



**GREATER HARTFORD MOBILITY STUDY**

# **EXISTING CONDITIONS REPORT**



**CONNECTICUT DEPARTMENT OF TRANSPORTATION  
DECEMBER 20 2021**



# Greater Hartford Mobility Study Existing Conditions Report

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**PREPARED FOR:**

**Connecticut Department of Transportation**

**PREPARED BY:**

**AECOM**

**TranSystems Corporation**

**Fitzgerald & Halliday, Inc.**

**WSP**

**Goody Clancy**

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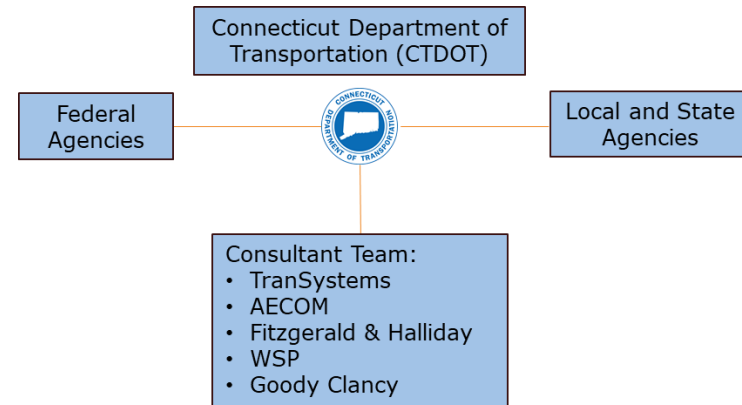
## 1 Introduction

The Connecticut Department of Transportation (CTDOT) is expanding its transportation vision for the Greater Hartford area by taking a holistic approach to improve mobility for all modes of travel spanning the Connecticut River from Hartford to East Hartford and throughout the region. The Greater Hartford Mobility Study (GHMS) will build upon the extensive planning and engineering work performed to date on multiple initiatives in the region, including the I-84 Hartford Project, CTfastrak East Expansion Study, Hartford Rail Alternatives Analysis, the I-84/I-91 Interchange Study, Bradley International Airport Master Plan, the East Coast Greenway and regional pedestrian and bicycle connectivity. These initiatives are illustrated in **Figure 1-1**, right.

GHMS is a comprehensive planning initiative that will assess the primary transportation deficiencies in the region and provide a mechanism to prioritize projects for further study and implementation. The study will consider all modes of transportation, including transit (rail and bus), freight (rail and truck), bicycles and pedestrians, and automobiles. A long-term, sustainable transportation system requires facilities to be brought to modern standards, prioritizing safety and efficiency, and providing mobility choices for all people in the region. The study will be executed by the study team, which is illustrated in **Figure 1-2**, right. The study team will be preparing a Project Management Plan (PMP) and Agency Coordination Plan (ACP) that will further elaborate on roles and responsibilities.



**Figure 1-1: Regional Planning Initiatives**



**Figure 1-2: Study Team**

## 1.1 Study Overview

GHMS is a *Planning and Environmental Linkage (PEL)* study that will facilitate simultaneous consideration of planning vision, economic goals, community goals and environmental goals by an early and ongoing coordination with the public, local stakeholders, and appropriate resource agencies. With multiple transportation initiatives currently in various phases of analysis and/or implementation in the Greater Hartford region, the GHMS PEL will provide a holistic approach to assess these initiatives and other potential multimodal mobility improvement opportunities with an integrated and overarching regional planning study.

The Study Area encompasses a broad geographic area that extends beyond Hartford and East Hartford. It was established to include major transportation facilities carrying people and goods within, through and around Hartford, as well as other regional travel hubs, such as Bradley International Airport, Hartford Line, and Hartford's Union Station. In **Figure 1-3**, following, this planning level study area is depicted in the boundary labeled Study Area. The Study Core of Hartford and East Hartford is the focus of several ongoing transportation initiatives with broader regional implications. However, it will be necessary to think beyond the core when defining project needs over the next several decades. Transportation to and from the core is as important as transportation within: therefore, six radial corridors have been defined based on the approximate travel sheds that feed into the Study Core. This study will identify mobility deficiencies both internal and external

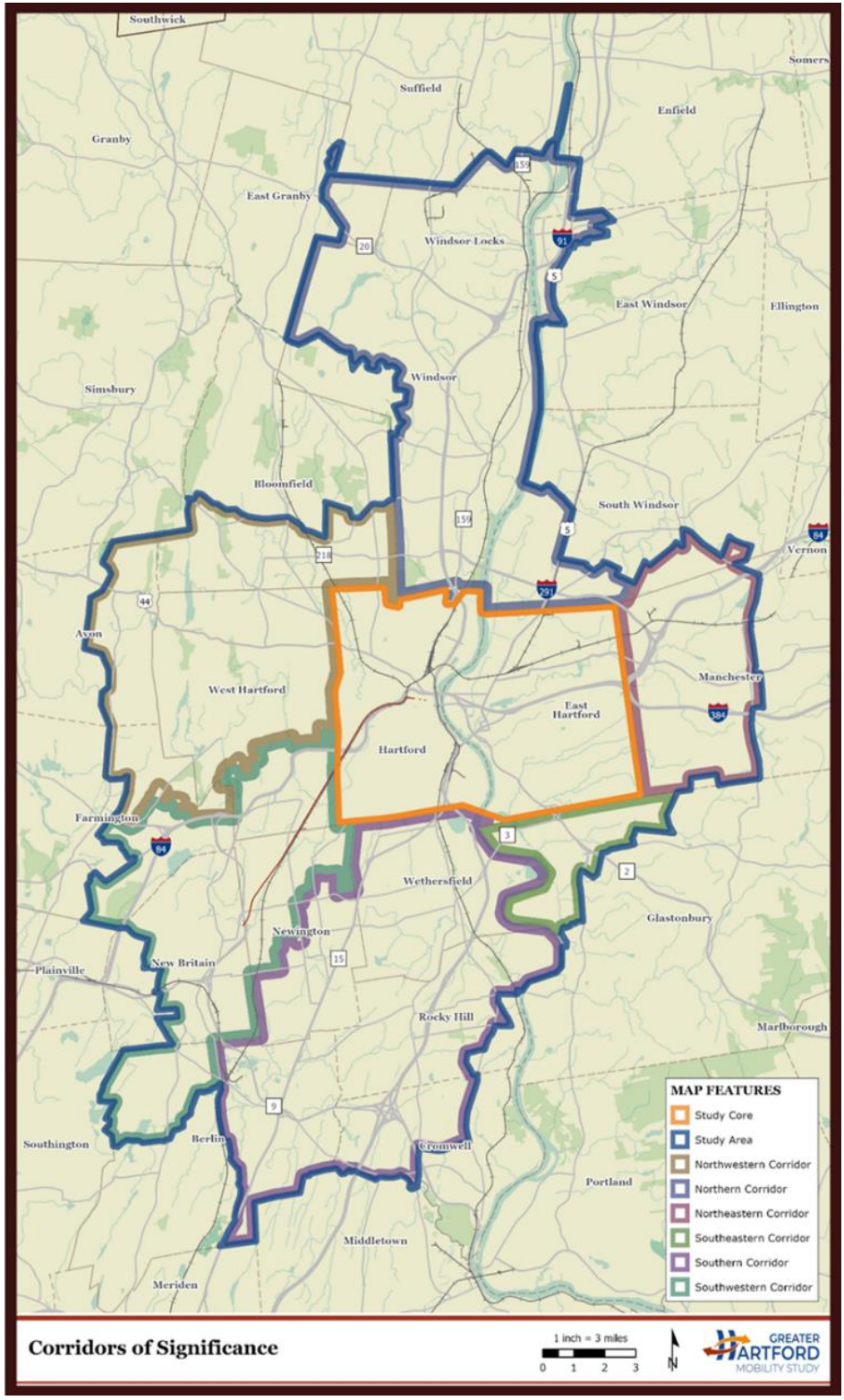
to the core. Potential transportation projects will be defined and studied based on logical endpoints to address those deficiencies.

PEL represents a collaborative and integrated approach to transportation decision-making that considers benefits and impacts of proposed transportation system improvements to the environment, community, and economy during the transportation planning process.

-FHWA

([https://www.environment.fhwa.dot.gov/env\\_initiatives/PEL.aspx](https://www.environment.fhwa.dot.gov/env_initiatives/PEL.aspx))

For analysis purposes, the study area was divided into seven (7) Corridors of Significance (COS) as shown . The COS form a primary multimodal transportation network that serve a vast number of people who move about the region. These corridors influence where people choose to live and work, where new development happens, the travel options that are available, and how the environment is impacted.



**Figure 1-3: Study Area and Corridors of Significance**



## 1.2 Vision and Goals

The GHMS will focus on identifying opportunities for successful implementation of a future transportation system that supports regional and state growth. A Vision Statement was developed for the purpose of creating a lens through which future transportation decision-making can be viewed. Projects that are defined by this study should be consistent with the Vision Statement, which is as follows:

*The Greater Hartford Mobility Study's Vision is to improve mobility by planning an integrated, resilient, multi-modal transportation system in the Greater Hartford Region thereby enhancing the quality of life, economic vitality, and opportunity in the region.*

The Vision is a high-level expression that is further defined by a set of Study Goals. The following five goals have been established:

1. *Improve the movement of people and goods.* This is a core study goal. Efficiently moving people and goods is essential for a healthy economy.
2. *Increase transportation options, accessibility, reliability and safety.* Transportation can no longer rely only on a system of roads and

highways to serve people's mobility needs. Sustainable transportation requires system redundancy and options for choosing how and when to make a trip. This includes making travel choices safe and reliable, as well as accessible to all people.

