Congestion Management Process Report

Hartford Transportation Management Area

November 2020

Capitol Region Council of Governments
Lower Connecticut River Valley Council of Governments
Naugatuck Valley Council of Governments
Northwestern Hills Council of Governments

Table of Contents

Table of Figures

Chapter 1 Introduction

Roadway Congestion and Congestion Management Process

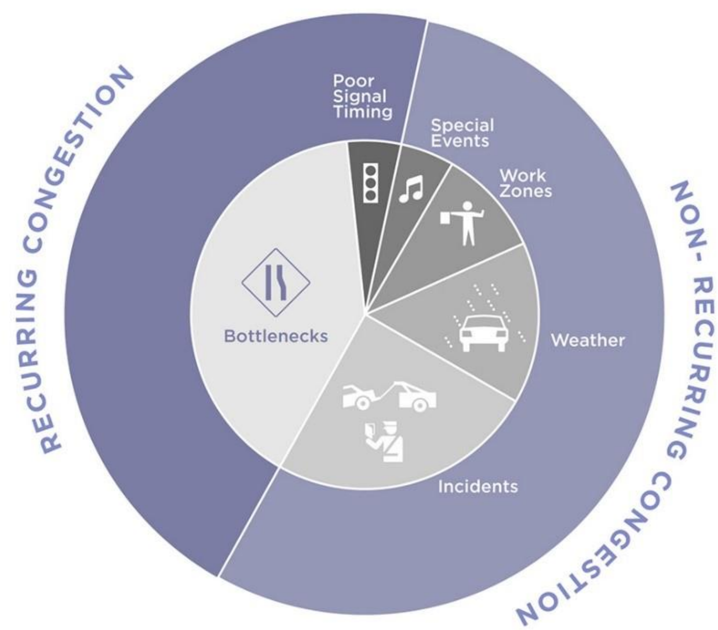
A Congestion Management Process (CMP) is a systematic approach to measuring transportation system performance and developing proposals to manage traffic congestion. The Fixing America's Surface Transportation Act (FAST Act) requires that each metropolitan area, with a population over 200,000, develop and implement a CMP as part of their metropolitan planning process. Hartford Transportation Management Area (TMA) population exceeds 900,000, and therefore the Capitol Region Council of Governments (CRCOG), in concert with Lower Connecticut River Valley Council of Governments, Naugatuck Valley Council of Governments and Northwestern Hills Council of Governments that comprises the TMA, has carried out a transportation monitoring and management program since 2005. This report updates the prior report dated May 23, 2017 that was based on 2015 travel time data. This report incorporates congestion monitoring and assessment data from 2019 the National Performance Management Research Data Set (NPMRDS) and seeks to advance the goals developed in ***Connect 2045***, the Metropolitan Transportation plan for the Capitol Region. Based on the CMP Guidebook developed by the FHWA, the process includes the following:

i. Development of congestion management objectives
ii. Establishment of measures of multimodal transportation system performance
iii. Collection of data and system performance monitoring to define the extent and duration of congestion and determine the causes of congestion
iv. Identification of congestion management strategies
v. Implementation activities, including identification of an implementation schedule and possible funding sources for each strategy
vi. Evaluation of the effectiveness of implemented strategies

The ideal transportation system for road users is one that is able to move people and freight from an origin to a destination in a quick, safe and cost-effective manner. However, as Americans continue to purchase vehicles, there is an increased demand placed on the existing roadway system. The inability of roadway capacity improvements to keep up with the increasing demand placed on the system has resulted in some major bottlenecks. These bottlenecks have resulted in congestion in major urbanized areas across the nation. Most of the congestion happens in highly urbanized areas, and for various reasons, road capacity improvements may not be the appropriate approach to address the congestion problem. There have therefore been calls to maximize roadway capacity through an integrated and efficient system that considers both physical and operational roadway improvements.

Generally, congestion is defined from a road user's perspective, and this perception solely relies on users' experiences from traveling on roadways. These experiences differ based on the location of road users. As a result, it is somewhat challenging to define congestion. However, the Federal Highway Administration (FHWA) generally defines congestion as stopped or stop-and-go traffic. The FHWA further identifies severity, extent, and duration as the main elements of congestion. The interaction of these elements determines the effects of congestion on road users. Severity in this context is defined as the magnitude of congestion at its peak. Extent of congestion describes the geographic area or the number of affected motorists. The duration of congestion refers to the length in time that road users experience congested conditions. According to the FHWA publication, Incorporating Travel-Time Reliability into the Congestion Management Process (CMP): A Primer, published in February 2015, the primary cause of congestion are traffic incidents (25%), work zones (10%), weather (15%), special events and fluctuations in normal traffic, traffic control devices (5%) and physical bottlenecks (40%). These seven (7) major causes of congestion can be grouped into Recurring Congestion, and Non-Recurring Congestion categories as shown in Figure 1. Traffic congestion caused by random causes, such as crashes, disabled vehicles, work zones, adverse weather events, and planned special events are categorized as Non-Recurring Congestion, whereas congestion caused by predictable causes such as road capacity, ramps, lane drops, weaves, merges, or curves, is termed as Recurring Congestion.

Figure 1: FHWA Chart on Causes of Congestion



This data shows that 55 percent of roadway congestion can be attributed to non-recurring events (special events, work zones, weather and incidents) which are difficult to predict. Due to this difficulty, the FHWA relies on travel time reliability index that helps in determining the reliability of roadways. Travel time reliability index (TTI) is captured as part of the Congestion Management Process (CMP), and this enables States, Metropolitan Planning Organizations (MPOs), and all other planning stakeholders involved in the planning and programming of transportation investments to better manage congestion.

Federal requirements mandate that CMPs to be developed in all TMAs and implemented as an integrated part of the metropolitan transportation planning process. In the Capitol Region, the CMP primarily seeks to advance goals developed in ***Connect 2045***, the Metropolitan Transportation plan for the Capitol Region. Additionally, the CMP works to enhance the connection between projects identified in ***Connect 2045*** and projects that are implemented through the Transportation Improvement Program (TIP). The 2020 CMP update aims to address the congestion management needs of the Capitol Region and incorporates consistent methods to support the ***Connect 2045*** plan and ensure compliance with federal performance measures under the Fixing America's Surface Transportation (FAST) Act.

History of Congestion Management Process

The Congestion Management System (CMS) was first introduced as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and continued under the successor law, the Transportation Equity Act for the 21st Century (TEA 21). Under these laws the CMS was designed as a systematic process for state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to provide information on transportation system performance and alternative strategies to alleviate and improve mobility of people and freight. The enactment of The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005 did little to change the requirements of the CMS. However, it changed the name from "Congestion Management System" to "Congestion Management Process." The name reflected the goal of the law utilizing a process that is an integral component of metropolitan transportation planning. While the CMS was treated as a stand-alone data analysis exercise, the CMP is intended to be an on-going process, fully integrated into the metropolitan transportation planning process. The CMP reports are documents that continuously evolve to address the results of performance measures, concerns of the community, new objectives and goals of the MPO, and up to date information on congestion issues.

The passing of the Moving Ahead for Progress in the 21st Century (MAP-21) Act in 2012 maintained the existing laws related to CMPs. Under MAP-21 emphasis was placed on performance measure-based approach to decision making and the development of transportation plans. The passing of MAP-21 brought with it an improvement in the monitoring and reporting of congestion and reliability performance measures. Following MAP-21 was the Fixing America's Surface Transportation (FAST) Act of 2015. As part of its responsibilities, the FAST Act provides funding for surface transportation infrastructure and planning between 2016 and 2020. The FAST Act backs and perpetuates the overall performance management approach introduced by MAP-21.

A Final Rule effective on May 20, 2017 included the following three system performance measures; two measures to assess the reliability of system performance and one measure to assess freight movement on the Interstate system.

1. Percent of reliable person-miles traveled on the Interstate
2. Percent of reliable person-miles traveled on the non-interstate National Highway System
3. Percent of Interstate system mileage providing reliable truck travel time (Truck Travel Time Reliability Index)

These 3 performance measures are also discussed within this report.

Overview of the Hartford TMA

As a result of the 2015 Regional Planning Agency (RPA) consolidation, there have been a reduction in the number of regions from fifteen (15) to nine (9), and changes to regional boundaries including those that serve the Hartford TMA. The regional consolidation resulted in the elimination of the Central Connecticut Regional Planning Agency (CCRPA) and the Midstate Regional Planning Agency (MRPA), as well as the expansion of the remaining regional planning agencies (RPA). As a result of this consolidation, the Hartford TMA boundary comprises the Capitol Region Council of Governments (CRCOG), the Naugatuck Valley Council of Governments (NVCOG), the Lower Connecticut River Valley Council of Governments (RiverCOG), and the Northwest Hills Council of Governments (NHCOG). With the exception of the Northwest Hills Council of Governments (NHCOG), the rest of the planning agencies listed in the foregoing are all designated metropolitan planning organizations (MPOs). Indicated in Figure 2 below are all the planning regions in study area.

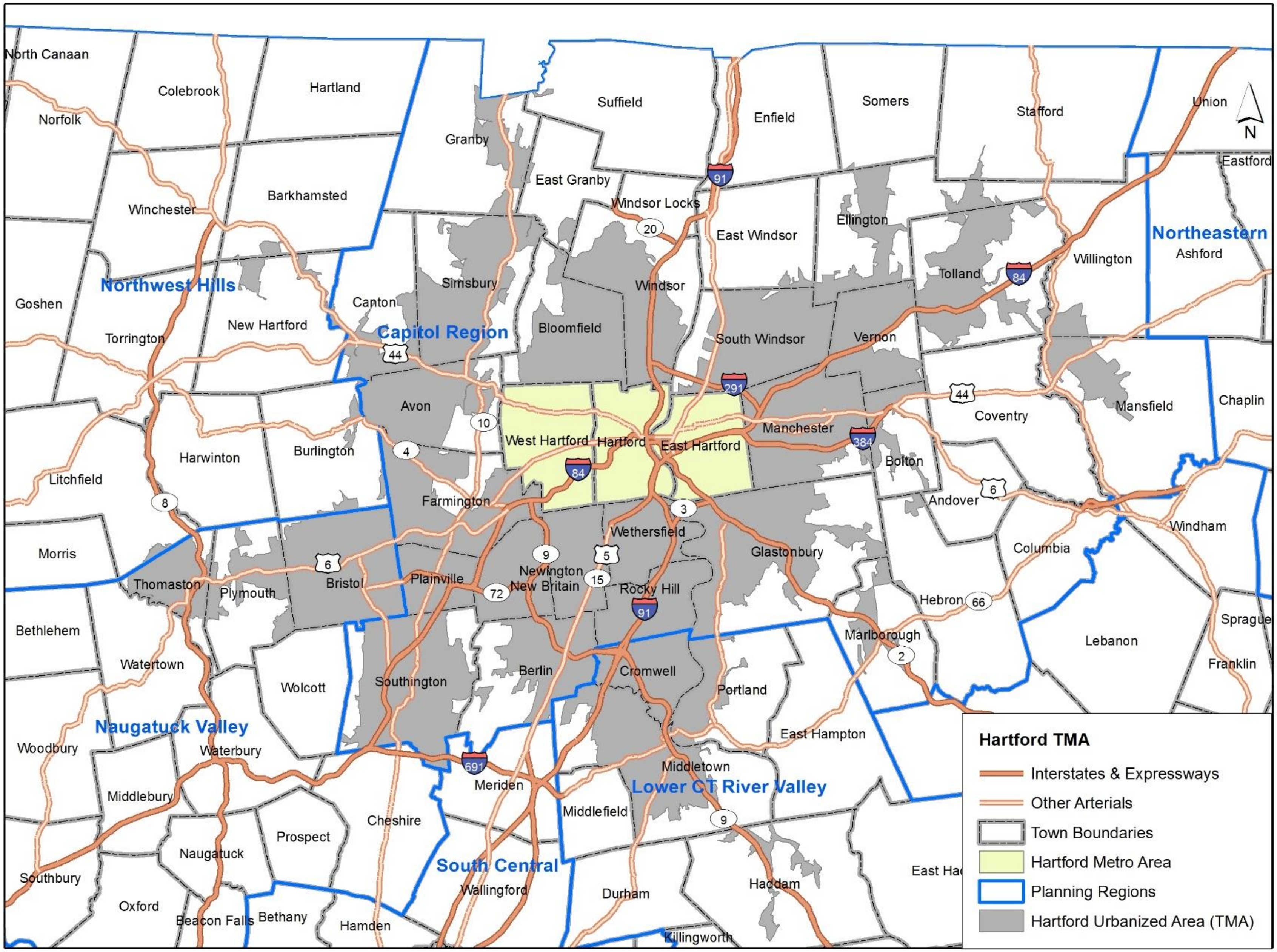
Currently, the CMP Hartford TMA extends into four (4) COGs. Current census data puts the population of the Greater Hartford area close to one million. The TMA has an extensive interstate system that includes I-84, I-91, I-291, I-384 and portion of I-691.The most heavily used interstates in the study area are I-84 and I-91. The Greater Hartford Area also has major commuting arterials including State Route Nos. 2, 4, 44, 6, 9 and 5/15 and U.S. Route Nos. 5, 6, 44 and 66. The interstates together with the major arterials carry most of the traffic in the region. These interstates also function as the major commuting routes and can be heavily congested during rush hour due to the large suburban population.

Public transportation has always been an important part of the multi-modal transportation system in the Greater Hartford Area. Bus services in the congestion monitoring corridors are primarily operated by the following providers:

- CT***transit***
- 9 Town Transit
- Middletown Area Transit
- Kelley Transit
- Northwestern CT Transit District
- New Britain Transportation Company

These bus transit operators provide both local and express services throughout the Greater Hartford Region. There are also train services provided by the Hartford Line (CT***rail***) and Amtrak, and both provide services between New Haven and Springfield (Massachusetts). Both services have stations in New Haven, Meriden, Berlin, Hartford, Windsor, Windsor Locks and Springfield (Massachusetts).

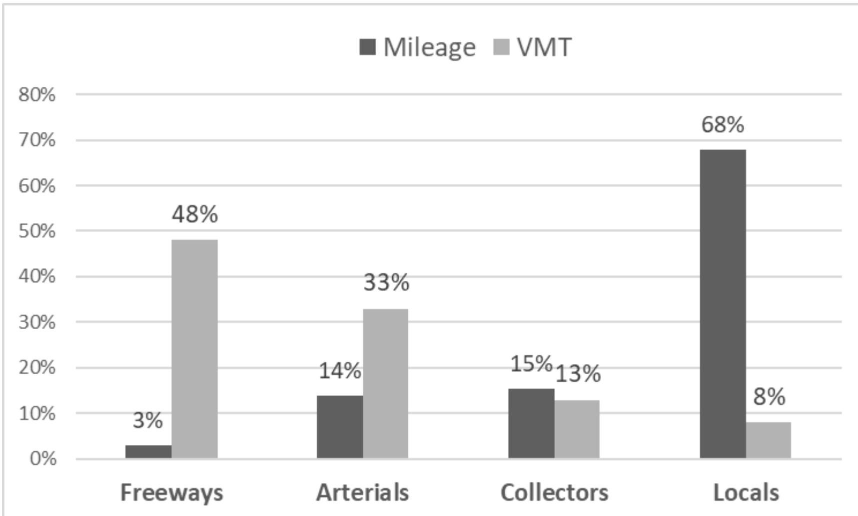
Figure 2: Planning Regions and Roadway Functional Classification in Hartford TMA



System Definition and Data Collection Techniques

The transportation congestion monitoring program is mainly focused on the study area's roadway system. This monitoring program is further subdivided into freeways and arterial routes, since the two are distinctively different in function and operation. The definitions of the systems and the data sources are described below. The goal of this project is to

Figure 3: Roadway Functional Classification in the Capitol Region



compile the data collected by FHWA's NPMRDS and use it to assess system performance. For this purpose, CRCOG has developed a program using the R programming language to compile and summarize the results. Figure 2 shows the roadway functional classification in the study area.

Freeway System

The Freeway System is defined as those roadways with limited access, grade-separated facilities and whose function is to serve longer distance trips and through traffic. As seen in Figure 3 above, based on data provided by CTDOT for the year 2019, freeways compose only 3 percent of the roadway system in the study area but carry 48 percent of the daily traffic. This number has remained constant for the past decade.

Arterial System

Arterial roadways are not limited access and generally have at-grade intersections. They typically serve a dual purpose of carrying longer distance trips, but also serve shorter trips and provide access to abutting land uses. The arterial system composes 14 percent of the roadway system while carrying 33 percent of the daily traffic.

Transit System

The transit system is the sum of local bus routes and commuter routes operated throughout the area. These transit services are provided by CT***transit***, New Britain Transportation Company and Middletown Area Transit. CT Transit is owned by the Connecticut Department of Transportation and operates in seven metropolitan areas in the state. The other two companies operate in Central Connecticut and Middletown area respectively. This report relies on performance reports from the ***CTtransit*** for additional transit data. This is expected to complement the monitoring of the highway system and provides a more comprehensive understanding of the performance of the multi-modal transportation system in the area.

Chapter 2 Development of Performance Measures

Performance Measures

A major component of the CMP is developing appropriate performance measures to effectively identify, assess, and communicate to others about congestion on the transportation network. This allows staff at the regional level to adequately assess system performance to enable them identify problem areas and communicate findings to the general public and policy makers. The use of performance measures in a CMP serves many purposes, however, the overall goal is to characterize current and future conditions on the multimodal transportation system in the region. According to FHWA's Guidebook on CMP, good performance measures should: be simple and clear to present and interpret; have the ability to describe existing conditions and predict changes; and be analytical and accurate.

Based on the criteria and data available, performance measures described in Figure 4, were selected to monitor and quantify the transportation system's performance in the Hartford Urbanized Area. These measures were classified as vehicle throughput, mobility, safety, and transit performance. The CMP includes safety performance measures because a major component of the highway delay is incident related. Crashes, disabled vehicles, and other incidents are attributed to 25 percent of the total highway congestion (FHWA). Thus, safety performance measures will help in understanding the non-recurring congestion in the area.

Figure 4: CMP Performance Measures

	Performance Measures	Definition
Vehicle Throughput	• Vehicle Miles of Travel	Total miles traveled by vehicles in a station area or segment
	• Vehicle Hours of Travel	The total time spent by all vehicles traveling through a station area or segment
Mobility	• Average Speed	Average speed of all vehicles traveling through a station area or segment
	• Delay	The total time vehicles spend traveling below the free-flow speed
	• Travel Time Index	A ratio of the average travel time during peak period or peak hours conditions versus the travel time during uncongested periods
Safety	• Crash Rate & Locations	The number of crashes per million vehicle miles traveled and locations of high crash rate
Transit	• Bus Ridership	The number of passengers using the bus services
	• Train Ridership	The number of passengers using the train services
	• Park & Ride Lots	The number of Park & Ride Lots, their usage and their locations around the metropolitan area
Transportation and Land Use Connections	• Land Use Strategies	Effective land use planning strategies to reduce total VMT and carbon emission
Non-motorized Alternatives	• Bikes & Pedestrian Programs	Utilization of available resources to encourage use of bicycle other non-motorized mode of transportation

Chapter 3 System Performance Monitoring

Hartford TMA Freeway System

Within the Hartford TMA there are about 155 route miles of freeway, including both Interstate and non-Interstate routes. Majority of the freeway falls with the Capitol Region. The freeways are the highest level in the hierarchy of roadway classes, and their importance is reflected in the disproportionately high share of traffic they serve. The Interstate routes include I-84, I-91, I-691, I-291, and I-384, and Non-Interstate routes include all, or portions of, Route 9, Route 72, Route 2, Route 3, Route 17, Route 20, Route 5-15, and Route 6.

