam	Rt. 57 - Rt. 5 on Ramp to end of Rt 57, N on RT 187, West of old 57 to Southwick T.L.	15.31
68	45	13	Ludlow	Center St. and East St. - Rood Street to Owens Way	15.26
69	37	10	Holyoke	Lower Westfield Rd., Homestead Ave - Elbert Dr. to Holyfamily Rd.	13.22
70	52	5	Amherst	Meadow St., Pine St., Bridge St., and Market Hill - Market and South Hills to Meadow and Roosevelt	10.00
71	NA	60	Amherst	Beginning at the intersection of Main St and Poets Corner Rd traveling westbound on Main st St to Amity St ending at the intersection of Rocky Hill Rd and North Pleasant St in Hadley.	9.33
72	48	3	Agawam	Route 75 from Mill Street to Main Street	7.00
73	56	4	Agawam	Route 187 - From Route 20 (Westfield) to Springfield St (Agawam), Springfield St to Mill ST.	6.85

Figure 8-2 – Congested Corridors and Bottlenecks in the Pioneer Valley



C. REGIONAL TRANSIT CONGESTION SEVERITY

Congestion is perceived in different ways depending on the type of transportation mode being used. Single occupancy automobile drivers often see congestion as how often they are forced to travel at less than the posted speed limit, while users of public transportation may perceive congestion as how often do they arrive at their destination on late or whether there are any seats available on the bus. This section discusses the various measures PVPC in cooperation with PVTA have access to. Based on these measures PVPC will develop a transit congestion severity formula for measuring transit congestion on our CMP corridors.

PVTA has a fully integrated CAD/AVL system by Avail Technologies. This system allows for real-time system monitoring by PVTA. The Avail system provides a suite of ITS technologies which improve the ease of collecting major transit performance measures such as; ridership, on time performance, as well as revenue mileage.

1. Regional Transit System Ridership

FHWA guidance cites transit ridership as a key CMP performance measure. Bus ridership is typically reported on an annual and monthly basis for individual routes. Following are PVTA ridership highlights for FY2013:

- 11.1 million total rides
- 927,000 average monthly rides

PVTA full system ridership from 2003 through 2013 is displayed Figure 8-3. Significantly, PVTA cut service approximately 20% in FY2002 and subsequent years in response to reduced government support; total ridership fell as a result.

In 2014 Nelson Nygaard performed a Comprehensive Service Analysis (CSA) on behalf of PVTA. The objective of the CSA was to conduct a detailed review of existing transit services, identify strengths and weaknesses, and develop recommendations to improve service for existing riders and attract new riders. Specifically the goals of this study were to ensure that PVTA services:

- Continue to meet and support community needs
- Provide an attractive transportation option for as many people as possible
- Operate in a cost effective and efficient way

PVTA is currently in the process of phasing in the recommendations of the CSA. Once implemented it is anticipated that these service changes will increase ridership throughout the region. For more information regarding the CSA please go to http://pvta.com/csa.php .