3. *Accommodate future needs and emerging technologies.* Just as important as addressing current system deficiencies, transportation improvements must consider the needs of future generations of users and upcoming innovative transportation technologies. Travel preferences are constantly in a state of change, as are decisions where people choose to live, work and play. Additionally, technology is an ever-evolving aspect continually impacting the status quo and the GHMS needs to consider the impacts of connected and autonomous vehicles, technology enabled transit, on-demand ride sharing, and alternative freight delivery technologies, among others.
4. *Prioritize social equity.* There has likely never been a time when social equity was a driving priority in so many areas of modern life. Public agencies are adapting to create a more inclusive and equitable future. Transportation should satisfy the needs of all users, regardless of race, color, gender, national origin, or economic status.
5. *Minimize environmental impacts.* CTDOT and partnering state agencies are committed to

addressing the deterioration of the natural and built environments. Transportation projects should avoid or minimize any further environmental impact, and should ideally improve conditions into the future.

The Vision Statement and Study Goals are the first steps towards establishing the means to identify and select potential transportation alternatives. During Phase 1 of GHMS, the study team will identify mobility deficiencies and develop quantifiable performance measures. These will be combined with the Vision Statement and Study Goals to create the Study Purpose and Need Statement.

### 1.3 Existing Conditions Approach

The existing condition performance assessment of the study area was conducted by the following modes and/or focus areas:

- Traffic
- Highway and safety
- Bus
- Rail
- Environmental resources and conditions
- Land use
- Multimodal connectivity

The COVID-19 pandemic significantly impacted transportation services, travel patterns and choices throughout 2020. While the transportation services and travel patterns are on the road to recovery in 2021, it is still too early to determine whether the transportation

industry will be back to the pre-pandemic levels or to a “new normal” with new travel patterns and choices. It is also unclear how quickly this full or partial recovery will happen.

Assuming that travel patterns and associated mobility considerations will be back to the pre-pandemic conditions, the GHMS team focused on pre-pandemic transportation data (mostly from 2019) to conduct multimodal existing conditions analysis. However, the team also recognizes significant and real potential for variations with travel behavior, travel choices, technological changes and policy implications that may impact transportation system performance and may alter transportation system improvement needs in upcoming years. As such, the team will be utilizing a Greater Hartford region-specific scenario planning tool for conducting future condition analysis.

As such, unless otherwise noted, the data used for conducting the existing conditions analysis is prior to COVID-19. At the time of publication, traffic volumes nationwide have mostly recovered to exceed pre-pandemic levels, but there are still lasting changes in the way people work and live. For example, the morning peak period has become less prominent, and mass transit ridership is still substantially below the pre-pandemic level.

## 2 Traffic Assessment

### 2.1 Introduction

This chapter focuses on summarizing existing traffic performance along key roadway corridors in the study area. Traffic performance is measured using various traffic variables such as overall traffic volumes, travel speed, traffic density, and delay. These variables have a direct connection with passenger and freight mobility within the study area. This chapter also outlines the findings of origin-destination (OD) patterns to better understand major traffic generators and attractors within the study area and overall accessibility.

**Mobility** is “**how far you can go in given time**” (a function of travel speed, traffic density/congestion, etc.)

**Accessibility** is “**how much you can get to in that time**” (a function of OD pairings, trip lengths, available travel options, etc.).

Both mobility and accessibility are important aspects for the Greater Hartford Mobility Study (GHMS).

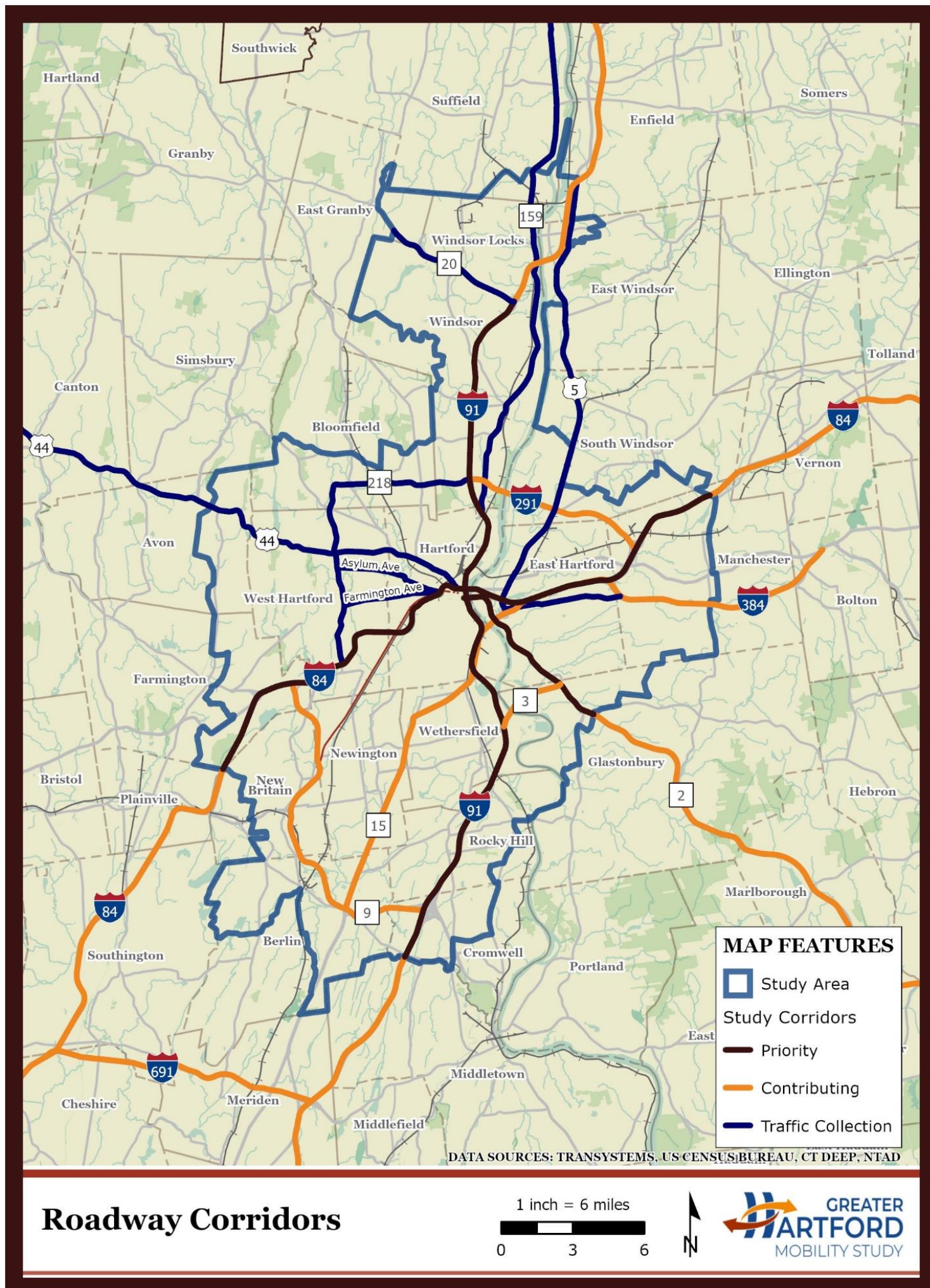
### 2.2 Traffic Data Collection

The following section details the sources and post-processing used for traffic data. This data was compiled in early 2021 using information from before the COVID-19 epoch (2019 and prior traffic data). This included traffic volumes collected by CTDOT, travel speeds from the National Performance Management Research Data Set (NPMRDS), and travel patterns from StreetLight Data, a big data platform for mobility.

Key study area roadway corridors were divided into three categories. Roads in the first category, Priority Corridors, are the most heavily used routes in the GHMS study area. These routes experience significant recurring congestion and account for a large portion of regional delay costs. The second category, Contributing Corridors, includes other high-volume, regionally significant routes within the Study Area. Finally, the Corridors for Traffic Collection category covers lower-volume arterials that act as crucial links between local destinations and the freeway network. Although they carry less traffic than freeways, these corridors have at-grade intersections that result in significant delay costs. **Table 2-1** and **Figure 2-1**, following, show the routes in each category.

**Table 2-1: GHMS Traffic Corridors**

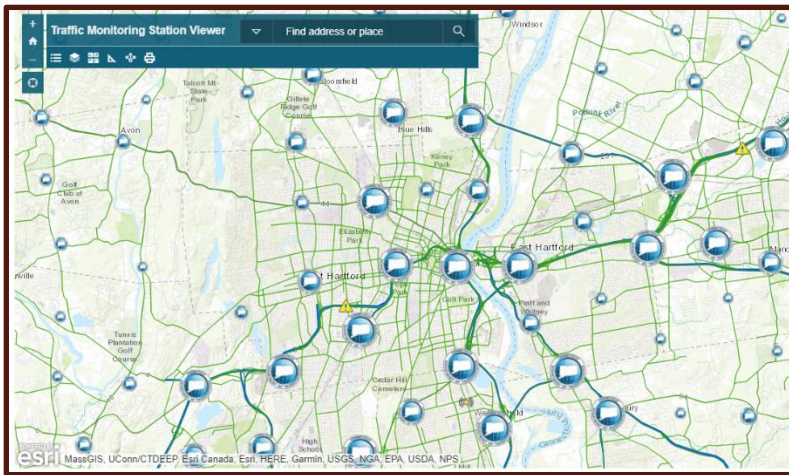
| Priority Corridors  | Contributing Corridors                          | Corridors for Traffic Collection  |
|---------------------|---|---|
| I-84; I-91; Route 2 | I-291; I-384; I-691; Route 3; Route 9; Route 15 | U.S. Route 5; U.S. Route 44; Route 20; Route 159; Route 218; Silver Lane (SR 502); Asylum Avenue; Farmington Avenue |



**Figure 2-1: Roadway Types for Data Collection and Analysis**

### 2.2.1 Traffic Volumes

Traffic volumes were collected from CTDOT count stations<sup>1</sup>. CTDOT collects traffic counts on a three-year cycle, with each freeway ramp and State-maintained route getting at least 24 hours of hourly traffic counts. These counts are normally taken on a weekday and avoid holidays or major construction. Since traffic volumes vary in a regular pattern, the CTDOT counts use a factor dependent on the month and day-of-week to turn a single day's counts into an estimate of annual average daily traffic (AADT). Some roads are counted more often, or have counts for several consecutive days, which allows a more thorough review of traffic patterns.