Interstates 84 and 91. I-91 and I-84 are the two major Interstate routes in the TMA, and they carry a large volume of long-distance traffic. They are also important commuter routes. I-84 is a primary east-west route through Connecticut. West of the Hartford, it links to the Connecticut cities of Waterbury and Danbury, the Hudson River Valley in New York, and northeastern Pennsylvania. To the east, it links to I-90 (in Sturbridge, Massachusetts), which is a primary route to the Boston metropolitan area. I-91 is a primary north-south route through Connecticut. To the south, it connects to I-95 in New Haven. To the north, it connects to I-90 in Springfield, Massachusetts. It is also a primary route to destinations further north in Vermont and New Hampshire.

Radial Shaped Freeway Network. A key feature of the freeway network in the Hartford area is its radial configuration with a focus on Hartford. I-84 and I-91 intersect in downtown Hartford, and Route 2 intersects with I-84 just east of the I-84/I-91 junction. This configuration results in five key commuter routes radiating out from Hartford: I-91 to the north, I-84 to the east, Route 2 to the southeast, I-91 to the south, and I-84 to the west. Furthermore, I-291 in the northeast quadrant, Route 3 in the southeast quadrant, and Route 9 in the southwest quadrant serves the traditional city-suburb commute trips plus some suburb-suburb commute trips that must pass through the central city to reach destinations on another side of Hartford.

Traffic Volumes. Daily traffic volumes from 2018 CTDOT counts show the highest traffic volumes on the freeway system are found near the interchange between I-84 and I-91. The average daily traffic volume on I-84 in downtown Hartford exceeds 160,000. On I-91, the average daily traffic volume exceeds 155,000 near the interchange with I-84. Volumes remain high on the primary routes radiating out of downtown, with highest volumes observed during the weekday peak commute hours of 7:00 – 9:00 AM and 4:00 – 6:00 PM. Volumes within these four hours account for about 30 percent of total weekday volumes and represent the morning and afternoon peak hour time periods used in this document for assessing performance.

System Performance Measures

As in the previous congestion management efforts, three different performance measures are used to evaluate the performance of each corridor: (1) vehicle delay, (2) average speed, and (3) travel time index. Each of the performance measures were calculated utilizing these peak hours weekday commuting periods only.

Vehicle Delay. This is the time (in hours) that vehicles are delayed when traveling at rates of speed below free-flow or a determined acceptable speed. In the case of freeways, this speed is set to 60 mph. Since arterials vary so much in terms of road geometry, traffic controls, and adjacent land use, the threshold speed is set differently. It is computed separately for each segment of each route by establishing the off-peak or free-flow speed for that segment.

Average Speed. This is the average speed (in miles per hour) of all vehicles traveling on a roadway during a specified timeframe. It is calculated at both the segment and route level.

Travel Time Index. The travel time index (TTI) is a ratio of the average travel time during peak period conditions versus the travel time during off-peak periods. If the index or ratio is 1.0, it means that there is no delay during peak periods. A ratio greater than 1.0 indicates that there is delay or congestion. The amount of delay is indicated by the size of the ratio. For example, a ratio of 1.25 means that it takes 25 percent longer to travel a given distance in the corridor during the peak period than during off-peak periods.

Freeway Performance Results

To assess freeway performance, the full year weekday travel time was analyzed for the **year 2019,** using data available from the Federal Highway Administration's (FHWA's) NPMRDS program. The latest version of the NPMRDS data, compiled and produced by INRIX, since 2017, furnishes round-the-clock observations of travel time data for road segments in the data set, aggregated to time-periods (called epochs) as small as five minutes. Interstates and freeways generally have almost twenty-four-hour coverage on a regular basis, arterials trend towards slightly less frequent coverage and some important local road may have coverage in peak periods only. The main benefit of the full year data is that it provides traffic conditions throughout the year and helps minimize effects of seasonal traffic fluctuations due to weather or other non-recurring factors. Performance measures were quantified both for the entire TMA and for the defined Hartford Metro Area to help illustrate the heavy concentration of congestion within and around the City of Hartford including the Interstate 84 and 91 interchange. **Hartford Metro Area** is defined as the area within West Hartford – Hartford – East Hartford, where most of the congestion is observed.

Overview of Monitored Corridors

Figure 5 provides an overview of the corridors monitored by freeway segment, which represent over 135 miles (or 88 percent) of the 155 miles of freeway in the Hartford TMA. As in the previous monitoring cycle, all the major freeways that intersect in and around Hartford were selected during this cycle as well. Based on NPMRDS data, these freeways serve about 11,345,000 vehicle miles of travel (VMT) on a daily basis. This represents an increase of 1.4 million VMT since the last CMP dated May 23 ,2017 based on data from 2015. VMT represents the total miles traveled by vehicles on a road (calculated by multiplying the vehicles counted by the length of the segment). The Hartford Metro Area contains only 16 percent of the TMA's monitored freeway miles but serves about 21 percent of its traffic (2,373,000 VMT daily). High daily VMT and traffic volumes illustrate the critical role the freeway system plays in the Hartford Metro Area.

Figure 5: Hartford TMA Highways Daily VMT 2019

	Hartford TMA				Hartford Metro Area			
		Daily VMT				Daily VMT		
Corridor	Miles	In	Out	Total	Miles	In	Out	Total
I-84 West of I-91	22.0	1,088,172	1,071,641	2,159,813	6.7	418,295	415,320	833,615
I-91 North of I-84	19.8	1,134,832	1,132,337	2,267,169	3.0	201,929	196,409	398,337
I-91 South of I-84	17.3	1,090,547	977,231	2,067,778	2.8	145,053	144,099	289,152
I-84 East of I-91	28.9	1,248,915	1,256,947	2,505,863	4.8	307,937	311,458	619,396
Route 2	19.7	464,746	461,699	926,446	4.0	120,841	112,096	232,937
Route 9	29.0	704,219	714,076	1,418,295	0.0	-	-	-
All Corridors	135.8	5,731,431	5,613,932	11,345,363	21.3	1,194,056	1,179,381	2,373,437

Corridor Level Performance

Vehicle Delay

Total vehicle peak hours delay for each corridor is presented in Figure 6. This is the cumulative amount of delay experienced by all vehicles traveling in each corridor during the morning and afternoon weekday peak periods. Additionally, Figure 7 shows delay separately for the entire TMA and the Hartford Metro Area. Although the Hartford Metro Area comprises only about 16 percent of the total freeways miles monitored within the TMA, the total peak hours delay within this area represents over 63 percent of the total observed freeway delay, confirming the perception that most of the regional freeway congestion occurs within the Hartford Metro Area.

Figure 6: Total Peak Hours Delay

		AM Peak Hours			PM Peak Hours			Daily Peak Hours Delay			
Corridor	Miles	In	Out	Total	In	Out	Total	In	Out	Total	Per Mile
I-84 West of I-91	21.9	1,343	164	1,508	2,066	1,838	3,904	3,409	2,003	5,412	247.5
I-91 North of I-84	19.7	928	88	1,016	1,378	410	1,788	2,306	498	2,804	142.0
I-91 South of I-84	16.4	858	22	881	459	1,048	1,507	1,317	1,070	2,388	145.8
I-84 East of I-91	29.0	527	21	548	448	291	740	975	312	1,287	44.4
Route 2	19.6	455	161	616	251	330	582	707	491	1,198	61.1
Route 9	29.3	428	361	789	591	604	1,195	1,019	965	1,984	67.8
All Corridors	135.8	4,540	817	5,357	5,193	4,522	9,715	9,733	5,339	15,072	111.0

Figure 7: Total Peak Hours Delay (Hartford TMA vs. Hartford Metro Area)

	Hartford TMA					Hartford Metro Area				
		Daily Peak Hours Delay					Daily Peak Hours Delay			
Corridor	Miles	In	Out	Total	Per Mile	Miles	In	Out	Total	Per Mile
I-84 West of I-91	21.9	3,409	2,003	5,412	247.5	6.7	3,177	1,953	5,130	766.6
I-91 North of I-84	19.7	2,306	498	2,804	142.0	3.0	1,396	202	1,598	538.2
I-91 South of I-84	16.4	1,317	1,070	2,388	145.8	2.8	375	501	876	317.9
I-84 East of I-91	29.0	975	312	1,287	44.4	4.8	923	296	1,219	254.3
Route 2	19.6	707	491	1,198	61.1	4.0	448	256	704	175.0
Route 9	29.3	1,019	965	1,984	67.8	0.0	-	-	-	
All Corridors	135.8	9,733	5,339	15,072	111.0	21.2	4,160	2,690	9,527	448.7

Further review of Figures 6 and 7, results in the following conclusions:

Total Freeway Delay (15,072 hours). The total delay recorded for the entire monitored freeway network is 15,072 hours. This is the total hours of vehicle delay recorded in all six corridors segments over four peak hours of travel, two hours in the morning and two in the afternoon.

Notable Freeway Congestion. In general, as in the previous 2017 CMP Report (prepared with the data from 2015) , *I-84 West of I-91* and *I-91 North of I-84* continue to remain the most congested corridors in the region, which together account for over 55 percent of monitored freeway congestion, with 82 percent of this congestion (45 percent of all monitored freeway congestion) occurring on these segments within the Hartford Metro Area. For the past five years, however, *I-91 South of I-84* has seen a significant increase in traffic delays in the areas close to Hartford.

I-84 West of I-91 – Most Congested. As in the past, *I-84 West of I-91* remains the most congested freeway segment with 5,412 hours of total peak hours delay per day. This is about 36 percent of the total observed freeway delay of 15,072 hours. When averaged over the 21.9 miles in the corridor, this amounts to 247.5 hours per mile, which drastically increases when just the Hartford Metro Area is considered. Although only 6.7 miles out of 21.9 miles fall within the Hartford Metro Area, the total delay within this area is about 95 percent of the total peak hours delay. Motorists traveling in and out of Hartford during both morning and afternoon peak hours continue to experience long delays and travel speeds as low as 10 mph over a six-mile stretch of the freeway. The intensity of delays has worsened since the last CMP report dated 2017.

- *Inbound vs. Outbound.* Significant delay on *I-84 West of I-91* is apparent in both the inbound and outbound directions, especially during evening commute. Inbound accounts for about 3,409 hours of delay, and outbound for 2,003 hours. Most of these delays occur within the Metro Area with peripheral areas not typically experiencing significant delays.
- *AM peak vs. PM peak*. Based on the peak hour data, the total delay in the AM peak hours (1,508 hours) is less than half that in the PM peak hours (3,904 hours).

<u>I-91 North of I84 - 2nd Most Congested</u>. The second most congested freeway segment is *I-91 North of I-84* with 2,804 hours of total delay during the four defined peak hours. The total delay in this segment has increased by about 15 percent since 2015.

- *Inbound vs. Outbound*. A significantly large imbalance of delay is observed between the inbound and outbound directions. The inbound direction records more than four times the amount of delay as the outbound direction, with 2,306 hours of inbound delay compared to 498 hours for the outbound direction.
- *AM peak vs. PM peak*. In contrast to 2015 data where the delay on *I-91 North of I-84* was fairly evenly divided between morning and afternoon peak hours, with 1,243 hours occurring in the morning and 1,205 in the afternoon, 2019 data shows a growing imbalance between the two peak periods, with afternoon delays almost double that of morning peak delays (1,788 hours vs 1,016 hours). Figure 7 shows the peak hours' delay by corridors and time periods.

Figure 8: Vehicle Delay by Direction and Time Period

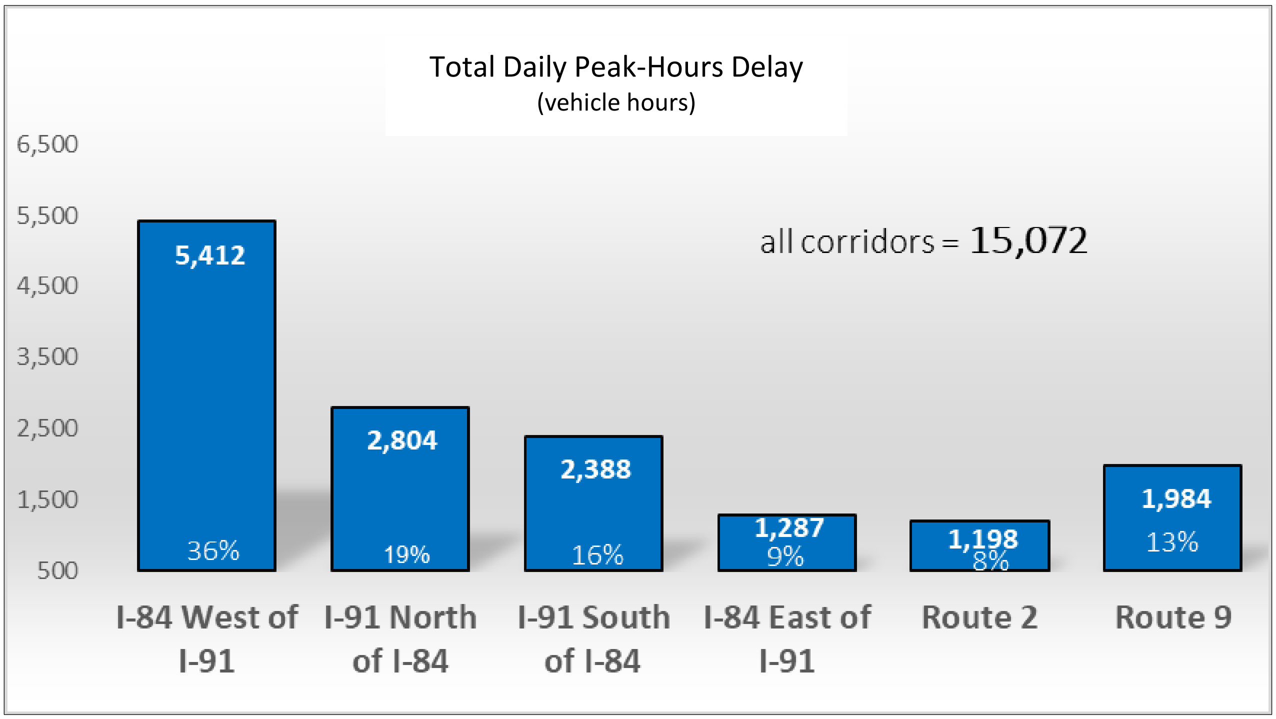
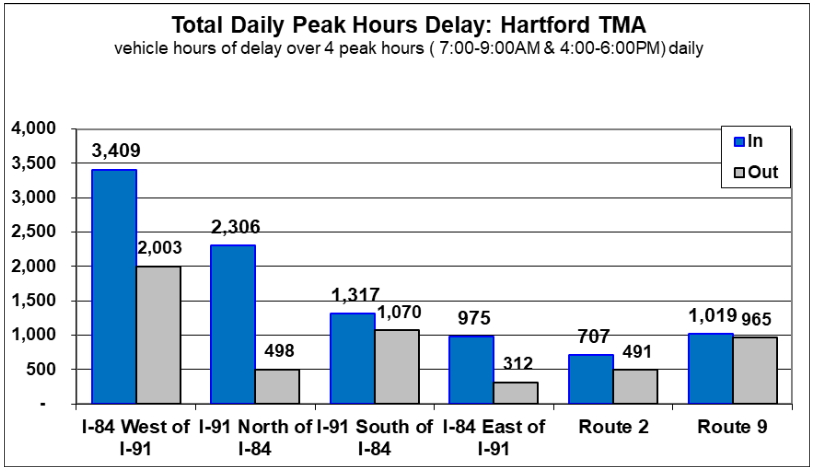


Figure 9: Total Daily Peak Hours Delay



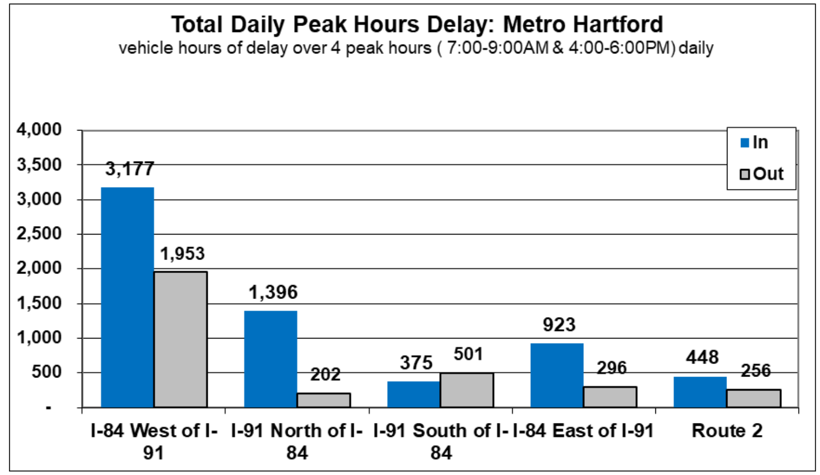
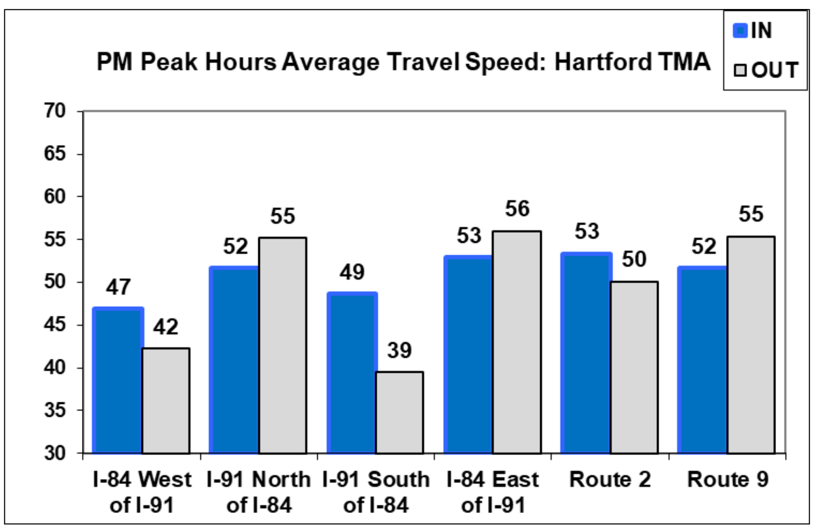
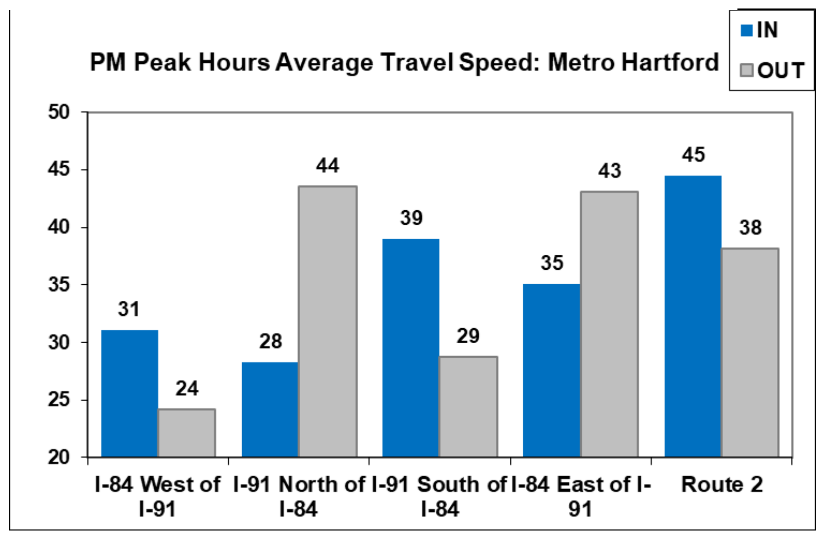


Figure 10: Afternoon Peak Hours (4:00 – 6:00PM) Travel Speed





Average Peak Hour Speed

Figures 10 through 14 illustrate peak period travel speed data on freeways within the Hartford TMA. Similar to findings in the 2017 CMP report based on data from 2015, these figures show the most substantial speed reductions occurring in and around the Hartford Metro Area, with their limits at times extending beyond the Metro Area into surrounding towns. Independent of the Hartford centered congestion, Route 9 near downtown Middletown experiences significant peak hours delays, mainly due to the traffic signal on Route 9 in Middletown.