Figure 8-3 – PVTA Ridership 2003-2013

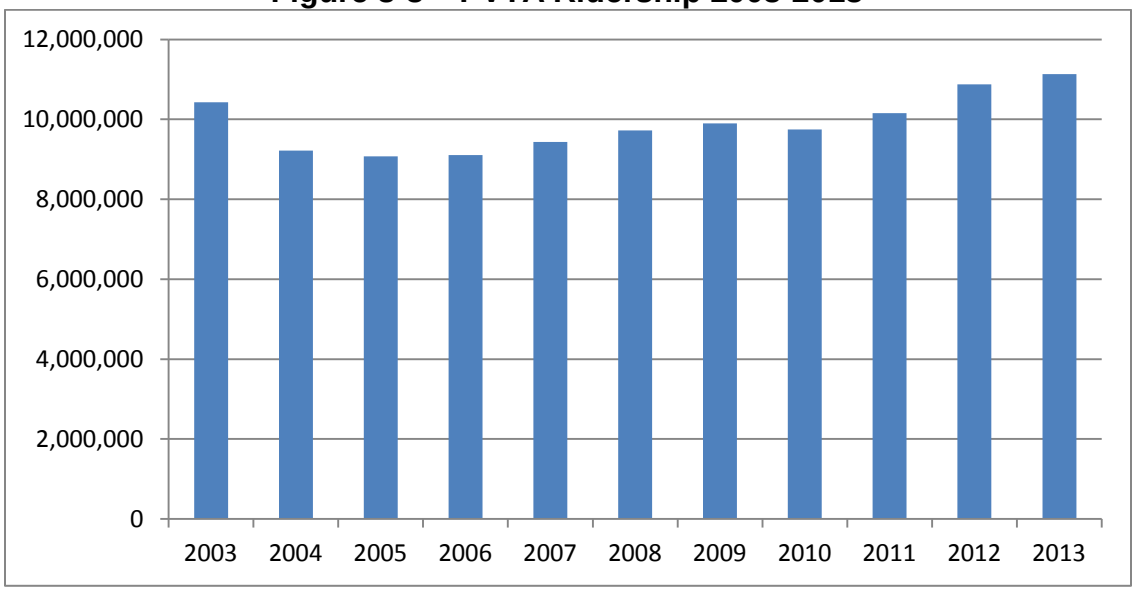
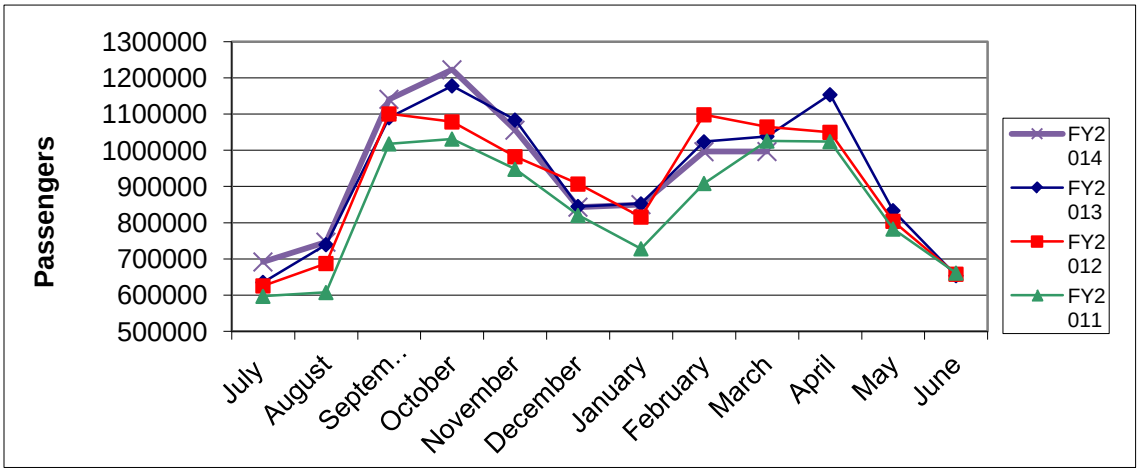
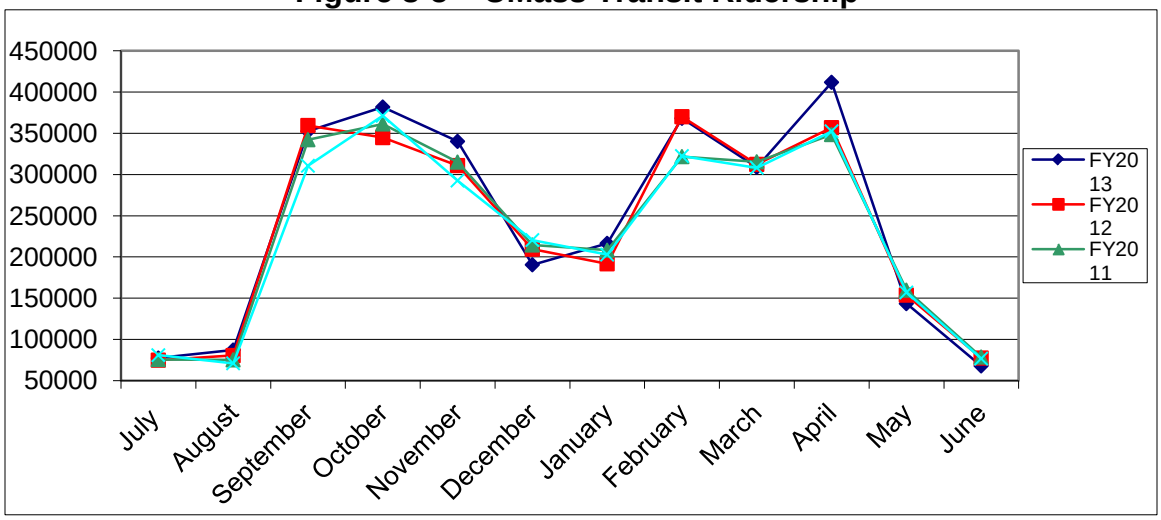