*Data from over 800 individual CTDOT count stations was used for GHMS.*

All recent (2015-2019) data was collected, along with older counts (especially where more recent information was not available), in order to provide at least 3 full days (72 hours) of counts at each location. 2020 counts were not considered due to COVID-19 related traffic anomalies. These counts were weighted based on how recently they were obtained. Counts were then adjusted using CTDOT's traffic adjustment factors to account for the month and day-of-week when they were taken.

The next step was to turn these isolated counts into a balanced count profile for each corridor. The balancing process seeks to establish a consistent set of counts along an entire route where, for a freeway, the total volume entering the road each hour equals the total volume exiting. The result was a 24-hour count profile for each corridor. An excerpt of one balanced count profile is shown in **Figure 2-2**.

<sup>1</sup> Available online at <https://tminfo-dot.ct.gov/TMINFO/index>.

| Final NB Location | I-91 NB      | To West St RKYH-117-North | I-91 NB      | From West St RKYH-116-North | I-91 NB      | To 99 RKYH-120-North | I-91 NB      | From 99 RKYH0121-North | I-91 NB      | To 3 & GMR WETH-272-North | To GMR WETH-283-North | To 3 NB WETH-270-North | I-91 NB      |
|-------------------|--------------|---------------------------|--------------|-----------------------------|--------------|----------------------|--------------|------------------------|--------------|---------------------------|-----------------------|------------------------|--------------|
| 12A               | 800          | 43                        | 757          | 32                          | 789          | 25                   | 764          | 47                     | 811          | 80                        | 3                     | 78                     | 730          |
| 1A                | 533          | 29                        | 504          | 18                          | 522          | 12                   | 510          | 29                     | 539          | 52                        | 3                     | 48                     | 488          |
| 2A                | 455          | 31                        | 424          | 23                          | 447          | 10                   | 437          | 25                     | 462          | 37                        | 4                     | 33                     | 425          |
| 3A                | 508          | 46                        | 462          | 28                          | 490          | 10                   | 479          | 25                     | 505          | 41                        | 1                     | 40                     | 464          |
| 4A                | 838          | 70                        | 768          | 63                          | 830          | 29                   | 801          | 60                     | 861          | 97                        | 2                     | 95                     | 764          |
| 5A                | 1730         | 184                       | 1547         | 82                          | 1629         | 90                   | 1539         | 115                    | 1654         | 273                       | 11                    | 262                    | 1381         |
| 6A                | 4489         | 610                       | 3879         | 229                         | 4108         | 251                  | 3857         | 287                    | 4144         | 817                       | 43                    | 774                    | 3326         |
| 7A                | 6840         | 1041                      | 5798         | 447                         | 6245         | 533                  | 5712         | 506                    | 6218         | 1299                      | 110                   | 1188                   | 4919         |
| 8A                | 6009         | 1066                      | 4942         | 545                         | 5487         | 561                  | 4926         | 503                    | 5429         | 1496                      | 93                    | 1402                   | 3933         |
| 9A                | 4186         | 581                       | 3604         | 407                         | 4012         | 354                  | 3658         | 427                    | 4085         | 960                       | 77                    | 883                    | 3125         |
| 10A               | 3633         | 434                       | 3199         | 322                         | 3521         | 299                  | 3222         | 351                    | 3573         | 744                       | 57                    | 687                    | 2829         |
| 11A               | 3832         | 454                       | 3378         | 346                         | 3724         | 352                  | 3371         | 367                    | 3739         | 754                       | 60                    | 695                    | 2984         |
| 12P               | 3860         | 466                       | 3395         | 376                         | 3771         | 401                  | 3370         | 460                    | 3830         | 844                       | 85                    | 760                    | 2986         |
| 1P                | 3819         | 453                       | 3366         | 354                         | 3720         | 345                  | 3375         | 441                    | 3816         | 878                       | 68                    | 810                    | 2938         |
| 2P                | 4236         | 501                       | 3735         | 376                         | 4111         | 352                  | 3759         | 466                    | 4225         | 1121                      | 72                    | 1048                   | 3104         |
| 3P                | 5104         | 590                       | 4514         | 536                         | 5050         | 430                  | 4620         | 486                    | 5106         | 1615                      | 88                    | 1527                   | 3491         |
| 4P                | 5562         | 754                       | 4808         | 642                         | 5450         | 503                  | 4947         | 507                    | 5454         | 1831                      | 85                    | 1746                   | 3623         |
| 5P                | 5479         | 748                       | 4731         | 603                         | 5334         | 524                  | 4810         | 502                    | 5312         | 1738                      | 78                    | 1660                   | 3573         |
| 6P                | 3686         | 469                       | 3217         | 387                         | 3605         | 311                  | 3294         | 433                    | 3726         | 1052                      | 56                    | 996                    | 2675         |
| 7P                | 2450         | 335                       | 2116         | 235                         | 2351         | 225                  | 2126         | 328                    | 2454         | 587                       | 33                    | 555                    | 1867         |
| 8P                | 2314         | 285                       | 2029         | 177                         | 2206         | 169                  | 2036         | 256                    | 2293         | 465                       | 28                    | 437                    | 1828         |
| 9P                | 1807         | 214                       | 1593         | 123                         | 1716         | 158                  | 1558         | 195                    | 1753         | 316                       | 14                    | 302                    | 1436         |
| 10P               | 1458         | 145                       | 1313         | 88                          | 1401         | 93                   | 1307         | 160                    | 1467         | 222                       | 11                    | 211                    | 1245         |
| 11P               | 1292         | 89                        | 1203         | 54                          | 1257         | 50                   | 1207         | 87                     | 1294         | 184                       | 8                     | 177                    | 1110         |
| AM                | 17337        | 2718                      | 14619        | 1220                        | 15839        | 1345                 | 14495        | 1296                   | 15791        | 3612                      | 247                   | 3365                   | 12179        |
| MD                | 23565        | 2889                      | 20677        | 2181                        | 22858        | 2102                 | 20756        | 2511                   | 23267        | 5301                      | 418                   | 4883                   | 17966        |
| PM                | 16144        | 2092                      | 14053        | 1782                        | 15834        | 1458                 | 14376        | 1496                   | 15872        | 5185                      | 251                   | 4934                   | 10687        |
| NT                | 17871        | 1939                      | 15932        | 1308                        | 17241        | 1183                 | 16058        | 1760                   | 17818        | 3407                      | 174                   | 3232                   | 14412        |
| Daily             | <b>74918</b> | <b>9637</b>               | <b>65281</b> | <b>6492</b>                 | <b>71772</b> | <b>6088</b>          | <b>65685</b> | <b>7063</b>            | <b>72748</b> | <b>17504</b>              | <b>1089</b>           | <b>16415</b>           | <b>55243</b> |
| CTDOT Est         | <b>76100</b> | <b>8000</b>               | <b>66800</b> | <b>6500</b>                 | <b>73300</b> | <b>5700</b>          | <b>67200</b> | <b>7200</b>            | <b>73900</b> | <b>16500</b>              | <b>1100</b>           | <b>17900</b>           | <b>57400</b> |

**Figure 2-2: Example Balanced Count Profile**

One important item to note is that, due to the CTDOT factors, these counts represent an average day of the year – traffic volumes during busy months, special events, or on Fridays are significantly higher than average. In addition, grouping traffic counts into one-hour bins results in an underestimate of actual peak