Hartford Metro Area Traffic. In general, the data show morning congestion approaching Hartford, but almost no congestion in the outbound direction. In the afternoon, major congestion throughout the Hartford Metro Area is apparent in both the inbound and outbound directions. At times congestion also spills into other adjacent towns, most notably inbound along I-91 in southern Windsor in both peaks, and inbound on Route 2 in northern Glastonbury during the morning peak. There has been a significant increase in delays along I-91 south of Hartford. Total daily delays have almost doubled since 2015 and the average travel speed has decreased by almost 20 percent in both directions. Some segments close to the Charter Oak bridge experience significant speed drops, with average travel speeds of less than 25mph. This delay in the area can be attributed to the reconstruction of the Charter Oak bridge and surrounding interchanges.

In the morning peak, slowdowns on I-84 eastbound become most apparent near the Farmington/West Hartford line as inbound traffic from multiple commuter routes (Route Nos. 4, 6, and 9) merge with I-84 eastbound traffic. As seen on the map below, the slowdown worsens as it gets close to the I-84 and I-91 interchange. Travel speed along the eastbound direction averages between 25-40 mph, with some bottlenecks near the Route 9 interchange. On I-84 westbound, morning slowdowns appear to concentrate much closer to Hartford, backing up approximately a mile or more east of the I-91 interchange and extending through the Route 2 interchange into East Hartford. Overall, the morning westbound traffic flow is observed close to free flow speeds.

Morning slowdowns on I-91 are most problematic inbound from both directions. Southbound traffic slowdowns typically begin around the interchange with Day Hill Road in Windsor and continuing into Hartford. Northbound morning traffic slows below free-flow on I-91 entering Hartford, but typically continues moving at or above 40 miles per hour. During the morning, outbound speeds are much higher than inbound in all corridors, which reflects the inbound/outbound imbalance associated with the Hartford commute.

In the afternoon peak, significant inbound slowdowns are primarily limited to I-84 and I-91 in Harford and in southern Windsor in similar areas as in the morning peak. Outbound however, the major slowdowns are observed on all freeways radiating out from downtown Harford. These are most problematic on I-84 westbound throughout Hartford and West Hartford, and on I-91 southbound throughout Hartford. The lowest average peak-hour speeds are found on the I-84 West corridor within the Metro Area in the evening peak hours for both inbound and outbound directions. The average speed in this area drops below 25 mph in many segments with some areas experiencing speeds below 10mph. The I-91 North corridor also experiences major slowdowns in the inbound direction during evening peak hours.

Middletown. In general, the Figures 11 and 12 show a mile or more of significant morning and afternoon congestion along Route 9 in both directions in Middletown. These speed reductions are in the downtown area of Route 9 resulting primarily from the intersections and ramps with Routes 17 and 66. These include two signalized intersections and various entrance & exit ramps with substandard acceleration and deceleration lengths that interrupt Route 9's limited access operations. Outside the influence of these elements, Route 9 traffic appears to flow acceptably in both directions during each peak.

Figure 11: Morning Peak Hours Average Travel Speed

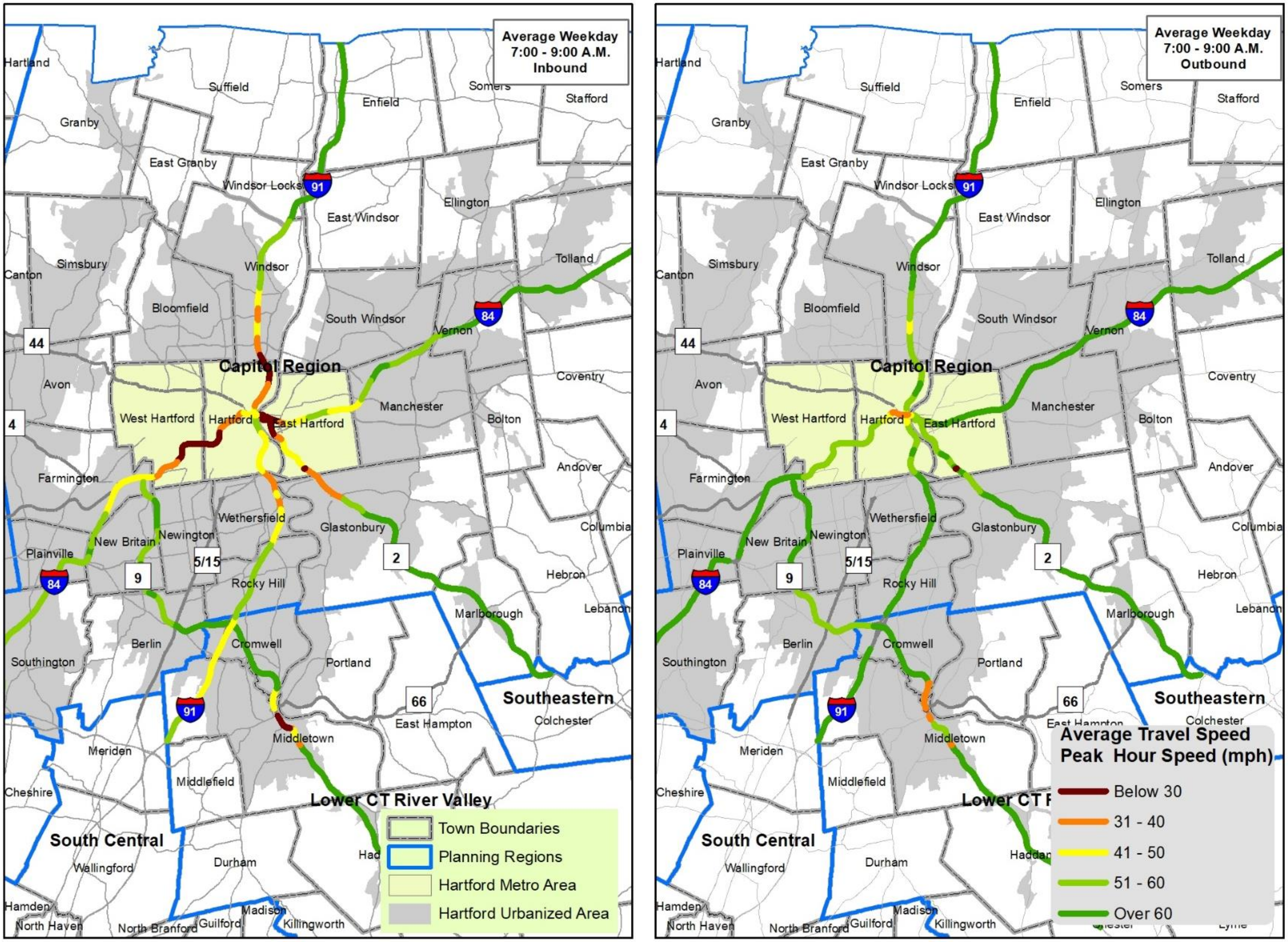


Figure 12: Afternoon Peak Hours Average Travel Speed

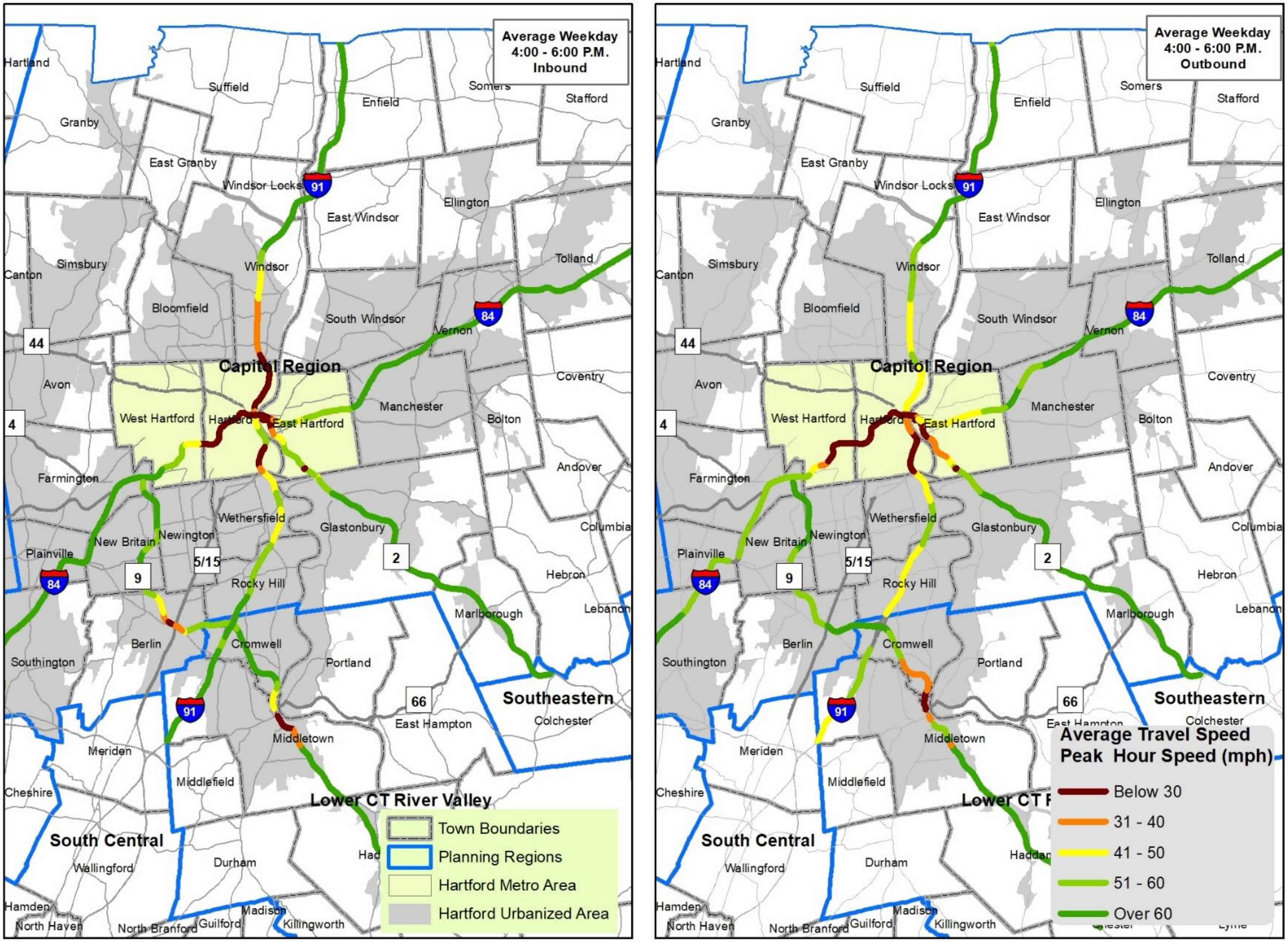
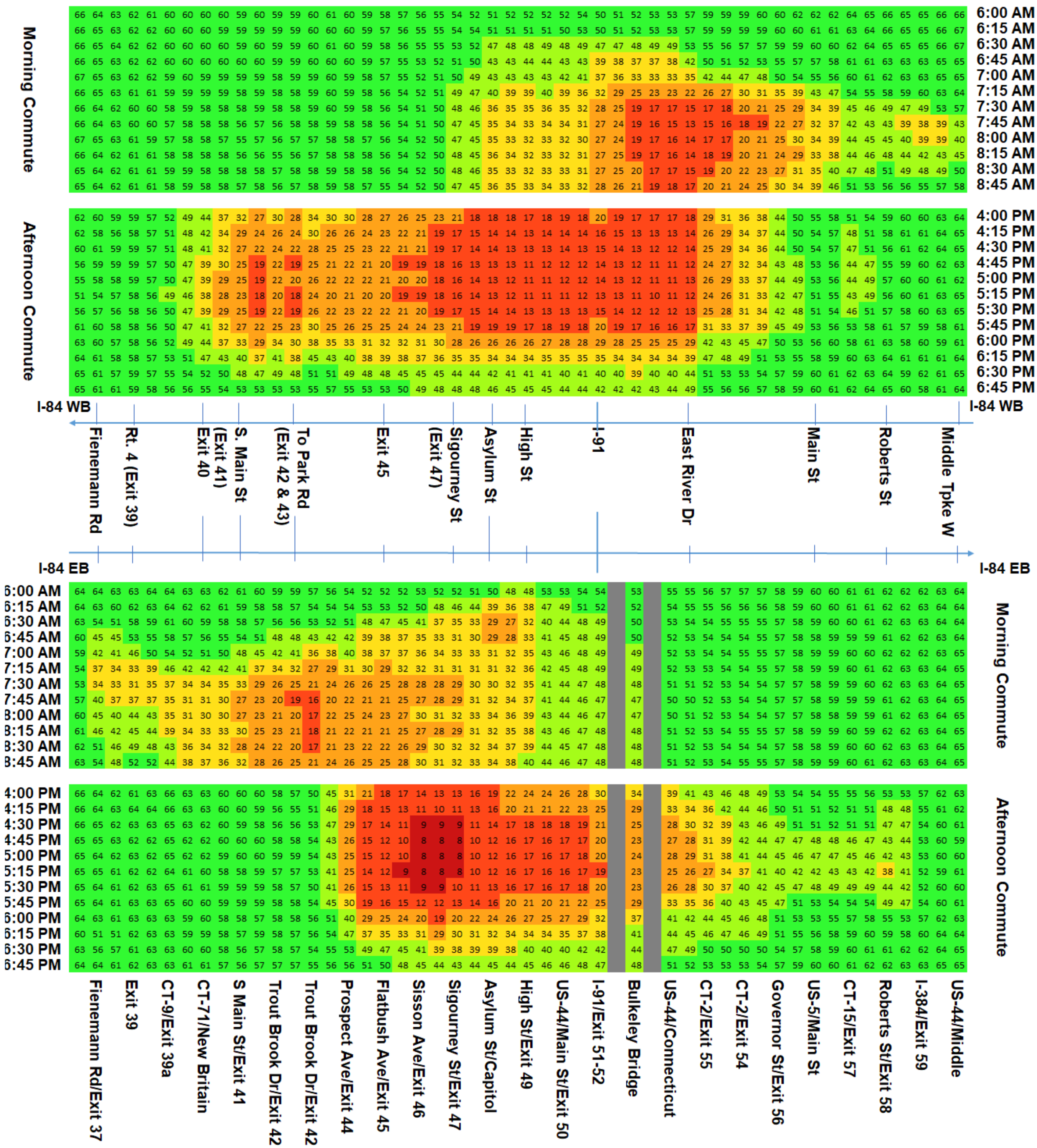
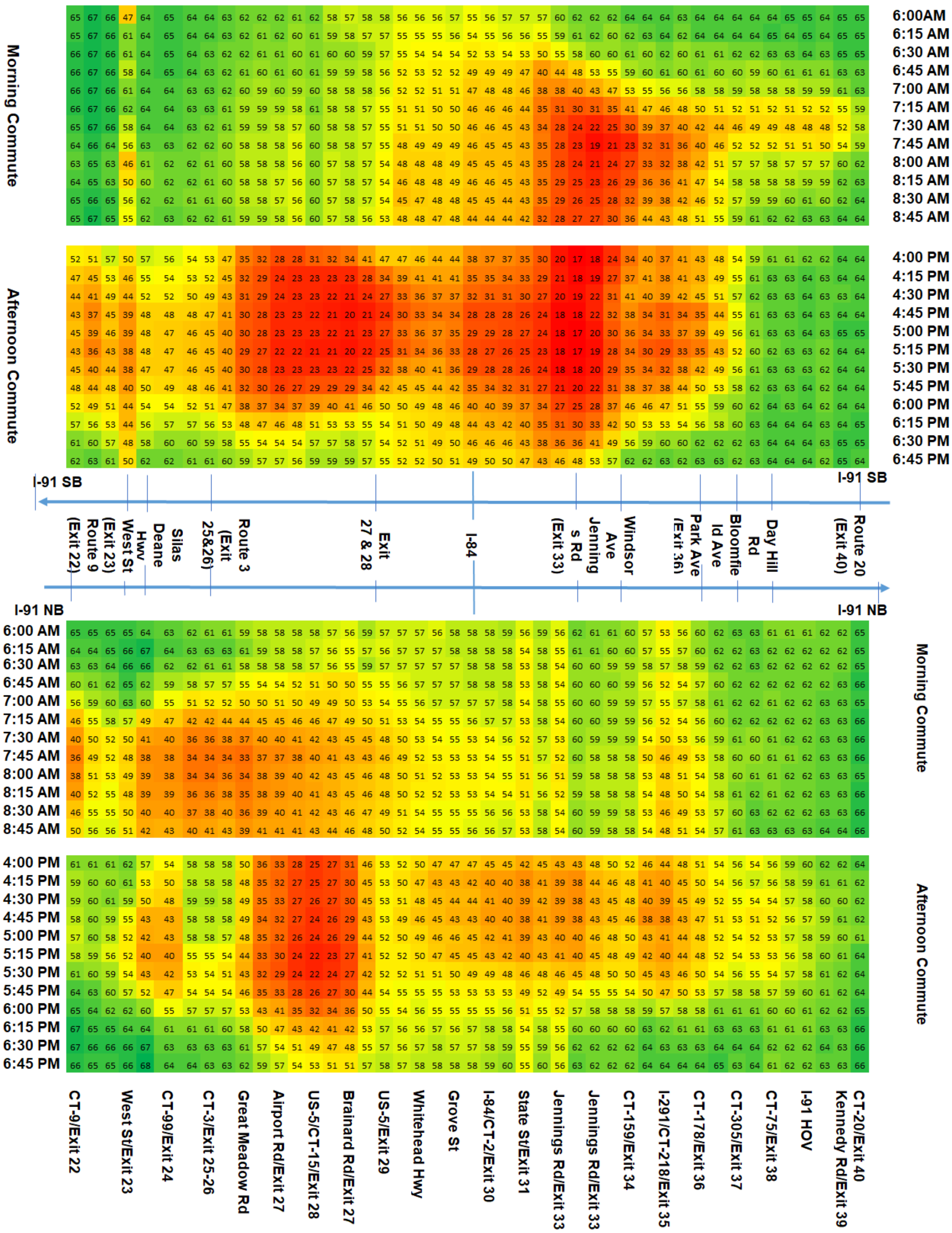


Figure 13: I-84 Morning & Afternoon Commute Speed Heat Map



Note: Numbers in each colored cell represent the average travel speed (in mph) at a particular location and time. Red colored cells indicate slow speeds, yellow cells indicate moderate speeds, and green cells indicate speeds approaching, or at, free-flow.