Figure 8-4 – SatCo and VatCo Combined Ridership



SatCo = Springfield Area Transit Company
VatCo = Valley Area Transit Company

Figure 8-5 – UMass Transit Ridership



1. Transit On-Time Performance

Transit on time performance information is cited by FHWA guidance as an important performance measure in CMP analysis. Industry research tends to show that transit passengers are willing to tolerate longer trips as long as they can be certain they will arrive on time.

Since PVTA implementation of the CAD/AVL system, on-time performance for each route became much more readily available. Therefore, transit on time performance information is now being incorporated as a performance measure.

Table 8-6 – Operational Statistics 2012 and 2013

2013 Operational Statistics

Provider	% On Time	% Late	% Early	Number of Departures
UMASS Transit	89.4	5.1	5.5	433060
VatCo	66.2	26.7	7.1	140380
SatCo	67.6	21.4	11	869833

2012 Operational Statistics

Provider	% On Time	% Late	% Early	Number of Departures
UMASS Transit	86.6	6	7.4	295516
VatCo	64.3	27	8.7	142724
SatCo	65.7	21.6	12.7	846225

SatCo = Springfield Area Transit Company
VatCo = Valley Area Transit Company

2. Transit Congestion Severity Ranking

PVPC is in the process of developing a transit congestion severity ranking. This measure will help quantify the number of transit users being impacted by delays on the PVPC CMP corridors.

In order to develop a Transit Severity Ranking PVPC will overlay PVTA's fixed routes on the CMP corridors in order to identify locations were bus occupancy and on time performance can be measured against the results of the regional roadway congestion severity analysis (see Figures 8-6 and 8-7). By doing this we can identify the number of transit users, number of buses, and the number of routes being influenced by congestion. This analysis may also help identify correlations between automobile delay and transit OTP. By including ridership we can then calculate the number of transit travelers being impacted by congestion.

For the RTP we will be including two routes for this analysis. The full system analysis will be completed at a later date as part of the CMP update. The routes being looked at are the Northampton portion of the Blue 43, this transit route corresponds to CMP corridor 15 (Route 9 in Northampton). The second route being looked at is the G1, this transit route corresponds with CMP corridor 78 (Main Street in Springfield). These two CMP corridors were selected based on their high congestion severity ranking. The two transit routes selected also experience high ridership.

Table 8-7 – Transit Severity Data

Transit Route	Average Ridership	Maximum Riders	Alights	Boardings	Number of buses	Number of Trips	Corridor 78 Main Street - Springfield	
G1 NB am	12	28	150	89	7	5	Severity Rank (Score)	2 (74.02)
G1 SB am	15	27	116	141		6	Delay	434.21
G1 NB pm	13	36	163	116	13	6	Ratio	7
G1 SB pm	19	38	105	188		13	Index	2.03
Average	**14.75**	**32.25**	**133.5**	**133.5**	**10**	**7.5**		
Transit Route	**Average Ridership**	**Maximum Riders**	**Alights**	**Boardings**	**Number of buses**	**Number of Trips**	**Corridor 15 Route 9 - Northampton**	
B43 EB am	8	22	6	90	4	6	Severity Rank (Score)	31(44)
B43 WB am	7	15	30	1		5	Delay	156.71
B43 EB pm	12	25	38	107	6	6	Ratio	1.97
B43 WB pm	11	24	57	0		5	Index	1.5
Average	**9.5**	**21.5**	**32.75**	**49.5**	**5**	**5.5**		

Table 8-7 shows the different types of data available to for analysis; for PVTA's fixed routes and how it can be matched up with our CMP data. The data is summarized by direction of travel and time period (AM = 7-9, PM = 4-6). The data can also be broken out by stop or stops to better correspond with the segmentation of our CMP corridors. More in-depth analysis will be done as part of our next CMP update.