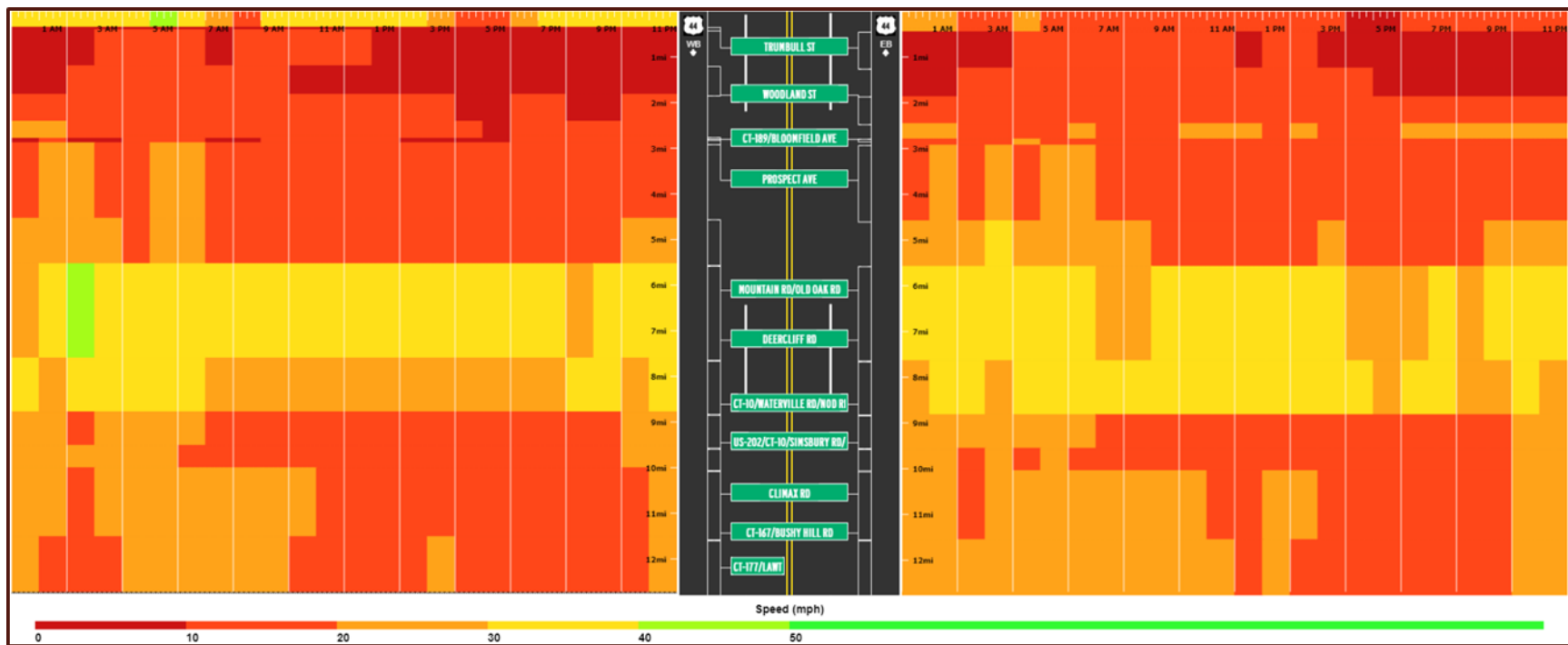
volumes<sup>2</sup>. As a result, the volumes in the balanced count profile cannot be used alone to determine whether a road segment is congested. Travel speed data and densities discussed in the next section help with determining congestion hotspots within the study area.

<sup>2</sup> The Highway Capacity Manual recommends the use of a peak hour factor to account for this. On a freeway, the peak 15-minute flow is typically 5-10% higher than the average hourly flow.

### 2.2.2 Travel Speeds and Densities

Average travel speeds were obtained via the NPMRDS Congestion Scan. This data was originally collected by INRIX using location-based cell phone services, and can be queried via the NPMRDS website<sup>3</sup> in order to analyze congestion trends one hour at a time. Weekday speeds on each route were averaged over the three-year period from January 2017 through December 2019.

Travel speed is a useful indicator for congestion, and can be combined with traffic volume, segment length, number of lanes, and value of time to produce delay, delay cost, density, travel time, and travel time index. The density can, in turn, be used to estimate level of service. A heat map from NPMRDS, showing how average speeds change over time and location, is shown in **Figure 2-3**.



**Figure 2-3: Example NPMRDS Heat Map**

<sup>3</sup> Available online at <https://npmrds.ritis.org/analytics/> (registration required).

Delay was calculated for each segment and hour based on the difference between the off-peak and peak travel speeds and the traffic volume. The value of time was taken from the Texas Transportation Institute: \$17.91 per hour for passenger vehicles, and \$100.49 per hour for commercial vehicles. All monetary values reflect current (2021 dollars).

### 2.3 Priority Corridors Traffic Assessment

The Priority Corridors are I-84 from New Britain to Vernon, I-91 from Cromwell to Windsor Locks, and Route 2 from Hartford to Glastonbury. Traffic volumes for each Priority Corridor are given in Appendix 1 - balanced count profile appendix. The highest daily volumes on I-84, I-91, and Route 2 are 175,400, 157,000, and 86,700 respectively.

#### 2.3.1 I-84 Eastbound

Travel patterns on I-84 Eastbound are shown in **Figure 2-5**. In this diagram, traffic is moving from left to right. The thickness of the lines indicates the average hourly traffic volume during each period, with thicker lines representing more vehicles. I-84 Eastbound carries vehicles per day on its busiest segment.

Broadly speaking, traffic patterns on I-84 Eastbound can be summarized as heading into Hartford in the morning and leaving in the evening. West of Hartford (left side of **Figure 2-5**), traffic volumes are highest during the morning peak as commuters head into the city. Around the Broad Street on-ramp, the trend reverses, as evening traffic departing the city grows

busier than morning and mid-day traffic. It is worth noting that despite this trend, traffic volumes remain high throughout the day all along I-84. It is only during the overnight hours that volumes subside.

I-84 has an eastbound high-occupancy vehicle (HOV) lane from East Hartford to Vernon. Traffic volumes in the HOV lane show a much more distinct peak, with nearly half of its daily traffic occurring during the three-hour evening peak.

*Drivers are using HOV lanes primarily when speeds on I-84 decrease and avoid them otherwise.*

I-84 Eastbound experiences congestion throughout the day, but it is heaviest during peak periods. During the morning peak, when inbound traffic is at its highest, speeds drop from Farmington east through Hartford, with the lowest speeds (18 mph) in West Hartford around the Park Rd. exit. Speeds in Hartford remain below 50 mph, then drop again during the evening peak. Evening congestion is more severe, with speeds as low as 8 mph around the Sisson Avenue ramps. Though congestion is worst in Hartford, slowdowns extend east to Vernon, recovering around Route 30 (see **Figure 2-4**). The posted speed limit on I-84 ranges between 50-65 mph within the study area.



On an average day, I-84 Eastbound experiences 5,000 vehicle-hours of delay between I-691 in Southington and Route 31 in Vernon. With an approximate commercial vehicle percentage of 8%, the annual cost of delay on I-84 Eastbound is as follows.

*I-84 Eastbound Annual Cost of Delay:  
Passenger Cars: Approx. \$30 Million  
Commercial Vehicles: Approx. \$15 Million*

### 2.3.2 I-84 Westbound

Travel patterns on I-84 Westbound are shown in **Figure 2-6**. In this diagram, traffic is moving from right to left.

A similar trend is apparent in this direction: morning volumes are heaviest entering Hartford, and evening volumes are heaviest leaving the city. For westbound traffic, the turning point appears to be around the Asylum Street off-ramp, but mid-day volumes in Hartford do not decrease much relative to peak volumes, indicating that the road is busy throughout the daylight hours. Once again, overnight volumes are much lower.

I-84 has a westbound HOV lane from Vernon to East Hartford. Traffic volumes in the HOV lane show a much more distinct peak, with nearly half of its daily traffic occurring during the three-hour morning peak.

This indicates that drivers are using the HOV lane primarily when speeds on I-84 Westbound decrease and avoid it otherwise.

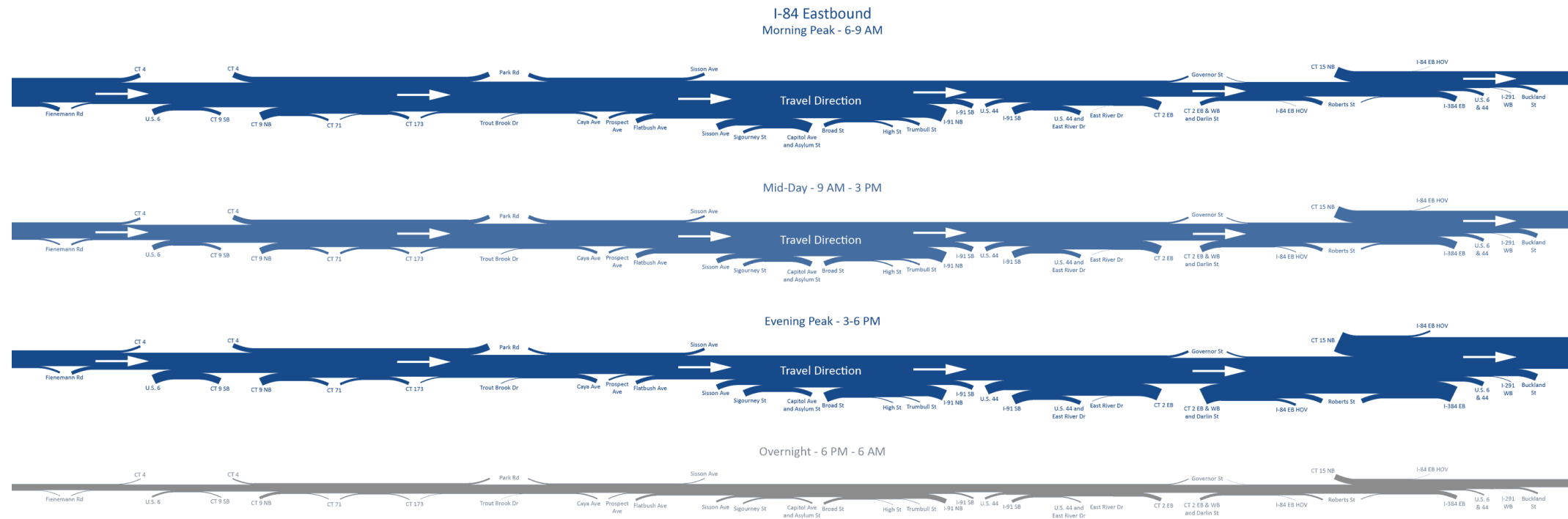
Like I-84 Eastbound, I-84 Westbound experiences congestion throughout the day, but it is heaviest during peak periods (see **Figure 2-7**). During the morning peak, when inbound traffic is at its highest, traffic slows down from the Governor Street exit in East Hartford to the Asylum Street exit in Hartford. The lowest speeds (15 mph) occur in East Hartford approaching the Bulkeley Bridge. Evening congestion is more severe, with speeds dropping to 13 mph in East Hartford and congested conditions extending to Route 9 in Farmington. The posted speed limit on I-84 ranges between 50-65 mph within the study area.