Figure 14: I-91 Morning & Afternoon Commute Speed Heat Map



Note: Numbers in each colored cell represent the average travel speed (in mph) at a particular location and time. Red colored cells indicate slow speeds, yellow cells indicate moderate speeds, and green cells indicate speeds approaching, or at, free-flow.

Travel Time Index

The travel time index (TTI) is a measure of the amount of extra time it takes to travel in a corridor during peak hour versus the time it takes to travel the same distance during off-peak or free-flow conditions. For purposes of this freeway analysis, the off-peak speed is assumed to be 60 mph[1]. The index is a simple ratio of peak travel time to time required to travel the same distance at an uninterrupted 60 mph. A ratio of **1.25** means that it takes **25 percent longer** to travel in the peak hour than it does in the off-peak period. The minimum ratio is set to 1.0 and means that peak period speeds are equal to or higher than 60 mph. The results are presented in Figures 15 and 16.

Figure 15: Hartford TMA PM Peak Travel Time Index

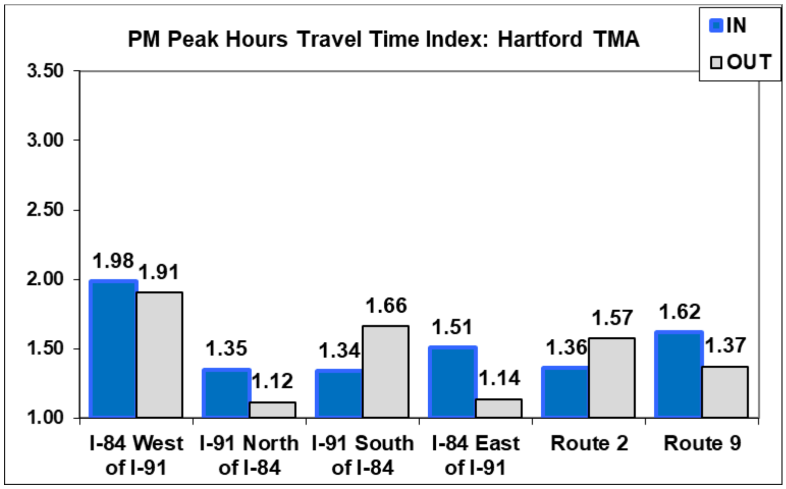
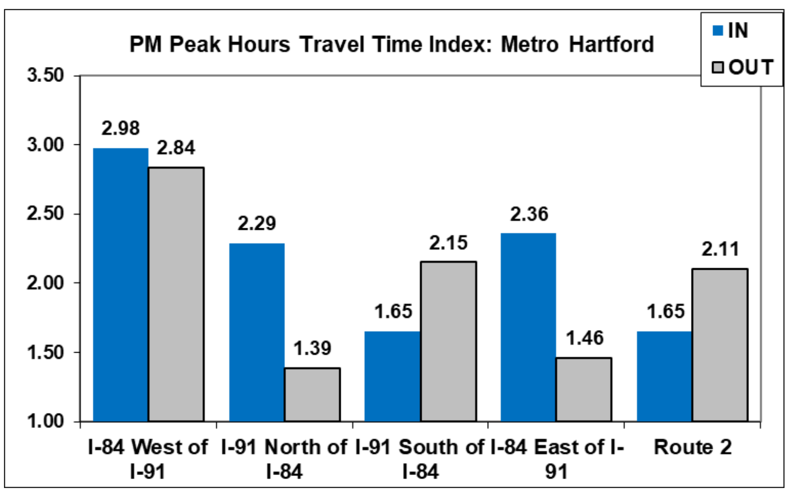


Figure 16: Hartford Metro PM Peak Travel Time Index



I-84. The highest TTIs were recorded inbound for both the AM and the PM peak in the *I-84 West of I-91* corridor. A ratio of 1.98 was recorded for the PM peak for the entire freeway segment, but it drastically increases to 2.98 within the Hartford Metro Area. Outbound within the Hartford Metro Area also has a very high TTI of 2.84 in the PM peak. Similarly, *I-84 East of I-91* corridor in the metro area has a high TTI of 2.36 during afternoon peak hours.

Other Corridors. Similar to the locations of decreased peak speeds on other corridors, higher TTIs are found mostly within the metro area in the PM peak hours for both the inbound and outbound directions. Most notable are *I-91 North of I-84* inbound and *I-91 South of I-84* outbound during the PM peak, with each being assessed a TTI of over 2.0.

In summary, these measures indicate that the corridor with the worst congestion is *I-84 West of I-91* in both the AM (inbound) and the PM (inbound and outbound) peak hours.

[1] 60 mph is the standard used by the Texas Transportation Institute in their mobility reports.

Hartford TMA Arterial System

Arterials comprise 14% (714 miles) of the total road network in the region. Arterials can be further divided into principal (245 miles) and minor (469 miles) arterials. The arterials carry almost 33% of the TMA's traffic (CTDOT 2019). Like Freeways, the total length of roadways comprises a small percentage of the regional total yet accounts for a very large share of total traffic volumes. Importantly, arterials carry major traffic flows while also filtering larger volumes of traffic from freeways down to local streets.

As mentioned earlier, the latest version of the NPMRDS data provides round-the-clock observations of travel time data for major road segments that are part of the National Highway System (NHS). Interstates and freeways generally have almost twenty-four-hour coverage on a regular basis, arterials trend towards slightly less frequent coverage and some important local roads may have coverage in peak periods only. Not every arterial was included in this analysis, owing in part to more limited data availability. Furthermore, the regional significance of arterials was taken into consideration as well as a desire to include important routes from all parts of the CRCOG region and Hartford TMA.

Figure 17: CMP Monitored Arterials

Arterial Routes	Description of Extent	Length **(miles)**
CT RT 4	Harwinton to I-84 Farmington	16.3
US RT 5	Meriden Town Line to Massachusetts	35.2
US RT 6	West: RT 8 to I-84 East: I-384 to Mansfield Town Line	31.0
CT RT 15	I-91 to I-84	1.4
US RT 44 West of Hartford	RT 318 in Barkhamsted to Hartford Town Line	28.0
CT RT 66	I-91 to RT 6	34.5
Total		146.4

Arterial Performance Results

Similar to freeway analysis, INRIX NPMRDS data aggregated up to fifteen-minute intervals for all weekdays in 2019 was used in this analysis. This year-round travel time data coverage was then further aggregated (by averaging) up to morning and evening peak hours for each weekday. Travel time indices, speed, VMT, and ultimately delay was calculated using this data, along with other accompanying reference data on segment attributes for these routes.

Overview of Monitored Corridors

Traffic on arterials is usually slower and more prone to excessive relative delay compared to limited-access freeways .Although the total traffic volume is less, delay as measured by deviations from a "reference" travel time can still be considerable on arterials, especially in certain areas – such as town centers. As can be seen in Figure 18, the average arterial speed is 33 mph, while the total delay is 2,257 hours. The travel time index (TTI) varies from 1.01 to 1.57 among the routes and peak periods segments chosen, with an overall average of 1.16. Generally speaking, the PM peak sees more congestion than the AM peak.

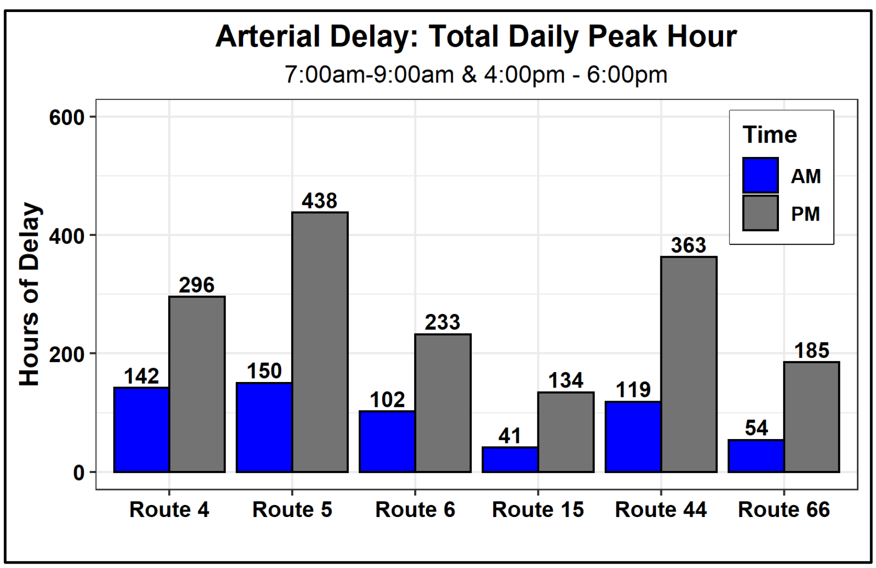
Figure 18: Arterial Summary

Arterial Routes	Length (miles)	Average Travel Speed			VMT	Total Delay (hours)			Average TTI		
		AM	PM	Both	Total	AM	PM	Both	AM	PM	Both
RT-4	16.3	30	29	29	42,758	142	296	438	1.16	1.23	1.20
RT-5	35.2	34	32	33	224,130	150	438	588	1.03	1.14	1.09
RT-6	31.0	36	35	35	115,073	102	233	335	1.03	1.10	1.07
RT-15	1.4	52	40	46	59,998	41	134	176	1.18	1.57	1.37
RT-44	28.0	25	23	24	86,475	119	363	482	1.07	1.26	1.17
RT-66	34.5	33	31	32	100,821	54	185	239	1.01	1.09	1.05
Total	146.0	35	31	33	629,255	608	1,649	2,257	1.08	1.23	1.16

Corridor-Level Performance

Delay data are summarized at the corridor level in Figures 18-20. Delay has been calculated for both directions of travel, which depending on the arterial road segment's location around Hartford, are designated as either in- or outbound. Inbound segments along these corridors would usually see more congestion during the AM Peak whereas the outbound segments would have greater congestion in the PM peak.

Figure 19: Arterial Total Daily Peak Hours Delay



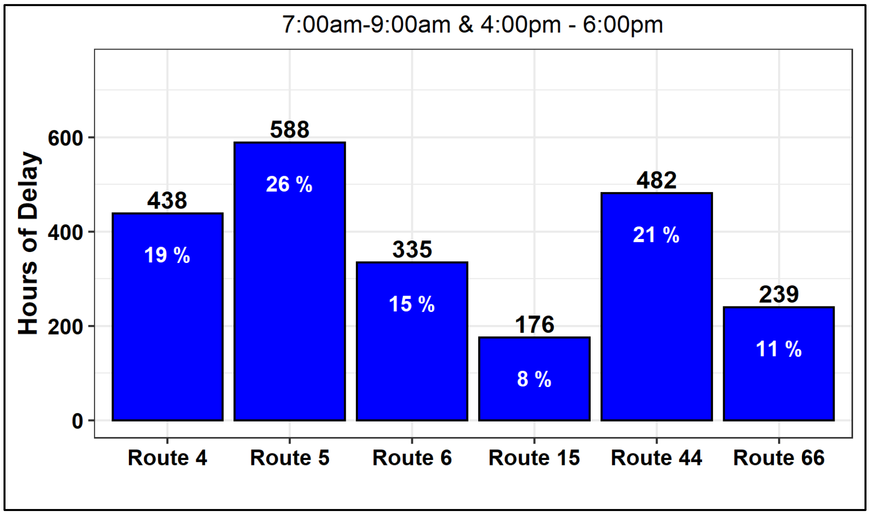
Route 4

The section of Route 4 analyzed in this report extends from the Harwinton town line to I-84 in Farmington, passing through the built-up areas of the downtown Burlington and Unionville (Farmington), and Farmington Center. From Unionville to the UCONN Health Center, there is significant congestion, especially going from the intersection with Route 10 uphill and towards the east, the outbound portion of which is the most congested arterial segment in this study at 185 hours of delay. Despite this fact, Route 4 as a whole is no longer the most congested of the arterials.

Route 5/15

The Route 5 corridor extends from the Meriden town line in the South to the Massachusetts border in the North. The segment south of Hartford runs through Berlin and Newington, then briefly becomes Route 15 (a 1.4-mile freeway facility) in northern Wethersfield where it merges and then diverges from I-91 to join with I-84 in East Hartford. The northern segment of Route 5 begins at the end of the Exit 90 ramp from Route 15 and runs north through East Hartford, South Windsor, East Windsor, and Enfield. Combined, the north and south sections are over 35 miles long and contain the most delay of all the arterials in this report at 588 hours of delay, 35% of which is located on the northern section vs. 65% on the southern section, particularly near Route 9.

Figure 20: Arterials Daily Peak Hours Delay



Route 6

Route 6 is split into two unconnected sections, one West of Hartford running from Route 8 to the Hartford town line and one East of Hartford running from the end of I-384 to the Mansfield town line. Towns along the western section include Plymouth, Bristol, and Farmington, while the eastern section includes Bolton, Andover, Columbia, Coventry, Mansfield, and briefly Windham. Together, both sections of Route 6 have 335 hours of delay, with the western section being the site of 83% of the total delay and the eastern section being 17%. The most congested eastern segments are found in Andover and Columbia while the most congested western segments are found in Farmington, at 38 hours of delay.

Route 44

The section of Route 44 runs from Route 318 in Barkhamsted, through New Hartford, Canton, Avon, West Hartford, and into Downtown Hartford. The Route 44 corridor contains several important business districts and thus sees significant congestion in places, with the most delay found in Avon. Much of Route 44 experiences delay, which leads to it having the second highest delay of the corridors in this analysis.

Route 66

The Route 66 section is situated to the southeast of Hartford and runs from I-91 through Meriden, Middlefield, Middletown, Portland, East Haddam, Marlborough, and Hebron to

Route 6 in Columbia. For the purposes of this report, lanes heading west towards I-91 were considered inbound and lanes heading East towards Route 6 were considered outbound. Segments of Route 66 on the west side of downtown Middletown are the most congested of the whole corridor. Parts of Route 66 near Route 2 in Marlborough are also congested.

Average Speed

Speed measurements of road segments produce statistics that can appear quite different from other measures. Roadway geometry and the concentration of congestion at specific locations play important roles, with the design geometry being key. Geometry includes width, path curvature, and slope of the roadway all of which influence operational speeds, regardless of the traffic volume at any given time.

Figure 21: Arterials Average AM & PM Peak Hours Speed

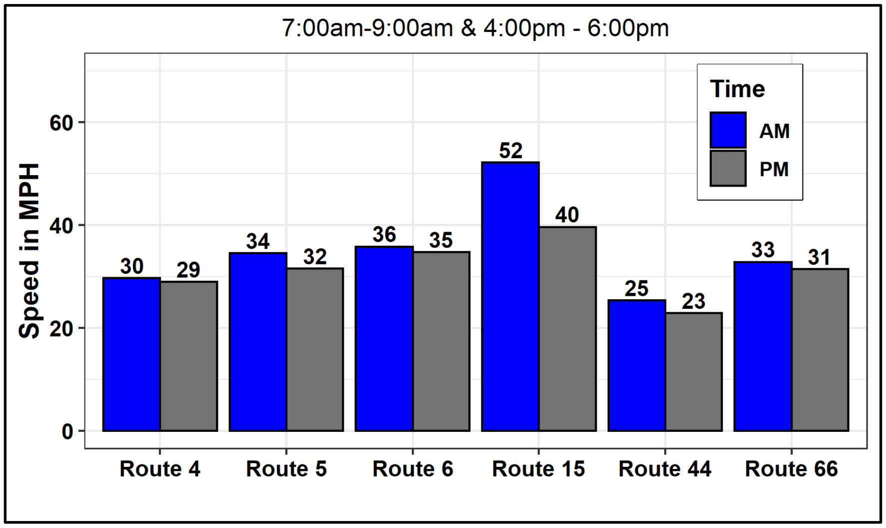
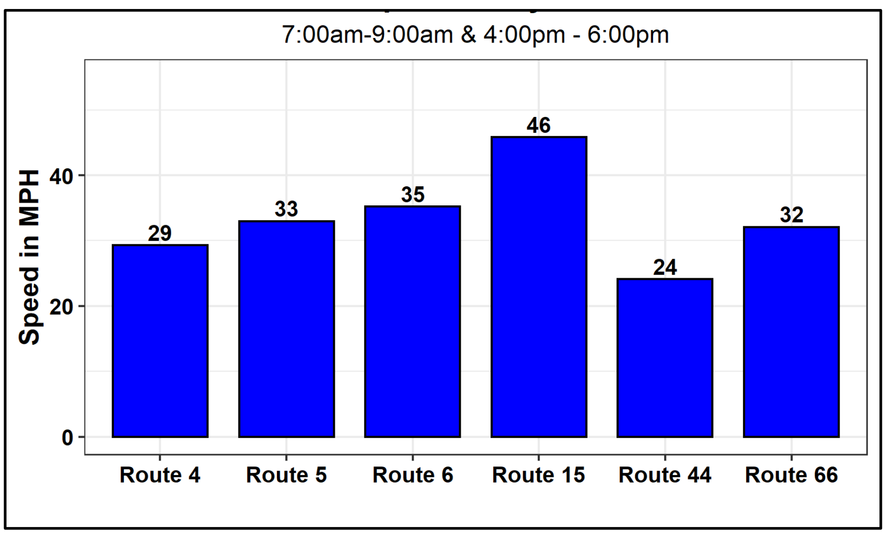


Figure 22: Arterials Average Daily Peak Hours Speed



Figures 21 and 22 show average speeds for all arterials differentiated by morning and evening peak periods as well as averages of daily peak hours. Of note are the slower speeds seen for Route 44 even though it is not the most congested corridor as well as the higher speeds for the small stretch of Route 15, which is a freeway facility.

Figure 25 and 26 show maps of average travel speed during morning and afternoon peak hours along the arterials in the region. The maps do not compare the peak hours speed against the posted speed limits. It is just the representation of average travel conditions during the peak hours.

Travel Time Index

Travel time index (TTI) tends to more closely reflect measures of congestion such as hours of delay as it compares congested travel time to off peak travel. Route 15 and Route 44 see far longer drive times in peak periods than other arterials in this report. It is also worth noting again that worse drive times are usually experienced in the PM Peak. This is indicative of more varied start times for work in the morning versus more uniform work end times in the evening. Additionally, people may run errands or make other trips after work and not return home directly, thereby adding to the congestion experienced at the end of the workday. Also, Route 15 is a principal commuter route that parallels I-91 south of Hartford; and Route 44 is located in some of the most densely developed urban areas and it also serves a major route to sub urban in the region. In addition to traffic volume, construction activity, vehicular crashes, frequent bad weather, sun glare, and traffic signals at intersections, among others, can add to travel time.