Table 8-7 also shows the average ridership by direction for both AM and PM peak periods, as well as the maximum number of riders on the bus while the bus was traveling on the CMP corridor. A significant number of alightings and boardings were recorded on the G1 in Springfield; this was due to transfers at the Springfield Bus Terminal. The table also includes information on how many buses travel the route during the peak hours as well as how many trips were made.

By overlaying the transit data over our CMP data we are able to see that the portion of the G1 route experiences a severe congestion with a congestion severity ranking of 2. The B43 route also experience serious congestion with a congestion severity ranking of 31. As we advance this process we anticipate being able to identify points along our corridors where congestion directly impacts the transit experience.

D. PIONEER VALLEY REGION BOTTLENECKS

1. Introduction

The CMP "Bottlenecks" analysis further refines the existing CMP methodology and evaluates individual roadway segments along each corridor. Segments are determined on a corridor by corridor basis and vary in length and physical characteristics. As a result, the degree of congestion severity can vary significantly along a given corridor.

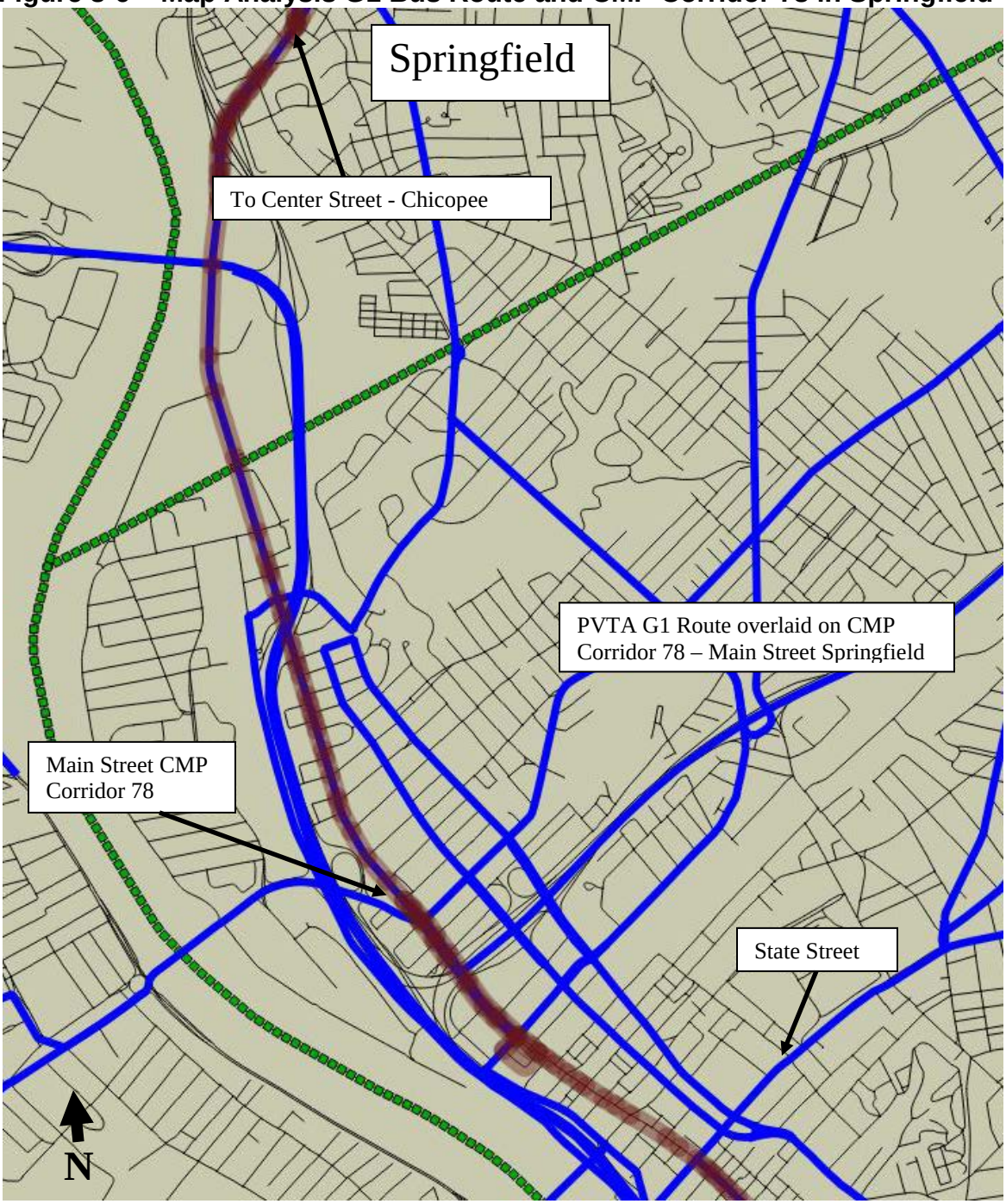
The Federal Highway Administration (FHWA) defines a congestion bottleneck as "A localized section of highway that experiences reduced speeds and inherent delays due to a recurring operational influence or a nonrecurring impacting event"[6]. If congestion occurs along an entire corridor, then the corridor is considered congested. Likewise, if the corridor is experiencing congestion only at a specific location, then the corridor is considered a congestion bottleneck.