On an average day, I-84 Westbound experiences 4,600 vehicle-hours of delay between Route 31 in Vernon and I-691 in Southington. With an approximate commercial vehicle percentage of 8%, the annual cost of delay on I-84 Westbound is \$41.1 million.

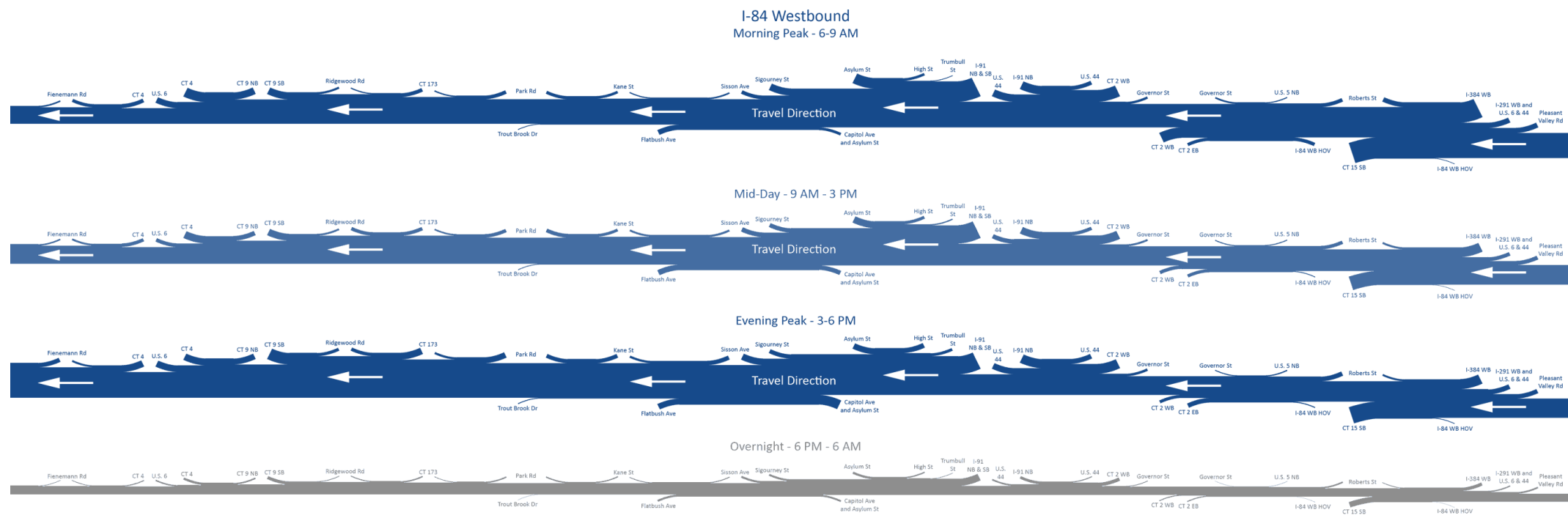
*I-84 Westbound Annual Cost of Delay:  
Passenger Cars: Approx. \$27.5 Million  
Commercial Vehicles: Approx. \$13.5 Million*



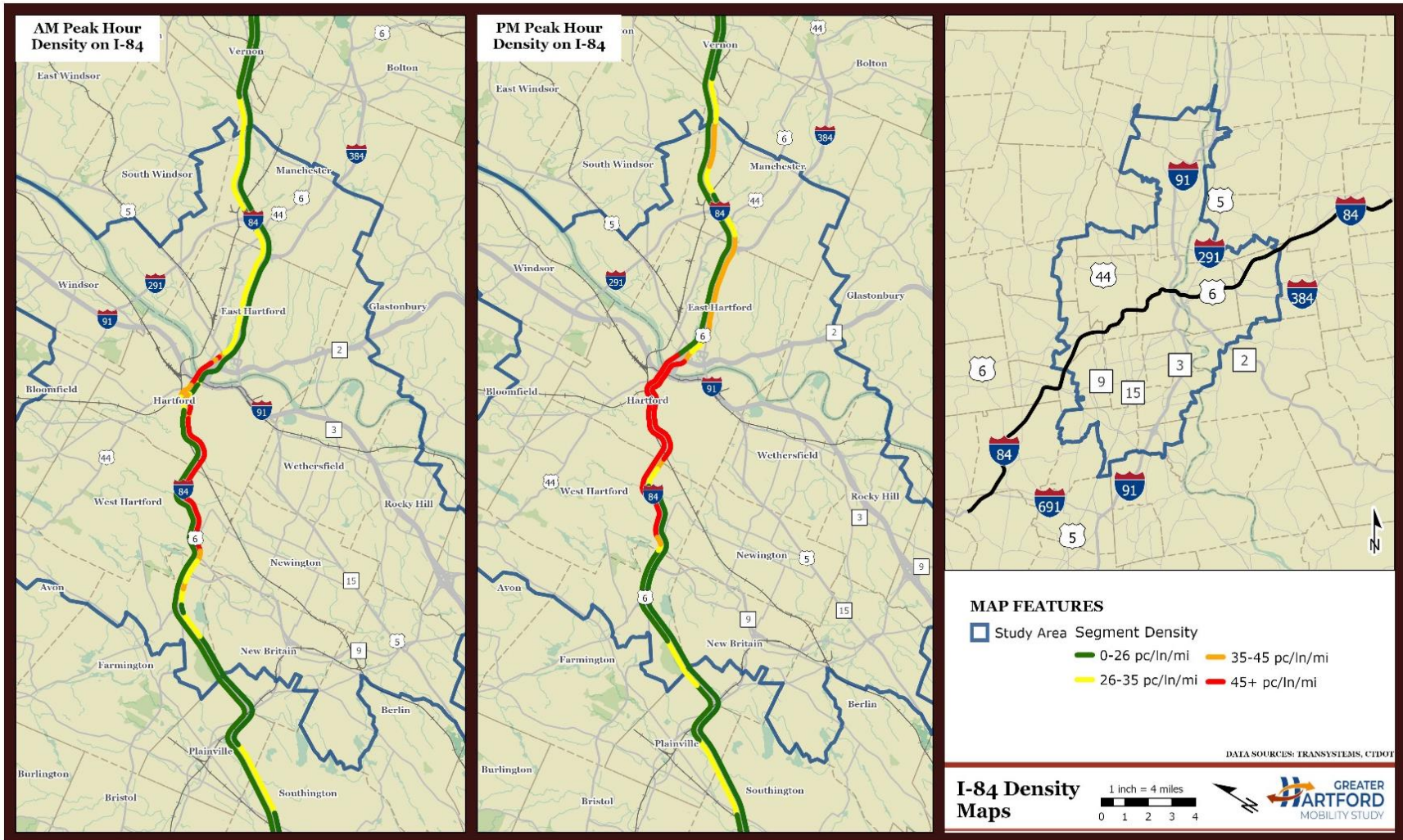
**Figure 2-4: I-84 Speed Maps**



**Figure 2-5: I-84 Eastbound Travel Patterns**



**Figure 2-6: I-84 Westbound Travel Patterns**



**Figure 2-7: I-84 Density Maps**

## Key Findings for I-84 Corridor

- ❖ Traffic volumes show predominant **study core-centric (Hartford & East Hartford) directional flows** – highest inbound volumes in AM peak and highest outbound volumes in PM peak.
- ❖ **PM peak is more severe** both in terms of increased congestion (higher traffic density) and corresponding reduced speeds (delay) dropping below 10 mph for some sections.
- ❖ **HOV lanes are predominantly used during peak hours** when I-84 mainline speeds are lower.
- ❖ **Congested areas** in the study core **correlate with increased crash rates**, especially around the Union Station curve and in weave areas.
- ❖ **Annual cost of recurring delays** is approximately \$85 million, a third of which is incurred by commercial/freight operators.

### 2.3.3 I-91 Northbound

Travel patterns on I-91 Northbound are shown in **Figure 2-9**. In this diagram, traffic is moving from left to right.

I-91 shares some characteristics with I-84. Commuters from south of Hartford (left side of **Figure 2-9**) take I-91 to the city during the morning peak, and commuters from north of Hartford leave the city in the evening peak. This pattern is much less pronounced, though, than it is on I-84. For example, I-91 in Rocky Hill has high volumes throughout the daylight hours, with only a slight reduction mid-day. Interchanges with Route 3, Route 15, and I-84 are likewise busy from morning through evening. It is only after 6 PM that I-91 volumes drop off.

I-91 has a northbound HOV lane in Hartford and Windsor. Traffic volumes in the HOV lane show a distinct peak, with over 40% of its daily traffic occurring during the three-hour evening peak. This indicates that drivers are using the HOV lane primarily when speeds on I-91 Northbound decrease and avoid it otherwise.

I-91 Northbound experiences congestion mainly during peak periods. During the morning peak, there are intermittent slowdowns south of Route 9 in Cromwell and from Route 3 in Wethersfield to the Charter Oak Bridge in Hartford. Average speeds are as low as 37 mph in Hartford (see **Figure 2-8**).

*In the evening peak, the ramp to the Charter Oak Bridge remains a pinch point, causing queues that frequently extend over a mile and average speeds of 24 mph.*

Farther north, another stretch of evening congestion extends from I-84 in Hartford to Route 178 in Windsor.

On an average day, I-91 Northbound experiences 3,400 vehicle-hours of delay between Route 15 in Meriden and Route 140 in East Windsor. With an approximate commercial vehicle percentage of 13%, the annual cost of delay on I-91 Northbound is \$34.9 million.