Figure 23: Average AM & PM Peak Hours Travel Time Index (TTI)

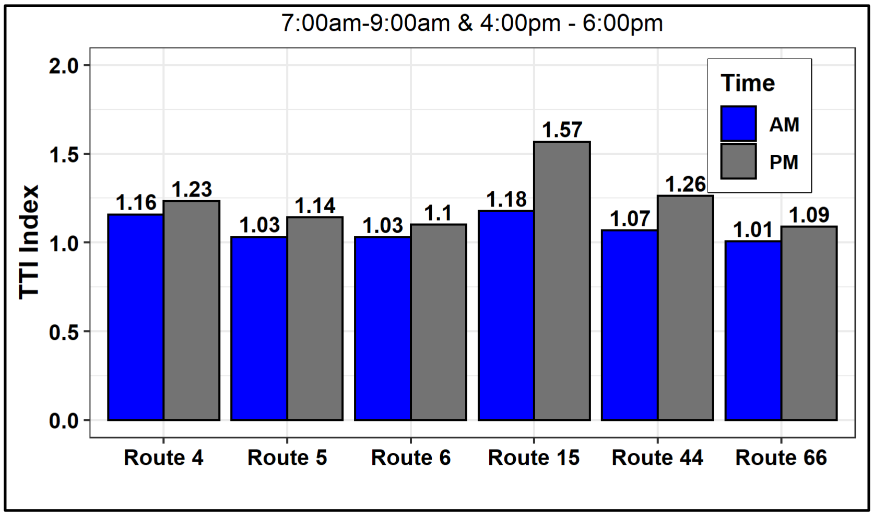


Figure 24: Average Daily Peak Hours Travel Time Index (TTI)

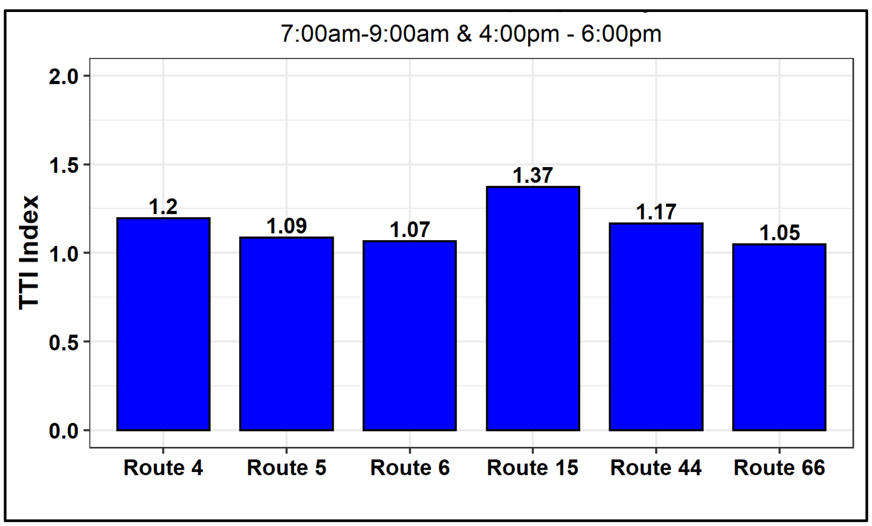


Figure 25: Arterial Morning Peak Hours Average Travel Speed

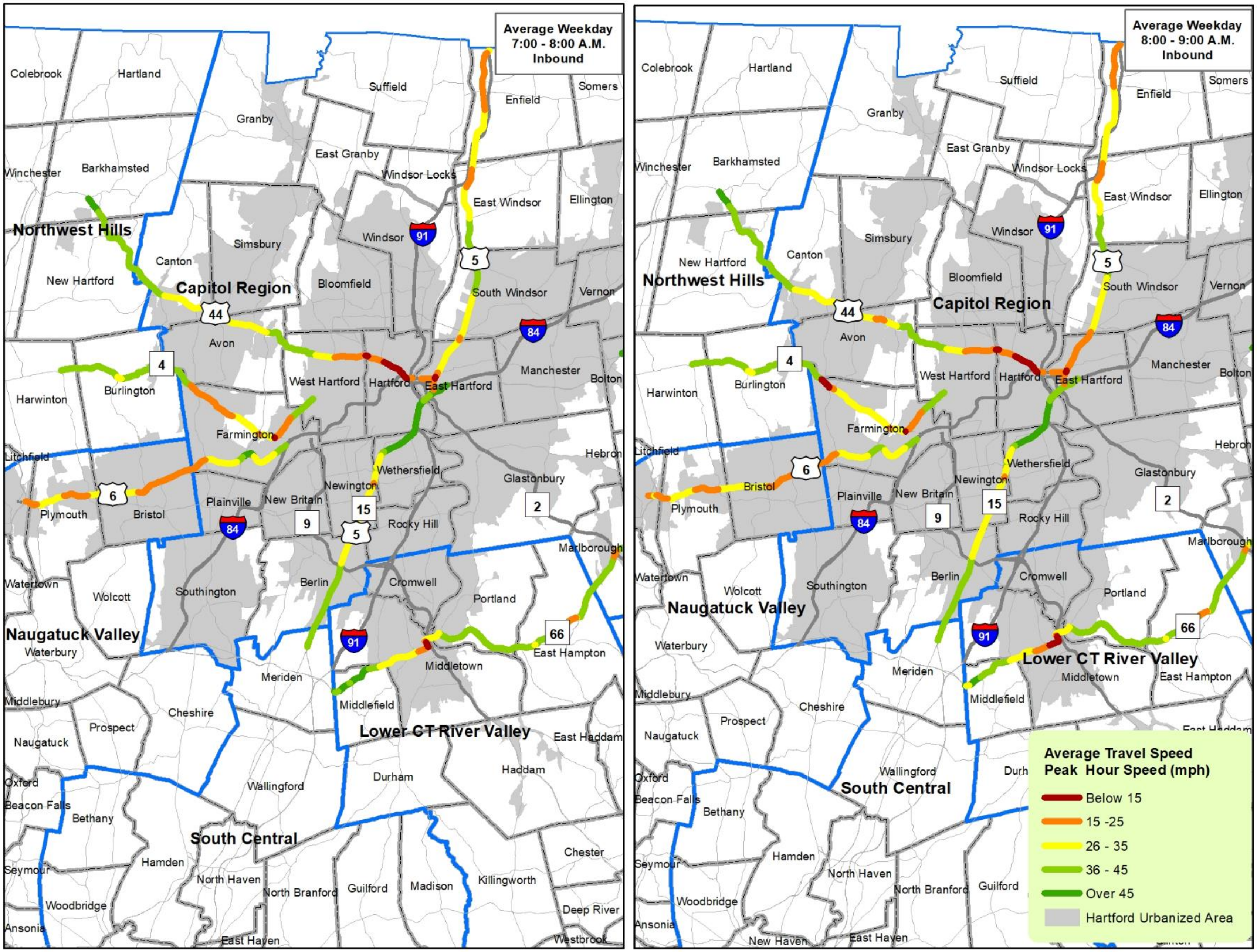
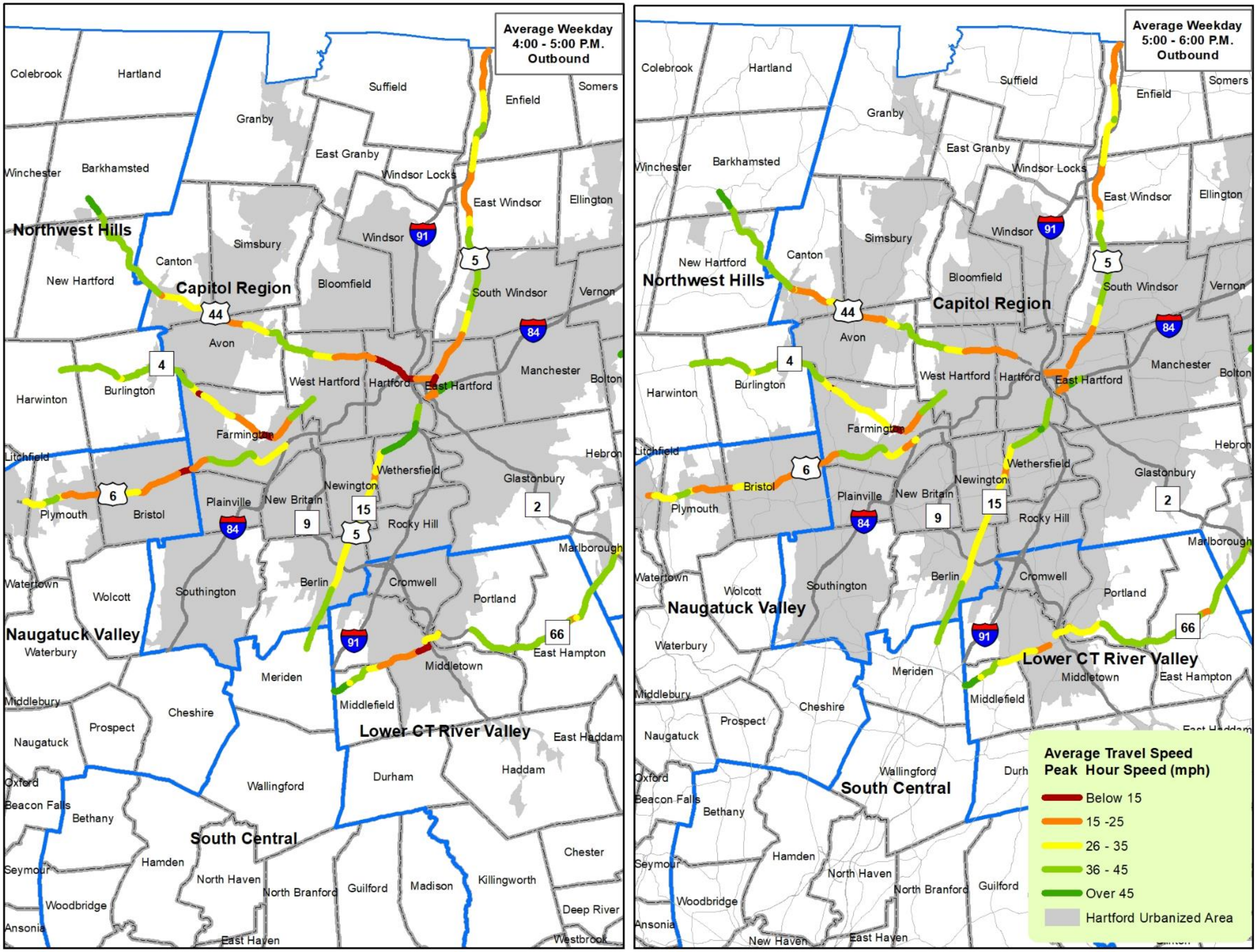


Figure 26: Arterial Afternoon Peak Hours Average Travel Speed



Federal Performance Measures: Level of Travel Time Reliability (LOTTR) and Truck Travel Time Reliability (TTTR)

The Fixing America's Surface Transportation Act or "FAST Act" of 2015 established a series of transportation system performance measures. The regulatory implementation of the FAST Act is found in Title 23 of the Code of Federal Regulations Section Part 490 (23 CFR Part 490), which details several transportation performances measures in the areas of safety, infrastructure, and the broad category of system performance. Subparts E and F (23 CFR Part 490 Subparts E & F) cover the overall performance of the national highway system (NHS) and the specific performance of freight vehicles on the NHS, respectively. These performance measures are used to create performance targets, which are used to evaluate the system at regular intervals of 4 years. The specific measure for overall system performance is the level of travel time reliability (LOTTR) whereas the measure for freight performance on the NHS is the truck travel time reliability (TTTR) index.

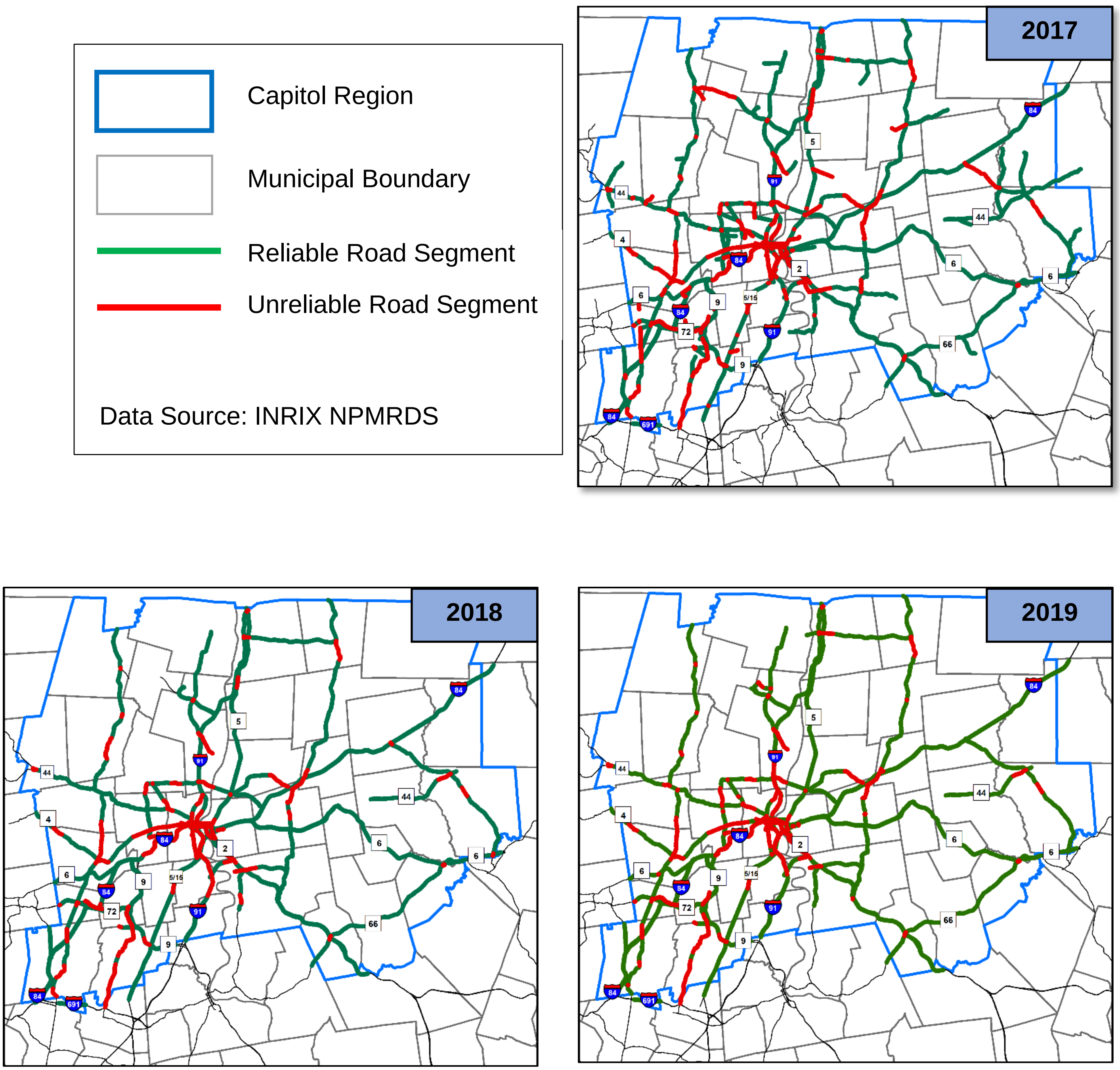
Like measures of hours of delay, speed, and travel time index (TTI) used in the CMP statistics, the LOTTR and TTTR are derived and calculated from the INRIX NPMRDS travel time data. They are calculated in a different manner than the CMP statistics and reflect different characteristics of the NHS. Whereas the CMP measures only included weekday observations from 7:00am to 9:00am (AM Peak) and 4:00pm to 6:00pm (PM Peak), the LOTTR and TTTR are far more comprehensive measures of performance across all times of the day, including weekends. The LOTTR is calculated using daily weekday observations from the morning from 6:00am to 10:00am, midday from 10:00 to 4:00pm, evenings from 4:00pm-8:00pm, weekends from 6:00am to 8:00pm; and additionally, the TTTR calculation includes overnight periods from 8:00pm to 6:00am.

For LOTTR, all observations within a given time of day period are arranged in rank order and the 50th and 85th percentiles of travel time taken for each traffic message channel (TMC) or road segment. The ratio of these two percentiles then gives the LOTTR for that time period, with the highest LOTTR from the morning, midday, evening, and weekend time periods becoming the reported LOTTR for that TMC. If the LOTTR is greater than 1.5, the TMC is then deemed unreliable. The LOTTR measure is ultimately the sum of person miles from reliable TMC divided by the person miles of all segments. For TTTR, all observations within a given time of day period are arranged in rank order and the 50th and 95th percentiles of travel time taken for each TMC. The ratio of these two percentiles then gives the TTTR for that time period. In contrast to the LOTTR, the highest of the TTTRs for the time periods is taken and multiplied by the length of the TMC. The length weighted TTTR score strikes a balance with the potentially opposing scenario where a short but highly congested segment would appear less important than a long but lightly congested segment. The ratio of the sum of length-weighted TTTR scores over the simple sum of segment lengths gives the overall TTTR performance measure.

One important consideration of using the NPMRDS data for a given year is the changing definition of the number and extent of the TMCs (segments) in the data set.

The NHS as a real-life, physical system of infrastructure changes very little from year to year, but which road segments are considered officially part of it for the purposes of this data source can indeed change. Furthermore, the length of individual TMCs can change from one year to the next. A consortium of state and federal agencies in collaboration with several private industry entities make these decisions and thus the “road layer” can change from year to year. For example, in the CRCOG region, several spurs from major highways present in the 2017 data set were dropped in subsequent years, whereas subsequent years sought to fully include HOV and inbound interstate lanes north and east of Hartford (Figure 27). Thus, for the sake of accuracy, performance measures for a given year must be calculated using that year’s road layer.

Figure 27: Level of Travel Time Reliability (LOTTR)



Trends in Performance Measures

This section compares travel time reliability from 2017 to 2019. When comparing performance measures, several variables become important in the calculation of the measures besides respective travel time. The number of TMCs and their individual along a corridor can be different from year to year. This greatly complicates direct one-to-one comparisons of TMC level performance across years. Thus, it is better to compare the relative performance at the system level than the performance of individual TMCs in order to produce a comparative analysis in which each year's calculations are separate and internally consistent. Fortunately, the federal performance measures are system-level measures that are already internally consistent and report their findings in percentages of a total. Although, changes in the number of TMCs as well as TMC length can affect results, this was somewhat mitigated by limiting the system comparison to a set of TMCs common to 2017, 2018, 2019. This common list of TMCs was then used to filter the datasets for each year down to more comparable individual sets. Analyzing the system-level measures from these three reduced datasets gives relative performance results that are less affected by changes in TMC length and number between years. It should be noted that results from the common TMC set will differ slightly from those derived from the standalone yearly datasets used in official performance measure reporting, but which are less comparable.

Figure 28 presents the measures for each year calculated from the corresponding yearly road layer. LOTTR is the percentage of person-miles from reliable segments over the total number of person miles. At the state level reliability of the Interstate system has been steady for all three years, although it has fluctuated in the case of non-Interstates. CRCOG has seen declining performance in both categories.