2. Analysis

Each roadway segment was ranked based on the inverse value of each of the travel time performance measures. Currently, there are a total of 456 roadway segments with travel time data available. The ranking scheme ranges from 1 to 456 with a value of 4456 indicating the highest level of congestion and 1 indicating the lowest level of congestion. For segments that had the same rank, priority was given to the corridor with the higher Travel Time Index. PVPC used this process to identify the top 15 congested segments in the region to identify the top bottlenecks in the Pioneer Valley Region. The results of the analysis are presented in Table 8-8 and Figure 8-3.

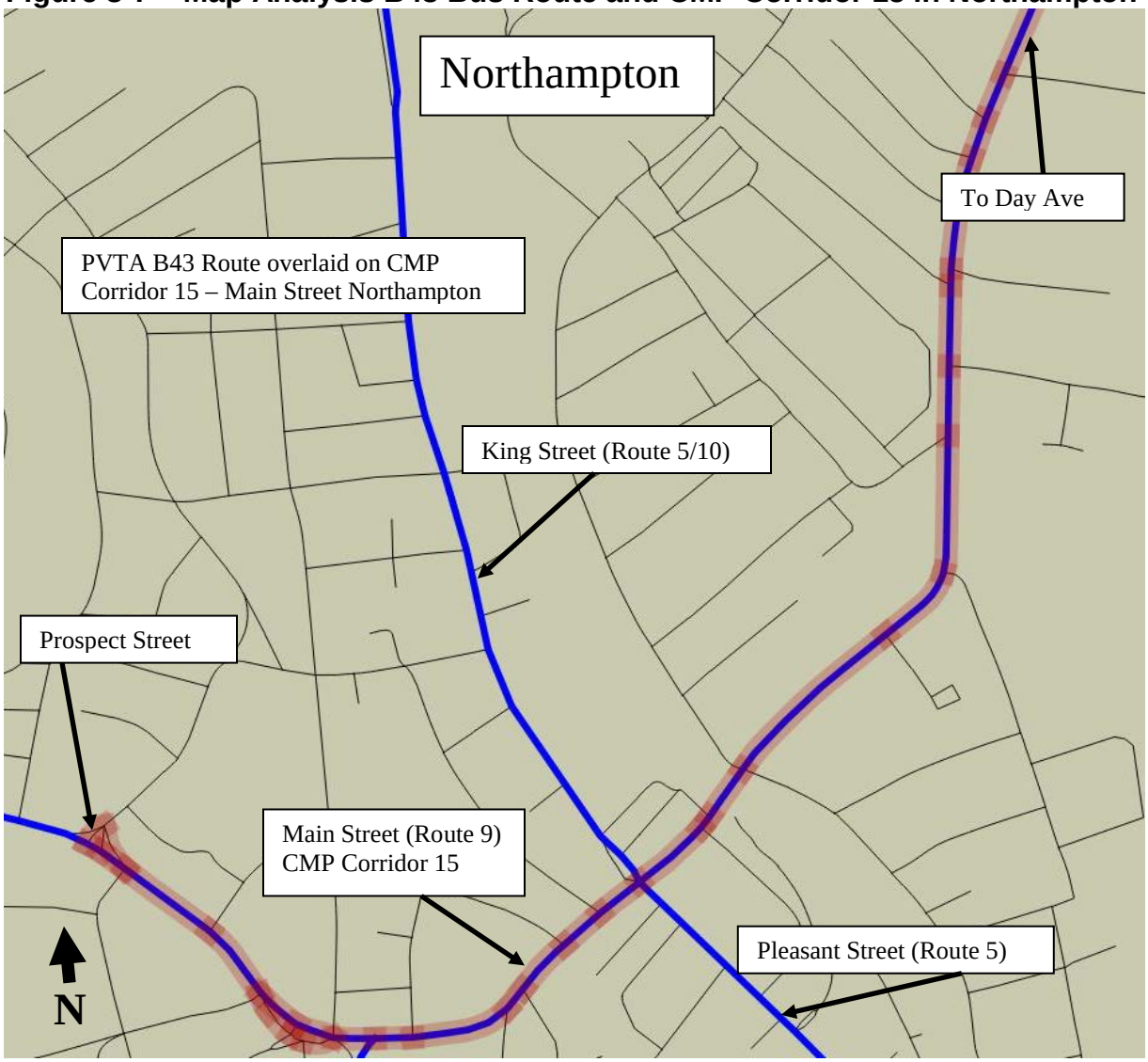
[6] http://www.ops.fhwa.dot.gov/bn/lbr.htm#g3