#### 2.3.4 I-91 Southbound

Travel patterns on I-91 Southbound are shown in **Figure 2-10**. In this diagram, traffic is moving from right to left. Similar to I-91 Northbound, there is a moderate inbound trend in the morning and outbound in the evening.

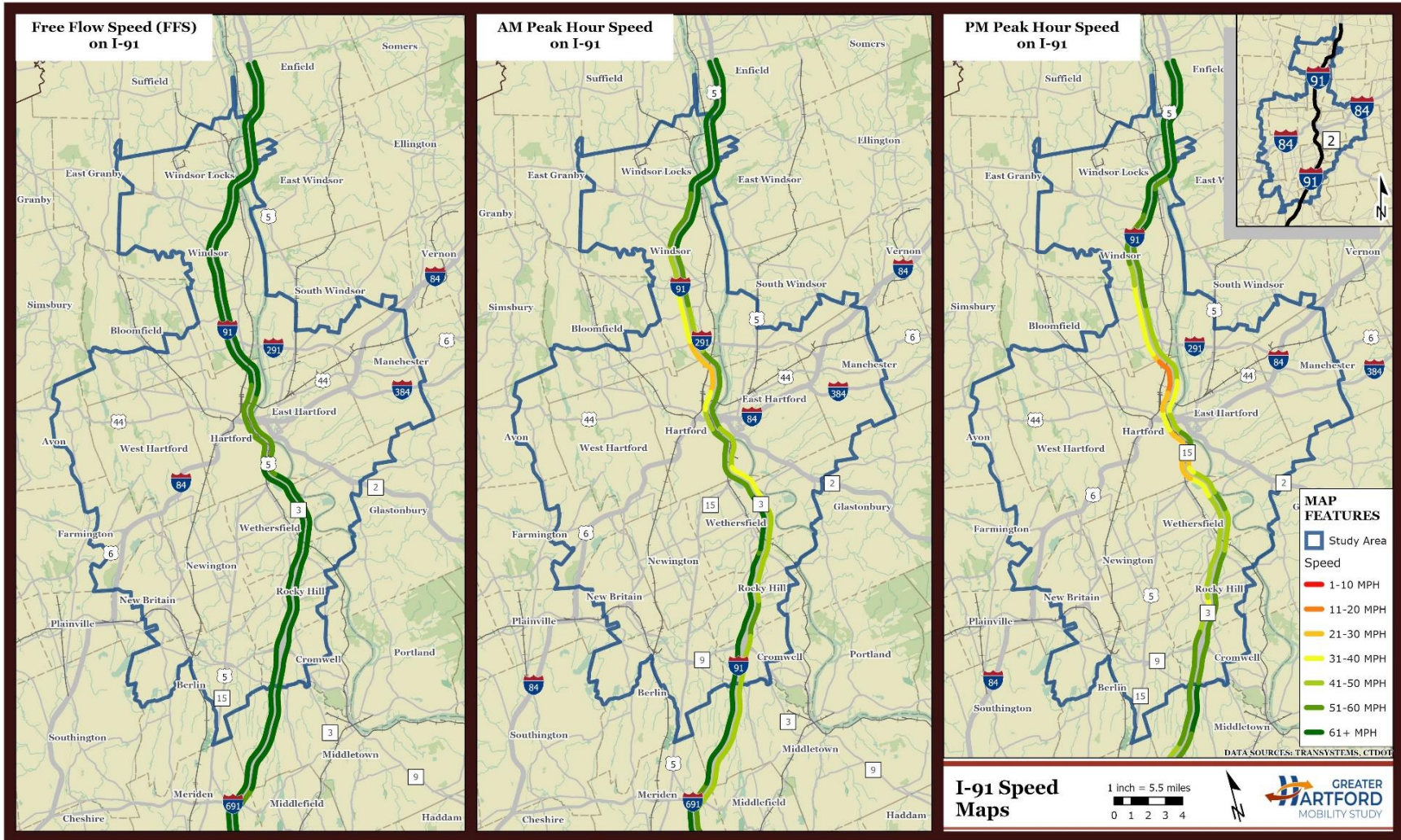
Mid-day volumes are also relatively high, especially within Hartford, where they are nearly as high as the

peaks. Its interchanges with Route 3, Route 15, and I-84 are busy throughout the daylight hours. The volumes are much lower overnight.

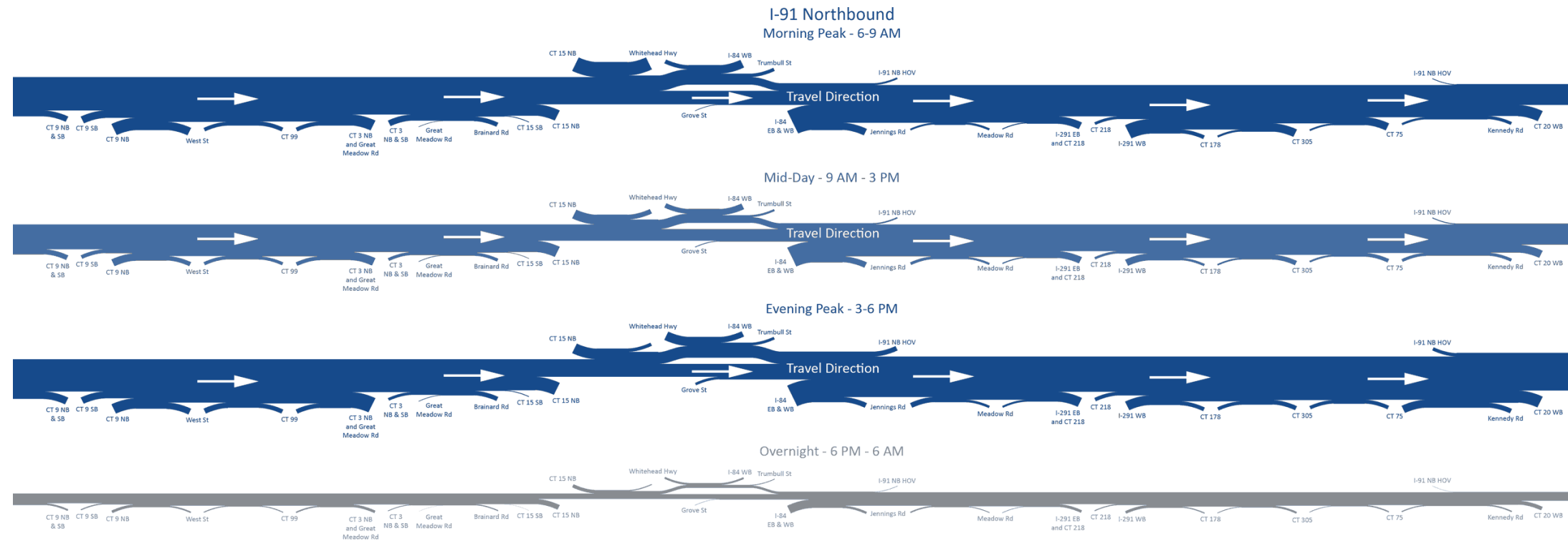
I-91 has a southbound HOV lane in Windsor and Hartford. Unlike the other HOV lanes, the southbound lane is busy during both the morning and evening peaks. This is likely because I-91 Southbound experiences recurring congestion from I-291 to I-84 in both peaks, and drivers are using the HOV lane to get around that congestion.

I-91 Southbound experiences congestion mainly during peak periods (see **Figure 2-11**). During the morning peak, congestion begins at Route 75 in Windsor and extends south to I-84 in Hartford, with average speeds as low as 23 mph in Hartford's North Meadows. In the evening peak, congestion is more extensive and severe. Slowdowns extend from Route 305 in Windsor to Route 3 in Wethersfield, then from Route 9 in Rocky Hill to Route 15 in Meriden. Evening speeds are slowest (17 mph) around Jennings Road in Hartford. The posted speed limit on I-91 ranges between 55-65 mph within the study area.

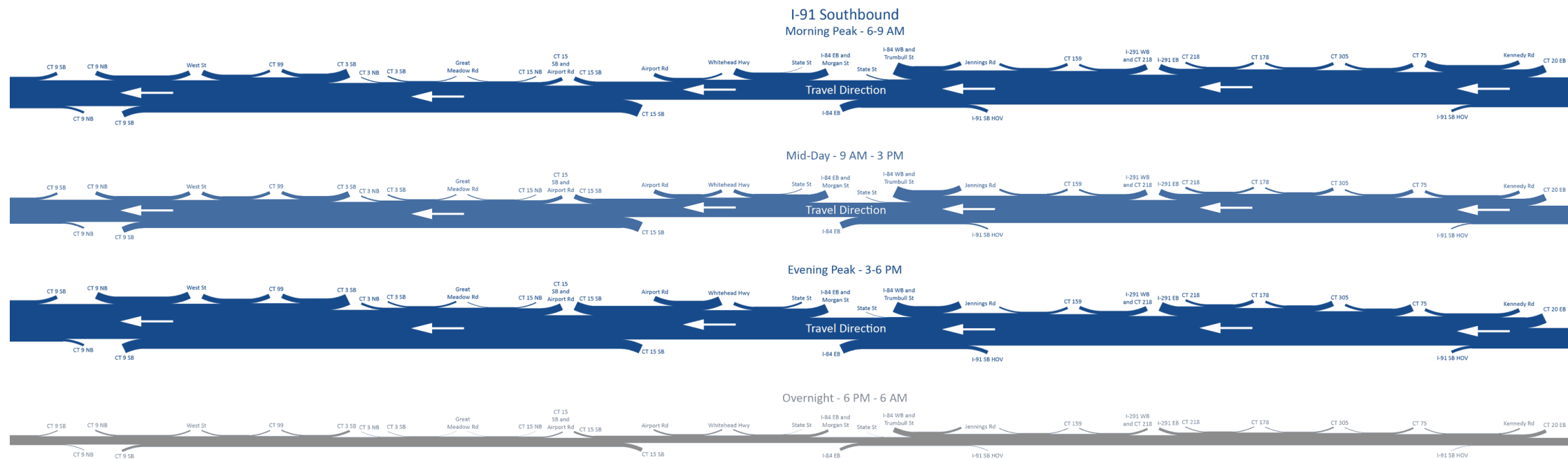
On an average day, I-91 Southbound experiences 6,500 vehicle-hours of delay between Route 140 in East Windsor and Route 15 in Meriden. With an approximate 13 % commercial vehicle share, the annual cost of delay on I-91 Southbound is \$67.7 million.