Figure 28: Federal Performance Measures

			CT Statewide			CRCOG		
Measures	System	Measure	2017	2018	2019	2017	2018	2019
NHS LOTTR	Interstates (statutory)	Percent Reliable	77.91%	76.81%	79.78%	86.77%	85.09%	83.55%
		Percent Unreliable	22.09%	23.19%	19.02%	13.23%	14.91%	16.42%
	Non-Interstates (statutory)	Percent Reliable	86.56%	87.60%	82.71%	87.16%	89.47%	83.05%
		Percent Unreliable	13.44%	12.40%	15.32%	12.84%	10.53%	15.15%

TTTR reflects the performance of the NHS from the point of view of freight vehicles. TTTR for Interstates increased both at the state level and in CRCOG from 2017 to 2018 but settled somewhat in 2019. The large increase in CRCOG was due in part to the inclusion of more inbound NHS segments into Hartford that would likely experience congestion during the workday. TTTR on non-Interstate NHS decreased sharply in the three-year period, owing in part again to changes in the road layer where some highway spurs were dropped from the data set. Additionally, several delay-inducing construction projects were completed.

Figure 29: Freight Travel Time Reliability

			CT Statewide			CRCOG		
Measures	System	Metric	2017	2018	2019	2017	2018	2019
NHS TTTR	Interstates (statutory)	TTTR Index	1.78	1.81	1.85	1.83	1.86	1.7
	Non-Interstates (non-statutory)	TTTR Index	2.31	2.28	1.93	2.34	2.32	2.06

Relationship between Performance Measures and CMP Measures

The Federal performance measures of LOTTR and TTTR fundamentally measure what are considered usual conditions on the NHS. Thus, as a road segment sees consistently slow traffic, this will not be reflected as urgent in the performance measures, even though in the realm of CMP measures the same segment could be seeing considerable hours of delay as well as speed reductions. The CMP measures of hours of delay and speed are much more absolute measures in this regard, but suffer from the shortcoming that they flag conditions that will almost inevitably occur when people, jobs, and traffic flow converge into a limited space in and around built up urban areas anyway. The approaches are complimentary, because simply put, the CMP measures point out how bad congestion is in real terms whereas the Federal performances measures of LOTTR and TTTR can indicate whether or not this would be expected for a given segment. Furthermore, while the CMP only examines a limited number of corridors of major Interstates and Arterials for a small number of hours of the day, the LOTTR and TTTR have far greater coverage both in terms of roadways included (the whole NHS) and times periods for the data observations.

Chapter 4 Congestion Trend Analysis

The trend analysis section consists of four parts: a brief discussion of the datasets used and their associated challenges, a discussion of trends on freeways, a discussion of trends on arterials, and finally a conclusion. *The Tables, Charts, and Maps should be closely consulted as the text will mostly not repeat or describe the data contained within them.*

Congestion Trends in the Hartford Metropolitan Area

The Urban Mobility Report published by The Texas A&M Transportation Institute (TTI) is a major source of historical and current analysis and statistics for roadway congestion in urban areas of the United States. The 2019 Urban Mobility Report gives a detailed description of congestion conditions in 494 urban areas across the United States. Summaries from the 2019 report indicates that the challenges presented by congestion is continuously growing.

The Capitol Region has 156 miles of freeways, and this represents only three percent of the total road miles in the region. However, the freeways accommodate close to one-half of the total vehicle miles traveled (VMT). Over the years the region has experienced a substantial amount of freeway congestion, and this has primarily been concentrated around the Hartford Area. Additionally, ***Connect 2045*** indicates that freeway congestion for both freight and commuters is likely to worsen. This can partially be attributed to the significant number auto commuters in the Hartford Metropolitan Area, which is defined by the Town boundaries of Hartford, West Hartford, and East Harford, as indicated in Figure 30.

The growth in auto commuters in the Hartford area over the years have contributed to the increase in the daily vehicle miles traveled (VMT) on freeways (Figure 2). As studies have shown, increased VMT has a direct correlation with congestion. Based on auto commuters and freeway daily vehicle miles of travel trends in the Hartford area, it is not surprising that travelers in the Hartford area are experiencing significant levels of congestion.

Associated with congestion is commuter delays, wasted hours and increased fuel consumption. As indicated by the Urban Mobility Report (2019), congestion at the national level as estimated by every measure has significantly increased over the last 36 years. Congestion measures in the Hartford area mimic the national trend. As stated earlier, traffic problems as measured by per-commuter measures have worsened over the years. The Hartford area has seen an increase in auto commuters, delay per auto commuter and an increase in total delay, as well as an increase in annual congestion cost (Figure 2). The effects of roadway congestion manifest in many different ways. Some of which include wasted fuel, an increase in fuel consumption, reduced safety, lost economic productivity, diminished quality of life, poor air quality, slowed emergency response, decreased system reliability and increased spending on infrastructure.

Figure 30: Congestion Trends in Hartford Metropolitan Area

Year	Auto Commuters (thousands)	Freeway Daily Vehicle Miles of Travel (VMT) (thousands)	Hours of Delay (per year)		Annual Congestion Costs	
			Per Commuter	**Total Delay**	**National ($billions)**	**Hartford ($millions)**
1982	295	4,790	9	3,213	15	27
1987	319	6,480	14	5,617	24	54
1992	349	8,315	25	10,443	39	121
1997	378	9,185	30	13,306	60	175
2002	417	10,360	36	17,440	86	257
2007	440	10,840	42	21,962	121	392
2012	450	10,545	48	25,017	150	489
2017	447	11,328	50	27,436	179	557

Source: TTI, 2019

Challenges of Comparing Three Years of Data

In 2017, the original version of the National Performance Measurement Research Data Set (NPMRDS), produced by HERE, was replaced by the second version of NPMRDS produced by INRIX. There are currently three years of high-quality travel time data available for analysis. One feature of the NPMRDS data is that travel time observations are tied to specifically defined road segments, which should all be part of the National Highway System (NHS). From year to year, different segments may be added or dropped from this dataset for a variety of reasons. Furthermore, the length of segments as present in the data set can be changed. Beginning in 2019, there were significant revisions to the length of these segments, although in aggregate the overall system length within the data set did not change significantly. Thus, the network of road segments that are an integral part of the INRIX NPMRDS dataset is never the same from year to year, meaning that direct comparison of delay cannot be made between the years, even when the analysis is limited to only those segments which were present in all three years: 2017, 2018, and 2019. However, each of the three years' data provide valuable information about the system performance in relative terms for each year.

The results for peak hours delay are presented as percentages of the total morning and afternoon peak hours delay for the freeway and arterial system respectively for the year in which the data is calculated. This ensures that the results are internally consistent and not influence by changes in network data, observational methods, or other supplementary data from year to year. Thus, the relative share of delay of a corridor vs the system total (either for freeways or arterials) can be compared across years. Also, speed and travel time index results are given for arterials. The results discussed below should be understood with the following important caveats:

- The 2019 results compared to 2017 and 2018 results differ somewhat from the 2019 results presented in the previous sections of this report. This is because in order to make a more meaningful comparison between 2017, 2018, 2019, only those segments (TMCs) common to all three years could be used.

- The results were further filtered for outliers and potentially problematic segments. Thus, the total delay for 2019 in the comparative analysis would be less than in the main report analysis of 2019. Furthermore, the distribution of delay among corridors would be slightly different. For example, unrealistically high speeds that were corrected by assigning a speed of 60 mph.

- Although limiting the segments to the "common" set between 2017, 2018, 2019 at the beginning of the analysis attempts to hold the number of segments constant (which changes as they are filtered for outliers in delay), this does not ensure that the segments compared are of the same length, a discrepancy that can render segment-to-segment comparison (such as in mapping) highly problematic.

- Total corridor and system level delay can still be influence by the abovementioned issues, thus comparisons at this level are not without flaws, but are more reliable than segment-level comparisons. Therefore, the relative delay expressed in percentages are used.

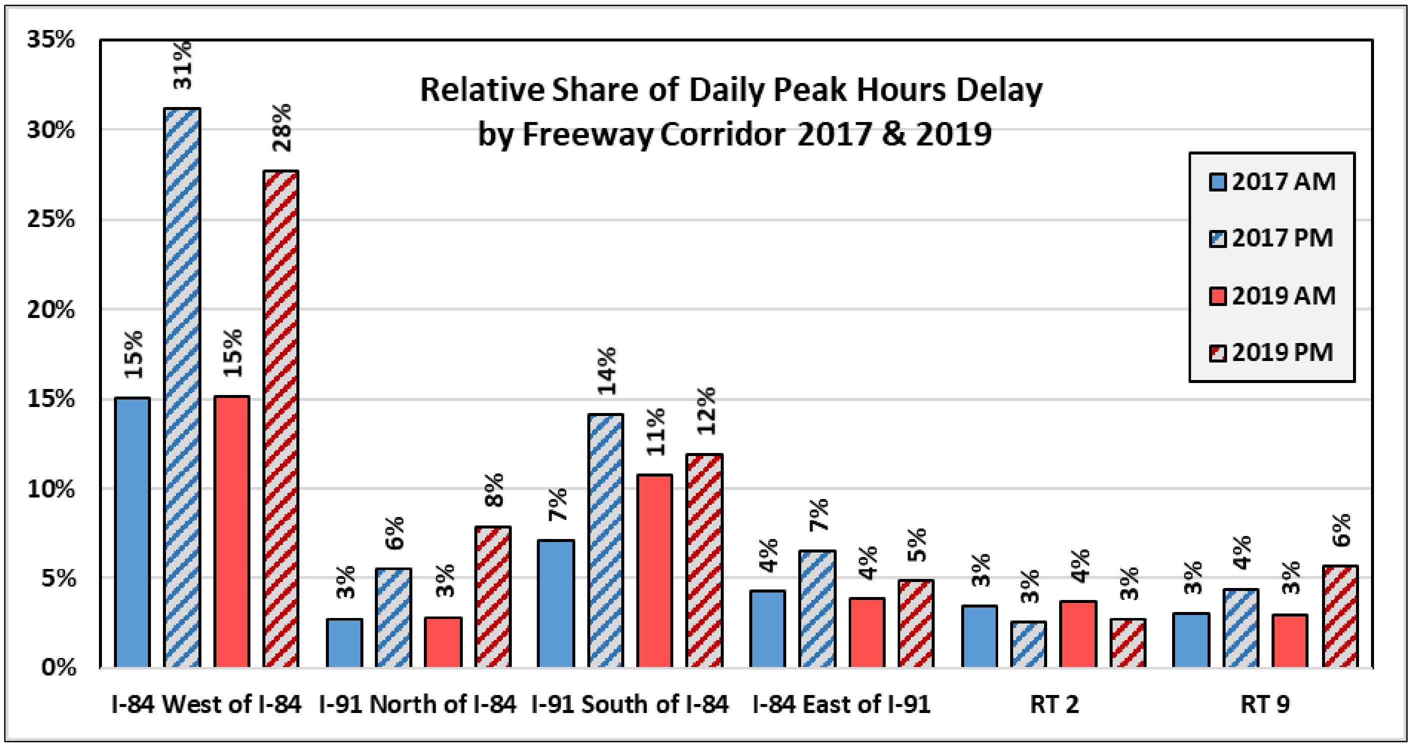
Freeway Trends

Overall, from 2017 to 2019 the distribution of the delay among the various freeway corridors held relatively steady. In relative terms, I-84 West of I-91 has consistently remained at the top of the list the largest contributor to total freeway delay in the region, accounting for slightly less than half of all delay. The inbound portion of I-84 West of I-91 alone comprises nearly one third of all delay in the system. I-84 East of I-91 has seen a relative decline in its proportion of the delay while I-91 North and I-91 South of I-84 have increased slightly. Inbound I-91 has become increasingly delayed in recent years. Specific figures for change in speed and delay can be found in Figures 31 and 32.

Figure 31: Freeways Peak Hours Delay Comparison 2017-2019

Corridor/ Length	Percentage of Total Peak Hours Delay by Corridor								
	2017			2018			2019		
Corridor	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total
I-84 West of I-91	30%	16%	46%	31%	15%	46%	26%	17%	43%
I-91 North of I-84	4%	5%	8%	4%	5%	9%	4%	7%	11%
I-91 South of I-84	10%	11%	21%	11%	10%	21%	13%	10%	23%
I-84 East of I-91	6%	5%	11%	6%	6%	12%	5%	3%	9%
RT 2	4%	2%	6%	4%	2%	6%	4%	2%	6%
RT 9	5%	3%	7%	5%	3%	8%	5%	4%	9%
All Routes	58%	42%	**100%**	59%	41%	**100%**	57%	43%	**100%**

Figure 32: Freeways Peak Hours Delay Comparison 2017-2019



Arterials Trends

The major trends in arterial performance are summarized below in terms of relative delay. Relative delay has generally held steady, although there is a trend of the morning peak hour commute (presumably inbound) generating an increasing proportion of the total daily peak hour delay. Route 44 maintains its position as contributing the most delay to the arterial total. Delay generated on RT 5 South has continued to grow in relative terms.

Figure 33: Arterial Peak Hours Delay: 2017-2019

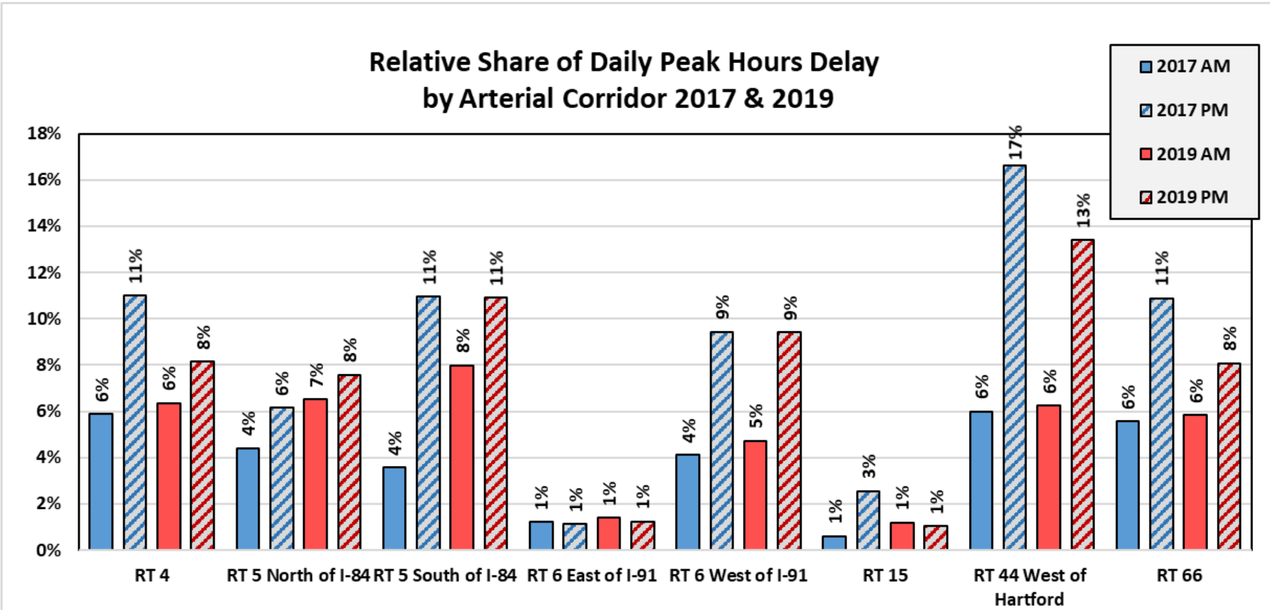


Figure 34: Arterial Peak Hours Delay Comparison: 2017-2019

Corridor	Percentage of Total Peak Hours Delay by Corridor					
	2017			2019		
	AM	PM	Daily	AM	PM	Daily
RT 4	6%	11%	17%	6%	8%	14%
RT 5 North of I-84	4%	6%	11%	7%	8%	13%
RT 5 South of I-84	4%	11%	15%	8%	11%	19%
RT 6 East of I-91	1%	1%	2%	1%	1%	3%
RT 6 West of I-91	4%	9%	14%	5%	9%	14%
RT 15	1%	3%	3%	1%	1%	2%
RT 44 West of Hartford	6%	17%	23%	6%	13%	20%
RT 66	6%	11%	16%	6%	8%	14%
Total	31%	69%	100%	40%	60%	100%

Trends Summary

Comparing trends across recent years can be a very beneficial exercise. However, it must be cautiously practiced. The structure, depth, and breadth of the INRIX NPMRDS data is very different from the pre-2017 HERE NPMRDS data, and thus measures calculated from recent (2017- present) data cannot be properly compared with older NPMRDS data, and certainly not with the even older data sources used in 2005 and 2010. Despite its more comprehensive nature, current INRIX NPMRDS data is not without its problems since the number of road segments included in the dataset as well as segment lengths can change from year to year. As always, there can be a small number of questionable observations that do not at all comport with what would normally be expected.

The observed trends in the largely show continuity in the distribution of delay around the system, with some small changes. However, since the trends reported here are only processed observations, they do not in and of themselves offer any explanation as to why delay consistently exists in a given corridor and whether that will remain the case in the future. It can be intuitively and logically argued that the delay has been induced or relieved by the presence and eventual completion of construction projects on the roads, transit ridership, job concentration, remote work, population change, and many other factors. However, until further research or modeling identify any of these factors as responsible for changes in delay, we cannot say for certain to which causes delay responds, or what delay trends will be in the future. Policy approaches to delay will necessarily be multifaceted and be able to anticipate multiple scenarios.

Chapter 5 Congestion Management Strategies

Congestion management strategies are designed to reduce vehicular traffic congestion through the promotion of alternative modes of transportation. Federal policy indicates that in developing congestion mitigation strategies, cost effective strategies that discourage single occupant vehicles be considered first before other expensive measures that promote reliance on automobiles. In achieving this, the Capitol Region through CRCOG has developed strategies that include a variety of policies, programs and projects which focus on the following:

i. Transportation demand management strategies to reduce single occupant vehicle trips.
ii. Transportation Systems Management and Operations (TSM&O) improvements to promote safety and maximize efficiency of the existing infrastructure through technology.
iii. Transit enhancements that make transit more attractive and serve as an alternative transportation mode.
iv. Transportation and land use strategies that promote compact, mixed-use and pedestrian friendly development that is well integrated with transit.
v. Bicycle and pedestrian programs to accommodate and encourage non-motorized travel.
vi. Improvements to roadways that include bridge enhancements, and the addition of lanes or the construction of new facilities to improve mobility.

The overall goal of these strategies is to reduce congestion and create an efficient, safe, sustainable and accessible multimodal transportation system that promotes economic vitality and improved quality of life for residents. The strategies developed by CRCOG are consistent with those identified in ***Connect 2045 (Metropolitan Transportation Plan for the Metro-Hartford Capitol Region)*** as well as the objectives of the CMP. This means that the strategies developed fit into the local context and contributes to achieving regional goals. It is important to add that some of these strategies are more regional or system wide in application, while others are corridor or project specific. Successful implementation of the identified strategies would necessitate coordination and collaboration between all stakeholders.

Transportation Demand Management (TDM)

TDM can be defined as a set of strategies that focus on maximizing traveler choices through the provision of alternatives such as work location, time of travel, route and mode[1]. The focus of these strategies is to increase system efficiency and promote a shift from single occupant vehicle (SOV) trips to non-single occupant vehicle trips and help in reducing vehicle miles traveled (VMT). These strategies include carpooling, vanpooling, transit, biking, walking and teleworking. These strategies are able to mitigate congestion without the significant financial investments and environmental impacts associated with roadway capacity expansion.