Figure 8-6 – Map Analysis G1 Bus Route and CMP Corridor 78 in Springfield



Map Key: Blue line indicates CMP corridor
Red highlight indicates transit route
Green Doted Line indicates municipal boundary
Black lines represent roads

Figure 8-7 – Map Analysis B43 Bus Route and CMP Corridor 15 in Northampton



Map Key: Blue line indicates CMP corridor
Red highlight indicates transit route
Green Doted Line indicates municipal boundary
Black lines represent roads

Table 8-8 – Congestion Bottlenecks in the Pioneer Valley Region

Rank	Municipality	Bottleneck Location	Score
1	Chicopee	Grove Ave/Front Street @ Grove Street - Chicopee	452
2	Springfield	Carew Street @ Saint James Avenue - Springfield	450
3	Holyoke	Dwight @ Race Street to Dwight at Maple Street- Holyoke	448
4	Ware	Main Street @ South Street/Church Street to Main Street @ North Street- Ware	447
5	Springfield	Main Street @ Boland Way/Harrison Ave - Springfield	444
6	Springfield	Sumner Ave @ The "X" - Springfield	444
7	Granby	West State Street @ Pleasant Street (5 Corners) - Granby	443
8	Agawam / West Springfield	Memorial Ave @ River Street to Suffield Street @ Main / Springfield Street including Walnut Street - Agawam / West Springfield	441
9	Longmeadow	Dwight @ Maple/Williams - Longmeadow	439
10	Wilbraham	Main Street @ Boston Road - Wilbraham	438
11	Holyoke	Hampden Street (141) @ Nonotuck Street - Holyoke	438
12	Northampton	Main Street (Route 9) @ Pleasant /King Street - Northampton	436
13	Hadley / Amherst (UMass)	Massachusetts @ Commonwealth Ave - UMass	432
14	Chicopee	I-291 @ Exit 6 - Chicopee	430
15	Chicopee	Westover Road @ Bernice Street - Chicopee	428

E. CONGESTION STUDIES

As part of the CMP process, PVPC is required to monitor and develop strategies to improve congestion in the region. Under this section we have identified several proposed locations PVPC can perform congestion studies in a future UPWP as well of a list of TIP projects that may improve congestion within the Pioneer Valley Region. Many locations identified as a regional bottleneck or a corridor of serious congestion do not appear Table 8-9 as a candidate for a future study as they were determined to have a planned transportation improvement project to reduce congestion, a planned congestion study, or have a recently completed study.