**Figure 2-8: I-91 Speed Maps**

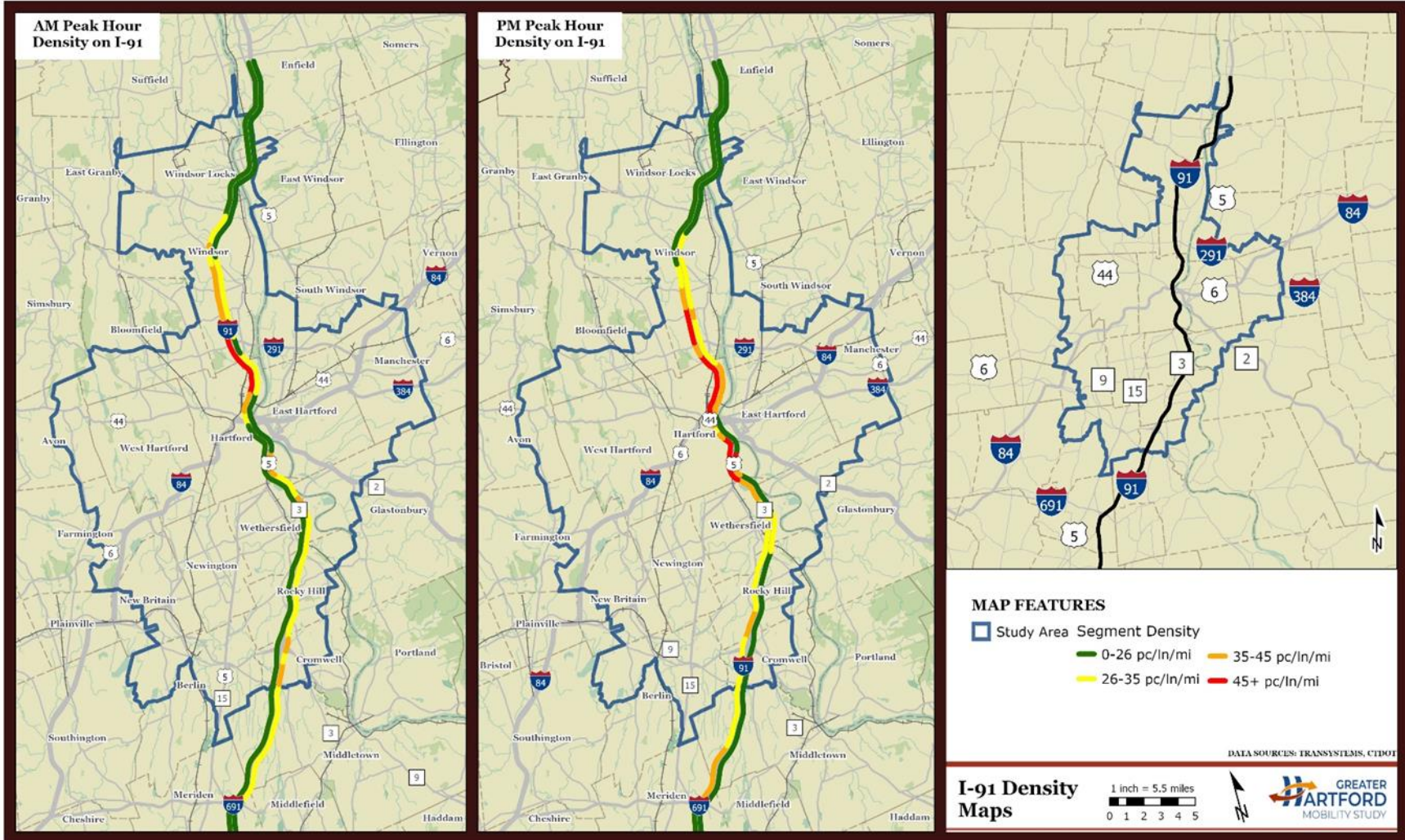


**Figure 2-9: I-91 Northbound Travel Patterns**



**Figure 2-10: I-91 Southbound Travel Patterns**





**Figure 2-11: I-91 Density Maps**

### Key Findings for I-91 Corridor

- ❖ Traffic volumes show **less predominant study core-centric (Hartford & East Hartford) directional flow tendencies** compared to I-84 – mid-day volumes are also relatively high.
- ❖ **HOV lanes are predominantly used during peak hours** when I-91 mainline speeds are lower.
- ❖ **PM peak congestion is more severe** compared to AM.
- ❖ Northbound **congestion at the Route 15 interchange in Hartford is associated with a very high crash rate** on I-91.
- ❖ **Annual cost of recurring delays** is approximately \$102 million.

#### 2.3.5 Route 2 Eastbound

Travel patterns on Route 2 Eastbound are shown in **Figure 2-13**. In this diagram, traffic is moving from left to right. Route 2 Eastbound displays a much higher disparity between peak hours than either I-84 or I-91. Eastbound volumes increase gradually throughout the

day, peaking in the evening, when most commuters are heading out of Hartford. Of particular note is the leftmost portion of the diagram, which represents the Founders Bridge.

*Most traffic using the Founders Bridge is continuing to I-84 Eastbound, not staying on Route 2. Similarly, much of the traffic on Route 2 Eastbound comes across the Bulkeley Bridge on I-84 Eastbound.*

Like the other Priority Corridors, volumes drop overnight.

Route 2 Eastbound is only congested during the evening peak. This coincides with commuter traffic leaving Hartford. Speeds are slow between I-84 and Maple Street, both in East Hartford. The slowest speed, 23 mph, is beneath the Charter Oak Bridge where Route 2 Eastbound drops from three basic lanes to two.

On an average day, Route 2 Eastbound experiences 430 vehicle-hours of delay between State Street in Hartford and Route 83 in Glastonbury. With an approximate commercial vehicle percentage of 3%, the annual cost of delay on Route 2 Eastbound is \$3.2 million.

### 2.3.6 Route 2 Westbound

Travel patterns on Route 2 Westbound are shown in **Figure 2-13**. In this diagram, traffic is moving from right to left. The time-of-day differences are less pronounced in the westbound direction. Though the morning peak is clearly the busiest, especially on the Founders Bridge at the left edge of the figure, evening volumes are similarly high in some locations.

There are many employment centers near Route 2 in East Hartford and Glastonbury, and the volumes indicate that employees at these locations use Route 2 to get to I-84. Like the other Priority Corridors, traffic decreases after 6 PM.

Route 2 Westbound experiences congestion during both peak periods (see **Figure 2-13**). In the morning, when traffic volumes are highest, Route 2 is congested from Route 17 in Glastonbury to the Founders Bridge in Hartford. Speeds on the bridge itself are relatively low throughout the day due to the traffic signal on its west end, but queues extend farther, and speeds are lower during peak periods. In East Hartford, the slowest morning peak speeds are 23 mph in the vicinity of Pitkin Street (see **Figure 2-12**). In the evening, congestion extends from Pitkin Street to I-84, with speeds as low as 22 mph around the I-84 interchange. The posted speed limit on Route 2 is 55 mph within the study area.

On an average day, Route 2 Westbound experiences 770 vehicle-hours of delay between Route 83 in Glastonbury and State Street in Hartford. With an approximate commercial vehicle percentage of 3%, the

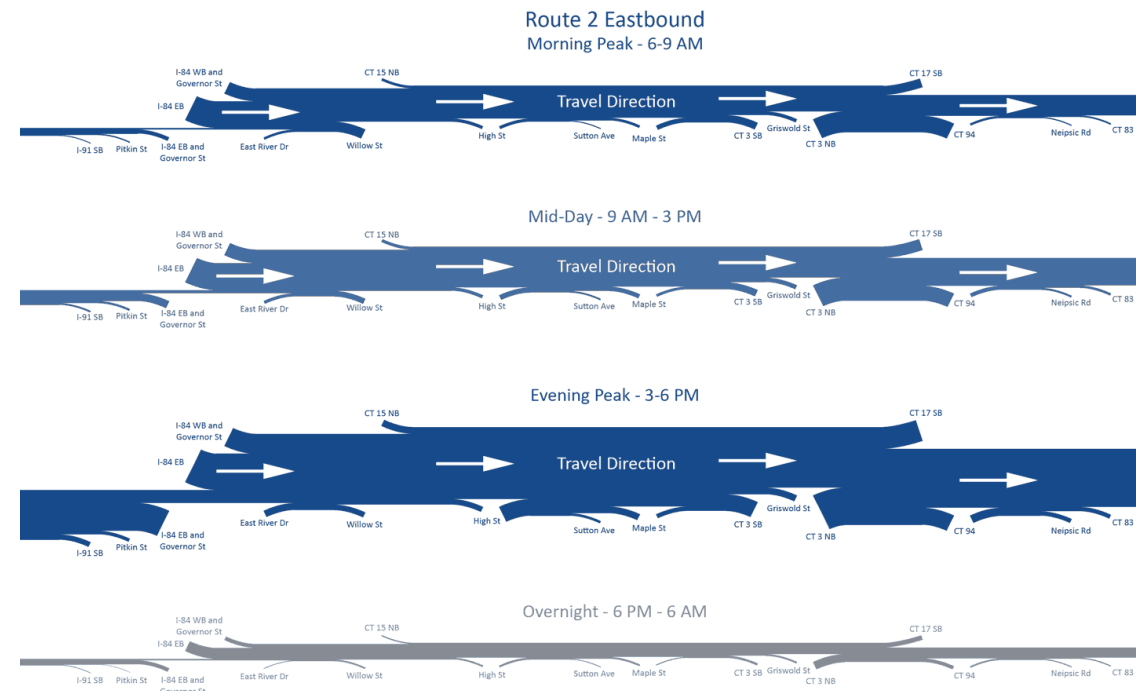
annual cost of delay on Route 2 Westbound is \$5.7 million.