In the Capitol Region, CT***rides*** is responsible for transportation demand management programs. CT***rides*** assist commuters in finding the best way to get to work or school and offers information and resources for travel options throughout the CRCOG Region. CT***rides*** programs mainly include carpools, vanpools, transit (bus and train), biking, walking and telecommuting. Additionally, CT***rides*** offers commuters special tools and programs such as a comprehensive website, customer service assistance on bus schedules, fares and routes, customized trip planning, commuter reward programs, trial ride passes, and emergency ride home. As of December 2019, CT***rides*** had over 300 employers from various businesses, agencies, and municipalities signed onto different transportation demand management programs. Up until the end of March 2020, CT***rides*** had assisted over 55,000 commuters save time and money in their commutes. Based on available statistics, CT***rides***' TDM strategies have saved commuters about $460,000. It is also estimated that CT***rides*** had assisted in providing commuters with over 4,000,000 shared rides. In May 2019, CT***rides*** had helped in eliminating over 47,000 car trips, had contributed to reducing vehicle miles by over 785,000 and prevented close to 700,000-lbs of emissions.

The cumulative impact of TDM strategies can have a significant benefit on system efficiency. This can also help the transportation system accommodate new growth and improve the success of the region. TDM strategies are highly effective when they are implemented alongside other complementary measures.

Transportation Systems Management and Operations

Transportation Systems Management and Operations (TSM&O) and Intelligent Transportation Systems (ITS) are a set of strategies that rely on the advancement in technology to enhance the efficiency of the existing transportation system. The primary focus of these strategies is to maximize the throughput of the existing road network and limiting capacity expansion. These strategies are able to yield maximum benefits when implemented together with other companion strategies.

CRCOG's transportation planning program focuses on assuring travelers who use the highways, transit and the entire roadway system, a reasonable level of safety. CRCOG continues to play a major role in Traffic Incident Management (TIM) both at the regional and state level. TIM is the primary tool for reducing highway congestion that occurs when crashes, breakdowns, or other incidents result in a full or partial blockage of the highway. This tool provides a systematic, planned, and coordinated multi-disciplinary approach to detect, respond and clear crashes to restore traffic capacity safely and quickly. This requires creating and sustaining partnerships with law enforcement, fire and emergency medical services, transportation and environmental agencies, towing and recovery, drivers, the media, the insurance industry, and other stakeholders.

In 2018, CRCOG established the Greater Hartford TIM Coalition (GHTC) with the responsibility of providing guidance and direction to the TIM community to achieve new goals and strengthen the program. The program includes the development of a general framework and approach to defining and engaging regional planning organizations and municipalities, reinforce the organizational practices and requirements established within the National Incident Management System, and define the role of the Coalition in TSM&O. The GHTC is made up of diverse stakeholder groups to promote collaboration and efficiency. TIM strategies for the Capitol region are listed as follows;

i. Support Traffic Incident Management Activities – CRCOG will continue with the planning, implementation and coordination of activities such as the adoption of a Unified Response Manual, updating of diversion plans, TIM training, and participation in the FHWA annual TIM Self-Assessment. There will also be the continuous development and implementation of a public awareness campaign for motor vehicle laws relating highway incidents such as the “Move It” and the “Move Over” campaigns.
ii. Support TIM Partnerships – continue to support governmental, private, and public stakeholders in cultivating best practices, legislation and policy, training, and performance measures.
iii. Work with CTDOT to support the Connecticut Highway Motorist Assistance Program (CHAMP Service).
iv. Support Performance Measures – CRCOG will continue to work on data integration and collection as it relates to safety performance measures that focus on non-recurring delay/congestion, reliability, quick clearance, and reduction in secondary crashes.

CRCOG first adopted a strategic plan for the deployment of ITS in the Capitol Region in 1997, and the plan was updated in early 2015. The objective of the Strategic Plan in the region was focused on the identification of applications for ITS that will benefit freeway operations, arterial road operations, and public transit operations. Additionally, in 2017, CRCOG assisted the CTDOT with updating the statewide ITS architecture. The statewide architecture identified existing and planned ITS systems, as well as additional improvements; information interconnectedness between and among the existing, planned, and needed ITS systems; and any agreements or ITS-related standards required for ITS project interoperability. The purpose of all this is to ensure that the statewide ITS architecture meets federal requirements.

CRCOG has identified ITS strategies to enable maximize the throughput of the existing transportation network in the region. As indicated earlier, the success of these strategies is more dependent on the implementation of other companion strategies. The ITS strategies identified for the region are listed below as:

i. Update of Regional ITS Strategic Plan – provide updates to the CRCOG regional ITS Strategic Plan every 5 to 10 years.
ii. Monitor Advancement in ITS Technology – monitor advancements in ITS technologies and continue coordination and education efforts with CRCOG municipalities.
iii. Ensure Modernization of the Regional ITS Architecture – continue to coordinate with statewide ITS activities including participation in statewide ITS architecture updates.
iv. ITS Implementation – continue working with CTDOT to implement ITS to update the freeway traffic management system and enhance incident management efforts.
v. Regional Traffic Signal Operations and Management – continue to research the benefits and impacts of providing a regional approach to operating and maintaining local traffic signal systems.

Transit

Public transportation is often seen as a means to decrease traffic congestion on urban roadways, and an alternate mode of transportation. An efficient transit system provides direct benefits to users and has the potential to shift automobile trips to transit. In the Capitol

Region, transit provides basic mobility needs for the region's transit dependent population and a small but significant portion of choice riders. Transit services in the region are provided by Connecticut Transit (CT***transit***) and the CT***rail*** Hartford Line. CT***transit*** operates a bus transit system that provides fixed route local services within the Hartford and surrounding towns, a bus rapid transit (BRT) known as CT***fastrak*** (introduced in 2015) and a commuter service (Express) that serves surrounding municipalities. The CT***rail*** Hartford Line (introduced in 2018) provides services to commuters between New Haven, Hartford and Springfield. CRCOG has continuously placed emphasis on transit improvements as a way of improving mobility for transit dependent residents, as a viable travel option, and as a measure to help reduce congestion.

As stated earlier, CT***fastrak*** is a BRT system that connects New Britain to Hartford along a 9.4-mile bus-only guideway. The system has four commuter (express) buses that use the guideway, five local routes which utilize the guideway for part of their alignment and ten feeder routes which do not use the guideway but service at least one of the stations along the guideway. When CT***fastrak*** launched in 2015, ridership on the corridor averaged 14,200 trips per weekday. Subsequently, weekday ridership on all buses that use the corridor grew by thirty one percent, thus exceeding the initial projections. CTfastrak provides mobility options for commuters and helps relieve congestion on Interstate 84.

The commuter service operated by CT***transit*** serves as a major connection into the Hartford area from surrounding communities. The service network is comprehensive and ensures that people living in the surrounding communities have access to job centers in and around Downtown Hartford. The express routes are designed to attract choice riders, majority of whom have access to private vehicles. In attracting choice riders who would have ordinarily driven, the system is able to shift automobile trips to transit. This gives riders the choice to avoid expensive trip costs due to long travel distances, parking charges at destinations or unreliable commutes due to congestion. In 2017, a comprehensive service analysis (CSA) of the bus system conducted in Hartford by CRCOG, revealed that a majority of the commuter routes have an on-time performance rate greater than ninety percent. The success of the commuter system is attributed to the following characteristics. First, the majority of the commuter routes utilize the interstate system to travel quickly and efficiently. Second, most of the interstates have high occupancy vehicle (HOV) lanes that ensures service reliability. Third, park and ride lots are located close to the interstates. Finally, the service fleet uses vehicles with seats more comfortable than that of regular (local) transit vehicles.

Available statistics indicate that more than one million riders have utilized the Hartford Line railroad since its launch on June 2018. Ridership on the system has grown faster than it was initially projected. It has been reported that ridership on the line has been growing at a rate of twenty five percent annually. Currently in its second year, the Hartford Line was expected on grow to exceed 750,000 passenger trips based on pre COVID pandemic projection, which would have been higher than the initial projection of 666,960. The service has become a regular commuting alternative for regional residents that commute between New Haven, Hartford and Springfield. The rail system has therefore helped shift automobile trips to transit and in the process has helped relieve congestion on the region's major highways.

Complementing the transit system and TDM programs are forty-four park and ride lots that are conveniently located throughout the Hartford TMA (Figure 37). These park and ride lots support transit, ridesharing and active transportation. For commuters who want to avoid traffic congestion and save on commuting costs, park and ride lots serve as convenient parking alternatives. This encourages commuters to utilize transit and ridesharing services as well as allowing those who want to walk or bike a portion of their trip to do so. In using transit and ridesharing services, single occupant vehicle travel is reduced, thereby relieving congestion on the highways. As stated earlier, the Hartford Metropolitan Area has forty-four park and ride lots, with over 6,300 parking spaces located in twenty-nine towns. Many of the park and ride lots are located close to freeways, major commuting routes, and railway stations. They are served by local and commuter bus services, as well as rail service. Figure 35 provides details on park and ride lots in the Capitol Region and surrounding communities.

As part of its efforts to address transit challenges in the region, CRCOG continues to develop short-term and long-term strategies to improve bus and rail services. These strategies are based on CRCOG's 2001 Regional Transit Strategy (RTS), the 2017 CSA of the CT***transit*** Hartford division, as well as the 2018 CSA of the CT***transit*** New Britain/Bristol division. These strategies are directed at making transit in the region more attractive and promote modal shift.

i. CT***fastrak*** Expansion – CRCOG supports CTDOT's plans to expand the BRT service east of Hartford. This is a two-phase strategy, and phase one was completed in 2017 with expanded hours of service to local bus routes, and the creation of Route 913 express service between Hartford, Buckland Hills and Storrs (University of Connecticut). The second phase looks to create BRT service along Silver Lane and/or Burnside Avenue in East Hartford with limited stop service.
ii. First-Mile Last-Mile Connections - work with state and local transit providers and Transportation Network Companies (TNCs) to develop collaborative service options to improve mobility management in the CRCOG region.
iii. Bradley Airport Connection – support the extension of CT***fastrak*** service to Bradley Airport as well as the implementation of a shuttle bus connection to Bradley Airport from Windsor Locks rail station.
iv. Install shelters at stops based on CRCOG's Sign and Shelter Policy and consider wayfinding improvements at park and ride lots.
v. Upgrade the CT***rail*** Hartford Line with infrastructure improvements from Windsor to Springfield.
vi. Passenger Rail Stations – support the development of new CT***rail*** Hartford Line stations in Newington, West Hartford, Windsor, Windsor Locks, and Enfield.

Figure 35: Park and Ride Lots in the Capitol Region

Municipality	Location	Capacity (Available Spaces)	Average Utilization % (2017-2019)	Bike Lockers	Local Bus Service	Express Bus Service	Rail Service
Andover	Route 6, West of Route 316	60	26.9	N	N	Y	N
Avon	Wal-Mart, Route 44	100	63.0	N	N	Y	N
Bloomfield	Sacred Heart Church, Route 189	85	4.5	N	Y	N	N
Bolton	Routes 6, 44 and I-384	87	48.7	N	N	Y	N
Canton	Route 179 at Route 44	81	27.8	N	N	Y	N
Columbia	Route 6 at Route 66	53	50.6	N	N	Y	N
	Route 66 at West Street	20	10.0	N	N	N	N
Coventry	2nd Congregational Church, Route 44	84	6.2	N	N	Y	N
East Hartford	Route 5 at Main Street (Route 15, Exit 30)	255	24.8	N	Y	N	N
Enfield	Enfield Square (I-91, Exit 48)	353	50.4	N	N	Y	N
Farmington	Fienemann Road (I-84, Exit 37)	70	27.4	N	N	N	N
	Route 4 (I-84, Exit 39)	15	93.3	N	Y	N	N
	St. Mary's Church, Route 4	50	24.3	N	N	Y	N
	Route 4 at Town Farm Road	72	13.9	N	Y	Y	N
Glastonbury	Main Street (Route 3 / Route 2, Exit 5)	323	30.0	N	Y	Y	N
	St. Paul's, Main Street	165	15.9	N	Y	Y	N
	St. Dunstan's, Route 83	34	9.8	N	?	?	N
Granby	1st Congregational Church, Route 189	65	18.7	N	N	Y	N
Manchester	Buckland Hills Park and Ride (I-84, Exit 62)	743	45.4	Y	N	Y	N
	Spencer Street (I-384, Exit 1)	245	27.3	Y	Y	N	N
Mansfield	Route 195 at South Frontage Road	87	11.5	N	N	Y	N
Marlborough	West Road (Route 2, Exit 12) - 3 Lots	196	45.4	N	N	Y	N

Figure 35 - Continued: Park and Ride Lots in the Capitol Region

Municipality	Location	Capacity (Available Spaces)	Average Utilization % (2017-2019)	Bike Lockers	Local Bus Service	Express Bus Service	Rail Service
New Britain	Route 71, across from Target	227	13.4	N	Y	N	N
Newington	CTDOT Headquarters, Route 15	157	10.4	N	N	Y	N
Simsbury	Route 10 North of Route 185	85	77.6	N	N	Y	N
	Highway Maintenance Garage, Route 10	55	15.5	N	N	Y	N
	Iron Horse Boulevard	179	20.7	N	N	Y	N
Somers	Route 190 at Ninth District Road	29	2.9	N	N	N	N
South Windsor	Route 30 (I-291, Exit 4)	157	8.6	N	N	N	N
Southington	Route 10 (I-84, Exit 29)	132	70.1	N	N	Y	N
	Route 322 (I-84, Exit 28)	105	22.9	N	N	N	N
Tolland	Route 195 (I-84, Exit 68)	132	39.6	N	N	N	N
	Route 74 (I-84, Exit 69)	59	16.9	N	N	N	N
Vernon	Rockville Park and Ride (I-84, Exit 67)	241	36.0	N	N	Y	N
	Green Circle Road (I-84, Exits 64/65)	192	55.6	N	Y	N	N
	Route 30 (I-84, Exit 65)	179	36.9	N	Y	Y	N
Wethersfield	Wolcott Hill Road at Jordan Lane	161	24.5	N	Y	N	N
Willington	Route 32 (I-84, Exit 70)	87	12.3	N	N	N	N
Windsor	Kennedy Road (I-91, Exit 39)	88	20.5	N	Y	N	N
	Poquonock Park and Ride (I-91, Exit 38)	219	23.0	N	Y	Y	N
	Route 305 (I-91, Exit 37)	49	49.0	N	N	N	N
	Route 159 at Corey Street	55	22.7	N	Y	N	N
	Route 218 (I-91, Exit 35)	208	15.9	N	N	N	N
Windsor Locks	Route 159 (I-91, Exit 42)	342	39.5	N	N	Y	N
Total Lots - 44	**-**	**6,381**	**31.9**	**-**	**-**	**-**	**-**

Transportation and Land Use

CRCOG's *Sustainable Land Use Code Project* defines transit-oriented development (TOD) as an approach to physical development of communities that leverages the unique opportunities provided by access to high quality public transportation. TODs are close to transit stations or transit stops; are compact, with mixed land uses; are pedestrian friendly; and effectively integrated with transit. TOD zoning districts and associated standards provide a way to promote and guide development around existing or future transit stations to enable people to conveniently get to the places they live, work, shop, and play by transit, as well as walk and bike rather than solely rely on the automobile.

In 2001, CRCOG made a commitment to give travelers in the region more travel options by improving the existing bus system and supporting the development of a new rapid transit system. The purpose is to use transit as a tool to shape urban form and encourage land use planning that can support additional transit investments in the region's transit corridors. TOD is fundamentally important to the Greater Hartford area and used as one of the strategies to curb congestion on the region's roadways. CRCOG's TOD strategies to help mitigate congestion in the region include the following:

i. CRCOG to provide general support for TOD in the region –
    a. Support TOD along all transit lines, including traditional bus corridors through coordinated actions by CRCOG, the state, and affected municipalities.
    b. Develop a long-range strategy for the region that encourages both transit and transit supportive land use and make station area and TOD planning a core element in the planning process for any rapid transit line or station.
    c. Build support for TOD among community groups, business leaders, and other stakeholders.
    d. Work with town officials and developers to integrate TOD into their plans and development projects through use of tools such as the "Making It Happen" report and the Mixed-Use/Transit-Oriented Development Model Zoning Regulation.

ii. TOD for the CT***fastrak*** and the Hartford Line as of 2019 –
    a. Support the planning of expansion of CT***fastrak*** to Storrs and Buckland Hills.
    b. Support operation of the bi-state Hartford Line passenger rail service.
    c. Support plans by CTDOT to add two entirely new Hartford Line stations (West Hartford and Enfield) and to replace three existing shelter stops with full-service, high platform stations (all five stations located in the Capitol Region).
    d. Create Station Area Plans that integrate transit, economic development, housing and open space, with the full and coordinated participation of CTDOT, relevant state departments and municipal officials.
    e. Work with local officials and station area landowners (both public and private) to assemble a critical mass of developable land with good access to the station. Key factors will include the availability of brownfield remediation assistance and funding, and an approach to commuter park and ride lots that avoids the long-term dedication of potential TOD sites to surface parking lots.
    f. Invite developers to build or improve stations through "joints development;" this could involve a competitive solicitation for developers to build on public land, or

a negotiation with adjacent landowners to fund station improvements in order to unlock the TOD value of their property.

g. Explore the creation of station-area Tax Increment Finance Districts to support transit or other key TOD infrastructure.
h. Engage the region's Anchor Institutions in discussions around the value of the region's transit investments to major and neighborhood anchors and potential implementation actions to bolster the region's transit corridors.
i. Recognize in all future planning under CT DOT's Greater Hartford Mobility Study (previously the I-84 Hartford Project), that Union Station and its walkshed represent a TOD opportunity of unique scale and centrality in the region.

Bicycle and Pedestrian Programs

In terms of bicycle and pedestrian planning in the region, CRCOG envisions a transformed region where population centers are connected, enabling residents to walk and ride their bicycles on dedicated infrastructure. This is another approach to addressing roadway congestion and encourage non-motorized travel. However, the region has challenges that make bicycling and waking difficult. These challenges include roadway infrastructure that is mostly designed for vehicular travel, poor bicycle and pedestrian connections to the transit system (first mile-last mile challenges), discontinuous sidewalks (non-existent in some cases), and unsafe roadway crossings for both bicyclists and pedestrians.

As a result, CRCOG has developed a complete streets plan and a regional complete streets policy to guide its efforts to address bicycle and pedestrian mobility within the region. The plan calls for streets that do not prioritize the use of motorized vehicles only, but one that accommodates all users regardless of mode, age, or ability[2]. The plan specifically calls for streets that capture the needs of bicyclists, sidewalks or paths for pedestrians, infrastructure for buses and bus riders, sidewalks and ramps for people with disabilities, as well as space for automobiles. The region's complete street policy makes complete streets a requirement of funding programs administered by CRCOG. Under the policy, the region's decision-making process focuses on protecting the most vulnerable road users in situations where a wide range of road users are considered.