Table 8-9 – Potential Congestion Studies to be Advanced Through a Future UPWP

Location	Study
Region wide	Develop a congestion "Toolbox" which will contain various congestion management strategies which can be applied to locations identified as being congested. Strategies will be based on type and extent of congestion
Region wide	Update the Top 15 Bottlenecks report
PVTA Service Area	Advance the "Transit Congestion Severity" calculation based on the data discussed in the transit congestion severity section of this chapter
Interstate 391 Exits 3 and 4 northbound off ramps	Study existing congestion that causes traffic to queue back onto the highway, particularly during the afternoon peak hour.
Grove Street at Front Street - Chicopee	Ranked as the #1 Bottleneck location in the region.
Boston Road at Main Street - Wilbraham	Ranked as the #10 Bottleneck location in the region.
Route 33 at Granby Road and Westover Road - Chicopee	Ranked as the #15 Bottleneck location in the region.
Route 9 at University Drive and Snell Street	Ranked as a corridor of Serious congestion.

Table 8-10 – TIP Projects that May Improve Congestion

Proposed Funding Year	Municipality	SID	Project Desrictiopn	Estimated Cost
2015	Springfield	605222	NORTH END & BRIGHTWOOD INFRASTRUCTURE IMPROVEMENTS, FROM OSGOOD STREET TO THE CHICOPEE CITY LINE (NORTHERLY SEGMENT)	$4,233,000
2016	Westfield	604446	RECONSTRUCTION OF ROUTE 187 (LITTLE RIVER ROAD) AND SHAKER ROAD - 300 METERS SOUTH OF ROUTE 20 TO 460 METERS EAST OF SHAKER RD (.8 MILES)	$5,504,386
	Westfield	604445	RECONSTRUCTION ON ROUTE 187, INCLUDES REPLACEMENT OF W-25-002, SHERMAN'S MILL BRIDGE OVER GREAT BROOK AT PONTOOSIC ROAD	$6,926,210
2015	Northampton	605066	INTERSECTION IMPROVEMENTS AT ROUTE 5 (PLEASANT STREET) AND CONZ STREET	$1,592,248
2016	Ludlow	605011	RECONSTRUCTION OF CENTER STREET (ROUTE 21) - FROM 35' WEST OF BEACHSIDE DRIVE WESTERLY TO GAS LINE BESIDE MTA OVERPASS (3,500 FEET)	$4,728,895
2016	Northampton	180525	RECONSTRUCTION OF DAMON ROAD, FROM ROUTE 9 INTERSECTION TO ROUTE 5 INTERSECTION (1.1 MILES)	$5,000,000
2015	Hadley	604035	SIGNAL & INTERSECTION IMPROVEMENTS AT ROUTE 9 (RUSSELL STREET) & ROUTE 47 (MIDDLE STREET)	$3,038,060
2017	Hadley	605032	RECONSTRUCTION ON ROUTE 9 BETWEEN THE LOWE'S AND HOME DEPOT SITE DRIVES (0.6 MILES)	$4,428,122
2016	Southwick	603477	Intersection Improvements at Four Locations on Route 57 (Feeding Hills Road)	$3,617,872
2016	Northampton	606555	Roundabout Construction Route 5/10 (North King Street) @ Hatfield Street	$2,874,896
2017	Agawam	600513	RECONSTRUCTION OF ROUTE 187 FROM 425 FT. SOUTH OF S. WESTFIELD STREET TO ROUTE 57 (0.3 MILES - PHASE I)	$1,558,000
	Agawam	607316	RECONSTRUCTION OF ROUTE 187, FROM SOUTHWICK/SPRINGFIELD STREET TO ALLISON LANE (1.29 MILES - PHASE II)	$5,562,610
	Belchertown	604692	RECONSTRUCTION ON SOUTH MAIN STREET & NORTH WASHINGTON STREET FROM SOUTH MAIN ST TO THE INTERSECTION OF NORTH LIBERTY (2.08 MILES)	$3,740,430
2016	Springfield	605385	SIGNAL & INTERSECTION IMPROVEMENTS @ ROOSEVELT AVENUE & ISLAND POND ROAD, ROOSEVELT AVENUE & ALDEN STREET	$1,900,000
	West Springfield	604210	Rte 5 Reconstruction	$4,800,000
	West Springfield	604746	BRIDGE REPLACEMENT, W-21-006, CSX RAILROAD OVER UNION STREET	$12,403,054
	Agawam	603372	RECONSTRUCTION ON ROUTE 5 CONNECTOR TO ROUTE 57, INCLUDES A-05-013 & A-05-014	$11,670,939
	Westfield	603449	ROUTE 20 ACCESS IMPROVEMENTS ON COURT STREET & WESTERN AVENUE HPP $2,503,688	$3,360,000
	Westfield	607773	WESTFIELD- IMPROVEMENTS & RELATED WORK ON ROUTE 20, COURT STEET & WESTERN AVENUE, LLOYDS HILL ROAD TO HIGH STREET/MILL STREET INTERSECTION (PHASE II) Eastern Section	$2,383,981
2017	Agawam	604203	Route 187/57 Intersection Improvements	$1,500,000