In working towards reducing congestion, CRCOG continues to focus on various strategies to enhance bicycle and pedestrian mobility throughout the region. The focus has been on the expansion of the regional trail system, the promotion of bike share programs and the need to educate officials and the public about the benefits of complete streets programs.

i. Developing a regional trail system - this has been a major focus of CRCOG since 2008. The current CRCOG Complete Streets Plan indicates that most of the gaps in the major regional trails have been filled. For instance, the Farmington Canal Heritage Trail (FCHT) that stretches from New Haven to Massachusetts is nearly complete. In the CRCOG region, there are various works being done on the FCHT in Plainville, Simsbury and Bloomfield. Most of the remaining works on the FCHT are being studied, planned, designed or under construction. Another example is the Charter Oak

[2] Capitol Region Complete Streets Plan (https://crcog.org/wp-content/uploads/2020/03/draft-plan-revised05182020.pdf)

Greenway, which is almost complete, besides a section in East Hartford. Also, the Connecticut Department of Transportation (CTDOT) has completed an extension of the Charter Oak Greenway from Manchester to Bolton, where the trail connects to the Hop River Trail.

CRCOG has also identified completion of the East Coast Greenway as a regional priority in its latest Metropolitan Transportation Plan adopted in April 2019. The East Coast Greenway (ECG) is a network of trails that, when complete, will stretch from Maine to Florida. Within the region, the trail will follow the Charter Oak Greenway and the Farmington Canal Heritage Greenway. Both of these trails have gaps, and the major gap in the ECG through the region is the connection between these two trail systems.

ii. Regional Bike Share Program - CRCOG has shown interest in a regional bike share program since 2014 but has been actively involved in developing one since 2018. In 2014, CRCOG together with the Greater Hartford Transit District, along with other partners, hired a consultant to evaluate the feasibility of implementing a bike share program in the Hartford region. The study indicated that based on the existing bike technology, capital costs was anticipated to grow overtime as the system expanded. As a result of this and other major challenges identified by the study, the regional bike share idea was placed on hold.

The introduction of smart bike technology has made the realization of a regional bike network more feasible, at the same time increased the enthusiasm for bike share. For instance, in 2018 the ridership numbers recorded for the pilot bike share program that was implemented by the City of Hartford along with LimeBike, gave an indication that the region might be ready for a bike share. Against this background, CRCOG invited interested communities in the region to discuss the potential for a regional bike share program. Through an RFP process in 2019, CRCOG selected Zagster to work with communities that could be served with a "No-Cost Bikeshare." Zagster has been working on agreements with six selected communities (New Britain, Newington, West Hartford, Hartford, East Hartford and Manchester) to roll out bike share program expected to commence in 2020. The COVID-19 pandemic, and ensuing economic shutdown, has called the schedule and viability of this program into question. CRCOG is still dedicated to pursuing this program as it is seen as a sustainable alternative to provide numerous benefits some of which include, to address first-mile and last-mile challenges in the region, provide affordable means of transportation for low income communities and reduce congestion.

iii. Education of Officials and Public - CRCOG recognizes that the provision of bicycle and pedestrian facilities is not enough to influence people to change their travel modes. However, a major challenge preventing residents from relying on bicycling or walking as a major form of transportation is their vulnerability to vehicular traffic. Additionally, many pedestrians, bicyclists and motorists do not have a good understanding of their rights and responsibilities on the roadway. As a result, CRCOG has decided to focus on educational programs that target various users of the transportation infrastructure. These educational programs have proven to be effective. For instance, some of the towns in the region have become “Bike Friendly Communities.” CRCOG’s Complete Streets Policy indicate that nine of the ten bike friendly communities in Connecticut are in the Capitol region. Additionally, the City of Hartford (located in the Capitol region) is the first in the state to become a “Walk Friendly Community.” There are also various advocacy groups such as Bike/Walk CT and The Center for Latino Progress who continue to offer bicycle education for various groups in the region.

Investing in bicycle and pedestrian infrastructure improves mobility and provides access to public transportation. This will help communities to reduce congestion on their roadways and improve travel times for all users.

Roadways and Bridges

Federal policy directs that congestion management strategies follow a structured approach. The policy dictates that high cost strategies that increase capacity for single occupant vehicles (SOV) are to be used only after more cost-effective strategies have been considered. However, there are situations where high cost strategies such as the addition of new lanes and facilities become necessary and inevitable.

Freeways and arterials in the Capitol Region experience congestion in and around the Hartford area during peak commuting hours. The region’s most congested corridors are I-84 west of I-91, as well as I-91 north of I-84. Interstate congestion during the morning peak commuter period is limited to inbound traffic, whereas during the evening peak, both inbound and outbound traffic are impacted. Freight traffic is also impacted along I-84 west of I-91 and I-91 south of I-84 near the Charter Oak Bridge. Additionally, the region has an aging bridge infrastructure and their conditions do not meet statewide targets. Future freeway congestion for both commuters and freight has been predicted to slightly worsen.

In addressing these deficiencies, CRCOG has adopted an approach reflecting a longstanding policy of first attempting to address highway issues by improving operational efficiency of the existing system before resorting to building new or wider highways. The approach relies mainly on the identification of critical improvements needed along discrete sections of the system and on implementation of Transportation Systems Management and Operations (TSM&O) policies.

CRCOG has designed strategies to help improve operations and relieve bottlenecks on existing freeways and arterials. Roadway strategies for improving congestion in the region include freeway improvements, arterial improvements, and bridge infrastructure improvements. These strategies are short-term and long-term in nature and are mostly project specific. Figure 36 is a summary table showing all the mitigation strategies, their impacts on congestion, as well as companion strategies to help address congestion in the Hartford area. Also, Figure 37 lists Transportation Improvement Projects (TIP) along CMP corridors.

- **Freeway Improvements**

  i. I-84 at Buckland Development Area – CRCOG looks to continue to partner with CTDOT and municipal officials from its eastern towns for opportunities to further extend

CT***fastrak*** service to the east along surface roadways and explore its ability to mitigate congestion.

ii. Replacement of I-84 Hartford Project – The CTDOT project to replace the I-84 viaduct structure has been transitioned to the Hartford Mobility Study by CTDOT. Discussions will continue with stakeholders throughout this study to develop a comprehensive multimodal approach and strategy for the I-84 corridor and associated timeline with CTDOT and the City of Hartford. The Hartford Mobility Study will also include examination of new concepts for
iii. I-84: Hartford to Farmington – work in partnership with CTDOT and municipal officials to advance projects such as the reconstruction of the interchanges of I-84 at Route 4, Route 6 and Route 9. Additionally, the construction of auxiliary lanes from South Main Street interchange (West Hartford) to the Ridgewood Road interchange.
iv. I-84 at Rentschler Development Area – assess the interchange improvements at I-84 and Silver Lane as recommended in the Rentschler Field Access Study.
v. I-91 at Charter Oak Bridge – monitor conditions during construction, including advocating for the concerns of CRCOG member towns, and also utilize CRCOG's traffic incident management capabilities to inform first responders' needs of maintenance and protection of traffic changes during the 3 year construction project that started in 2019.
vi. I-91 at Day Hill Development Area – work with CTDOT to provide direct connection to northbound I-91 from Day Hill by constructing spans over Route 75 and Interstate 91; as well as widen northbound Interstate 91 to provide an additional operational lane from the Route 75 interchange to the Kennedy Road interchange or to the Route 20 interchange. The additional northbound lane will require widening the existing bridge carrying Interstate 91 over the Farmington River.

- **Arterial Improvements**
  i. Route 2 within the Region – work with CTDOT to provide safety improvements along Route 2 in East Hartford including ramp geometric improvements and safety improvements.
  ii. I-384 Expressway/Route 6/Route 44 Interchange – improve connectivity and safety at the I-384 Expressway/Route 6/Route 44 interchange, including addressing the safety and connectivity concerns of Notch Road access.

- **Bridge Infrastructure Improvements**
  i. Monitor Putnam Bridge Condition – continue to monitor the condition of the current Putnam Bridge, including the likely timeline needed for replacement.
  ii. Funding for Municipal Bridges – support funding initiatives that assist Municipalities in securing monies to address bridge repair, replacement or removal on town roadways, while placing priority on bridges that most improve regional performance measures.

Figure 36: Congestion Mitigation Strategies Summary

1. Travel Demand Management		
Strategies	**Congestion Impacts**	**Companion Strategies**
• Rideshare (carpooling and vanpooling)	• Reduced peak period VMT • Reduced peak period SOV trips • Increased use of alternative modes • Reduced parking demand	• Teleworking • Transit • Biking and walking
• Teleworking	• Reduced peak period VMT • Reduced overall VMT • Reduced VHT • Reduced parking demand	• Ridesharing • Park and Ride Lots
2. Transportation Systems Management and Operations (TSMO) & Intelligent Transportation Systems (ITS)		
• Support traffic incident management (TIM) partnership and activities	• Reduce vehicle delay due to incidents • Reduction in secondary crashes	• Traffic signal coordination and modernization • Enhanced enforcement • Communications networks and road monitoring coverage
• Implement ITS to update freeway traffic management system and enhance incident management efforts • Monitor advancement in ITS technology • Update Regional ITS Strategic Plan • Ensure modernization of regional ITS architecture	• Reduction in work zone related incidents • Increased travel time reliability • Reduced VHT	• Enhanced enforcement • Traffic incident management

Figure 36 – Continued: Congestion Mitigation Strategies Summary

3. Transportation and Land Use		
Strategies	**Congestion Impacts**	**Companion Strategies**
• Support TOD along bus and rail corridors through coordinated actions • Develop regional long-range strategy that encourages transit and transit supportive land uses • Integrate TOD into plans and projects of towns and developers • Incorporate TOD opportunities in the Hartford Mobility Study	• Reduced VMT • Increased use of alternative modes	• Bicycle and pedestrian programs • Complete streets policies • Local land use plans
4. Bicycle and Pedestrian Programs		
• Developing a regional trail system	• Increased mobility • Increased use of alternative modes	• Regional Bikeshare Program
• Regional Bike Share Program	• Increased mobility • Increased use of alternative modes	• Complete street policies • Improved transit stations/stops
• Education of officials and public	• Increased mobility • Increased use of alternative modes	• Complete street policies • Improved transit stations/stops • Regional Bike Share Program

Figure 36 – Continued: Congestion Mitigation Strategies Summary

5. **Transit**		
Strategies	**Congestion Impacts**	**Companion Strategies**
• Expansion of CT***fastrak***	• Increased transit ridership • Improved travel time • Enhanced travel time reliability • Reduced VMT • Stimulation of TOD along corridors	• Park and ride lots
• Improve Bradley Airport Connection	• Reduced VMT • Enhanced travel time reliability • Increased transit ridership	• Park and ride lots • First-mile last-mile connections • Complete street policies
• Install shelters at stops	• Increased transit ridership • Enhanced travel time reliability • Reduced VMT • Increased use of alternative modes	• Complete street policies • Bicycle and pedestrian programs
• Upgrade infrastructure on CT***rail*** Hartford Line from Windsor to Springfield	• Increased ridership • Reduced VMT • Increased rail ridership	• Park and ride lots •
• Develop new CT***rail*** Hartford Line stations in Newington, West Hartford, Windsor, Windsor Locks and Enfield	• Reduced VMT • Increased ridership • Increased rail ridership	• Park and ride lots • First-mile last-mile connections • Complete street policies • Bicycle and pedestrian programs

Figure 36 - Continued: Congestion Mitigation Strategies Summary

6. Roadway and Bridge Improvements		
Strategies	**Congestion Impacts**	**Companion Strategies**
• Replacement of I-84 Viaduct	• Increased throughput via additional vehicle capacity • Reduced congestion	• Roadway signage improvements • Traffic signal coordination and modernization
• Reconstruction of interchanges of I-84 at Routes 4, 6 and 9	• Increased throughput via additional vehicle capacity • Reduced congestion due to removal of bottlenecks	• Roadway signage improvements
• I-84/I-91 interchange improvements	• Increased throughput via additional vehicle capacity • Reduced congestion due to removal of bottlenecks	• Increasing lanes • Roadway signage improvements
• Interchange improvements at I-84 and Silver Lane (Rentschler Development Area)	• Increased throughput	• Roadway signage improvements
• Monitor conditions during construction of I-91 at Charter Oak Bridge	• Reduction in traffic incidents • Decreased in delays • Improved travel time	• Increasing lanes • Roadway signage improvements
• Improve connection to I-91 at Day Hill Area Development	• Increased throughput via additional vehicle capacity • Reduced congestion due to removal of bottlenecks	• Roadway signage improvements
• Work with CTDOT to provide safety improvements along Route 2 in East Hartford	• Reduction in traffic incidents	• Enhance enforcement • Roadway signage improvement
• Improve connectivity and safety at I-384 Expressway/Route 6/Route 44 interchange	• Reduction in traffic incidents • Increased throughput	• Enhance enforcement • Roadway signage improvement

Figure 37: TIP Projects Along CMP Corridors

CMP Corridor	Project Description	Mitigation Strategy	Status	Year
I-84	Bridge Rehabilitation – East Hartford	Bridge Rehabilitation	Design/Engineering	2020
I-84	Bridge Rehabilitation – Hartford	Bridge Rehabilitation	Construction	2020
I-84	Realign I-84 EB on-Ramp – Farmington	Highway Realignment	Construction	2020
I-91	Bridge Rehabilitation – Enfield	Bridge Rehabilitation	Design/Engineering	2020
I-91	Bridge Rehabilitation – Hartford	Bridge Rehabilitation	Design/Engineering	2020
I-91	Bridge Rehabilitation – Windsor Locks	Bridge Rehabilitation	Construction	2023
I-91	Resurfacing, Bridge & Safety Improvements – Wethersfield/Hartford	Safety	Construction	2020
Route 2	Bridge Rehabilitation – Marlborough	Bridge Rehabilitation	Construction	2020
Route 44	Replace Bridge – Coventry	Bridge Replacement	Design/Engineering	2020
Other	CT Safety Research Center - Newington	Safety	Study	2020
Other	Highway Safety Office Tasks – Newington	Safety	Study	2020
Other	Intersection Improvement at Sigourney St. & Asylum Ave – Hartford	Intersection Improvements	Construction	

Figure 37- Continued: TIP Projects Along CMP Corridors

CMP Corridor	Project Description	Mitigation Strategy	Status	Year
Various	CT***transit*** Systemwide Bus Replacement	Transit	Acquisition of Capital Equipment	2020
Various	CT***fastrak*** Infrastructure/Station/Facility Improvements	Transit	Construction	2021
New Britain	New Britain Fixed Route	Transit	Other	2020
Southington/Cheshire	Southington Commuter	Transit	Other	2020
Vernon	Vernon Commuter	Transit	Other	2020
NHHS	Hartford Line Operating	Transit	Other	2020
Trail	Construction of Ped/Bike Trail Loop – New Britain	Mobility	Construction	2020
Trail	Construction of a Portion of the Farmington Canal Heritage Trail	Mobility	Construction	2020
Riverwalk	Ped/Bike Trail Extension, from the Boathouse to Weston St.	Mobility	Construction	2021
Enfield	Construct High Speed Rail Crossing to Bike & Ped Trails along CT River	Mobility	Construction	2021

Chapter 6 Conclusions & Next Steps

This Congestion Management Process Report continues to provide a snapshot of congestion in the region and is a significant update to our previous CMP report date 2017. This report is a result of ongoing collaboration efforts between CRCOG, NCCOG, Northwest Hills COG and River COG, to monitor roadways in the Hartford TMA. This report has advanced congestion monitoring process with better data processing and analysis techniques. It is also added new elements such as outcome of previously proposed mitigation strategies as well as introducing new mitigation strategies. This report represents an important update to 2015 performance monitoring and assessment efforts for the entire Hartford TMA transportation system. It presents the results of the system assessment utilizing newly available INRIX NPMRDS data, identifies congested locations and causes for congestion, and further establishes a foundation for future CMP efforts between the four planning agencies that encompass the Hartford TMA. A major component of this report is the summary of entire year worth of travel time data instead few months or few runs.

Results of Previously Proposed/Implemented Congestion Mitigation Activities

We reported a wide variety of congestion mitigation strategies and their progress in this report. The key to reducing congestion in the region is to provide continue support these strategies as well as programs. We have successfully completed or implemented several congestion mitigation strategies that we outlined in our 2010 CMP. A summary of continued as well as completed action items is provided below:

- Completed the Comprehensive Transit Service Analysis (CSA) to understand potential local/express transit service improvements throughout the region.
- CT***fastrak*** and CT***rail*** Hartford Line commenced expanding transit options and connectivity. Both systems are showing strong ridership.
- Established a program to annually monitor park and ride lot usage and work with CTDOT on improvements such as expanding lots with high utilization rates, reviewing transit service access as part of the Comprehensive Service Analysis, and providing/upgrading amenities such as shelters and bike racks/lockers where appropriate.
- Conducted a detailed monitoring the status / ratings (structurally deficient/functionally obsolete) of bridges on interstate and limited access highways within the Capitol Region.
- CRCOG completed an in-house preliminary analysis on suitability of roundabout in the higher crash rate intersections. This analysis is intended to leverage upcoming roundabout screening study.
- Completed an update to the CRCOG ITS Strategic Plan.
- Provided continued support to the statewide effort to improve Traffic Incident Management. Added a staff member, a Safety Coordinator, at CRCOG to focus on traffic safety and incident management.

- Encourage Transit Oriented Development (TOD) including the development of model sustainable land use regulations.
- CRCOG adopted a complete streets policy in February 2020 and a complete streets plan in May 2020. The policy requires that all projects funded by CRCOG include complete streets elements unless an exception is granted. The plan is developed to facilitate complete streets corridors between activity nodes. The plan also includes a Quick Build Guide developed by the consultant to implement demonstration projects as well as small scale projects to test different complete streets elements.
- Enhance pedestrian and bicycle connections throughout the Capitol Region by exploring options that create a regional bicycle sharing program; Provide technical support to communities strengthening the multimodal network and continue to build upon our regional trail system.
- Support educational initiatives that encourage safe bicycle and pedestrian transportation.

Next Steps

Roadway congestion is an ongoing problem that transcends political or geographical boundaries. Managing congestion, therefore, should also be able to encompass similar boundaries. Congestion management is an ongoing and evolving process. CRCOG is continuously striving to improve monitoring techniques as well as summarizing results to gain a better understanding of congestion, its causes, and implement effective mitigation strategies. Our goals over the next few years include the following:

<u>Congestion Monitoring</u>

- Continue collaboration between partner COGs in order to produce the next Hartford TMA Congestion Management Process Report.
- Continue including federal performance measures to the freeway monitoring system.
- Assess the CMP area/roadways and expand it as necessary.
- Identify additional performance measures that will assist congestion monitoring and management in the region.
- Continue evaluating the effectiveness of mitigation strategies and redesign them if necessary.
- Design and evaluate additional congestion related elements as necessary.

<u>Future Congestion Mitigation Actions</u>

- Continue advancing projects in the TIP that relate to congestion mitigation.
- Continue to advance and promote CT***rail*** Hartford Line Service to expand service and number of trips.
- Identify top five congested areas in the region and further analyze them to determine the prime reason for congestion.

- Develop Transit Priority Corridors Implementation Strategy. The purpose of this effort is to further examine the conceptual recommendations made by CRCOG's CSA, identify opportunities for transit priority treatments/technologies, and develop actionable implementation steps.
- Complete the Capitol Region Roundabout Screening Study to analyze suitability of roundabout to address capacity, safety, and operational improvements.