Table 8-10 – TIP Projects that May Improve Congestion (cont.)

Proposed Funding Year	Municipality	SID	Project Desrictiopn	Estimated Cost
	Hadley	605881	RECONSTRUCTION ON ROUTE 9, FROM MIDDLE STREET (ROUTE 47) TO EAST OF MILL VALLEY ROAD (LOWE'S) (1.27 MILES)	$6,900,000
	Holyoke /West Springfield	604209	REHABILITATION OF ROUTE 5 (RIVERDALE ROAD), FROM I-91 (INTERCHANGE 13) TO MAIN STREET IN HOLYOKE & FROM ELM STREET TO NORTH ELM STREET IN WEST SPRINGFIELD (3.2 MILES)	$3,000,000
2018	Northampton	604597	I-91 INTERCHANGE 19 IMPROVEMENTS AT ROUTE 9 AND DAMON RD	$5,000,000
	Palmer	601504	RECONSTRUCTION OF ROUTE 32, FROM 765 FT. SOUTH OF STIMSON STREET TO 1/2 MILES SOUTH OF RIVER STREET (PHASE I) (1.63 MILES)	$6,134,080
2018	Northampton	607502	INTERSECTION IMPROVEMENTS AT KING STREET, NORTH STREET & SUMMER STREET AND AT KING STREET & FINN STREET	$1,633,150
	Chicopee	607736	CHICOPEE- SIGNAL & INTERSECTION IMPROVEMENTS AT 11 INTERSECTIONS ALONG ROUTE 33 (MEMORIAL DRIVE), FROM FULLER ROAD TO BRITTON STREET	$3,651,800
2018	Holyoke	606903	IMPROVEMENTS TO LOWER WESTFIELD ROAD ON I-91 (INTERCHANGE 15)	$1,031,250
	South Hadley	607735	SOUTH HADLEY- SIGNAL & INTERSECTION IMPROVEMENTS AT ROUTE 202 (GRANBY ROAD) & ROUTE 33 (LYMAN STREET)	$500,004
	Agawam	607317	Route 187 Reconstruction from Allison Ln to Westfield City Line, 1.69 miles(Phase III)	$7,589,668
	Granby	606895	Route 202 Intersection Improvements 2 Locations @ 5 Corners and @ School Street	$500,000
2016	Holyoke	606450	TRAFFIC SIGNAL UPGRADES AT 15 INTERSECTIONS ALONG HIGH & MAPLE STREETS	$1,564,867
	Northampton	607433	INTERSECTION IMPROVEMENTS @ PROSPECT STREET, JACKSON STREET & WOODLAWN AVENUE	$1,248,180
	Northampton	607501	INTERSECTION IMPROVEMENTS @ NORTH ELM STREET, ELM STREET & WOODLAWN AVENUE	$1,489,520
	Holyoke	606156	RECONSTRUCTION OF I-91 INTERCHANGE 17 & ROUTE 141	$2,600,000
	Hadley	606547	PEDESTRIAN SIGNAL INSTALLATION AT 2 LOCATIONS ALONG ROUTE 9 NEAR WEST ST	$134,600