### Key Findings for Route 2 Corridor

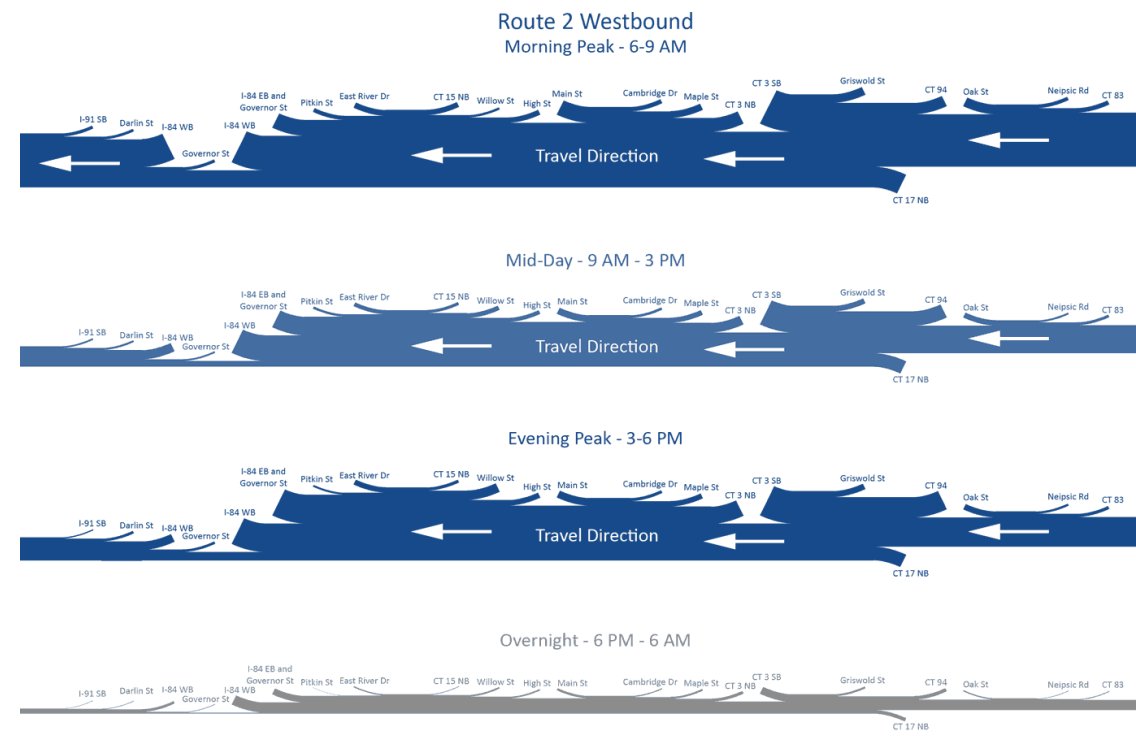
- ❖ **Route 2 Eastbound** displays much higher disparity between peak hours than I-84 and I-91. It is **only congested during evening peak**.
- ❖ **Cost of recurring congestion** related delay is approximately \$10 million, which is **significantly lower for Route 2 compared to I-84 and I-91**.
- ❖ **Speeds on the Founders Bridge itself are relatively low throughout the day** due to the traffic signal on its west end, but queues extend farther, and speeds are lower during peak periods. Crash rates on the Founders Bridge are higher than elsewhere in the corridor.



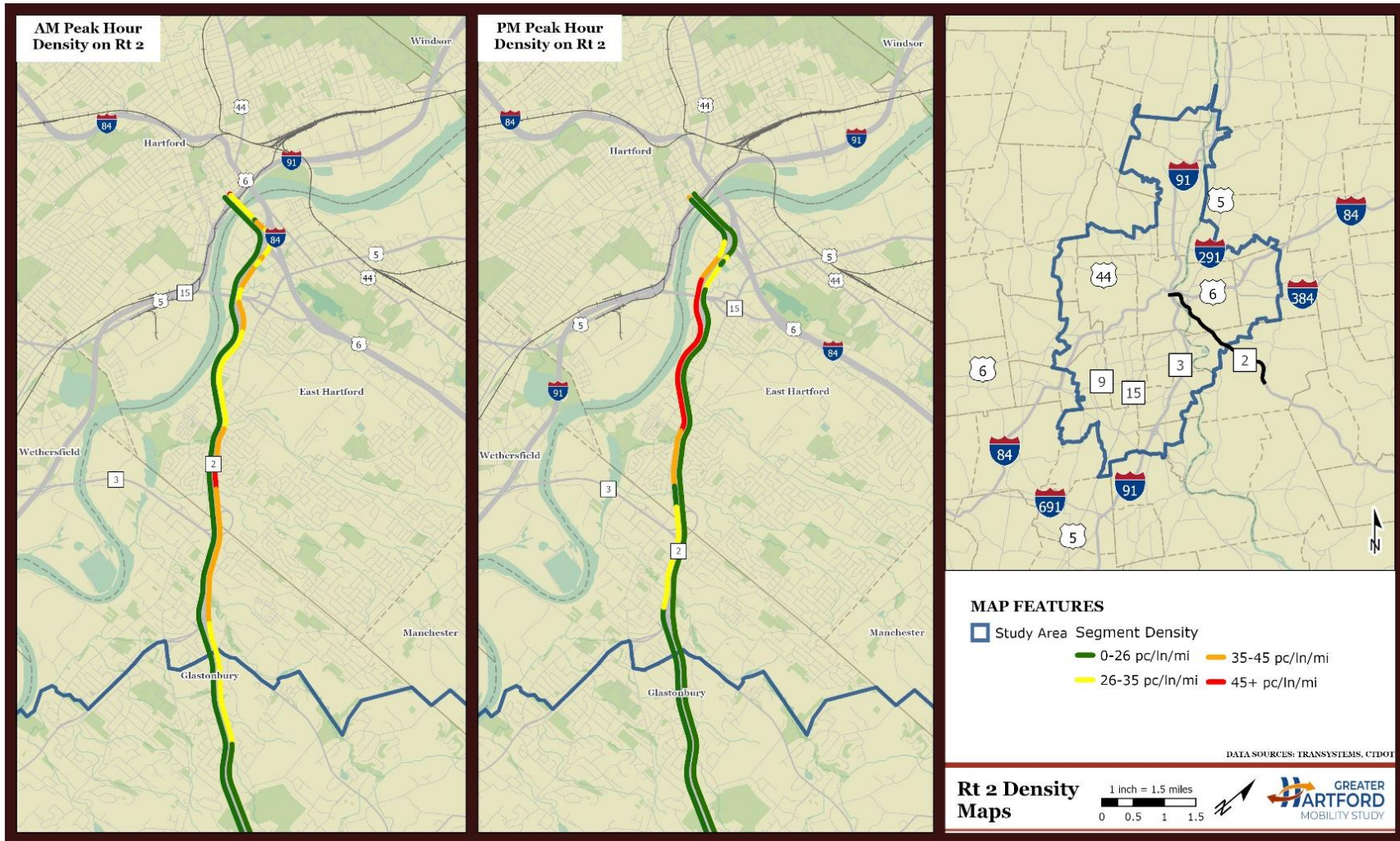
**Figure 2-12: Route 2 Speed Maps**



**Figure 2-13: Route 2 Eastbound Travel Patterns**



**Figure 2-14: Route 2 Westbound Travel Patterns**



**Figure 2-15: Route 2 Density Maps**

## 2.4 Contributing Corridors Traffic Assessment

*Definition of Contributing Corridors:  
Contributing Corridors are the other high-volume, regionally significant routes within the study area that are not classified as Primary Corridors.*

The Contributing Corridors for the GHMS are as follows:

- I-291
- I-384 (partially within the GHMS study area and partially outside)
- I-691 (fully outside the GHMS study area)
- Route 3 between I-91 and Route 2
- Route 9 between I-91 and I-84
- Route 15 between Route 9 and I-84

In addition, some portions of I-84, I-91, and Route 2 outside of the study area are considered to be Contributing Corridors.

Traffic volumes for each Contributing Corridor are given in Appendix 1 - balanced count profile appendix.

### 2.4.1 I-291

*I-291 serves as a bypass around Hartford to the northeast, allowing tens of thousands of vehicles per day to avoid much of the recurring congestion on I-91 and I-84.*

In addition, I-291 provides a way for traffic to access U.S. Route 5 in South Windsor without going through downtown East Hartford. Its busiest segment is the Bissell Bridge, where nearly 68,000 vehicles cross the Connecticut River each day, split roughly equally between eastbound and westbound traffic. I-291 has two basic lanes in each direction. Listed from west to east, the freeway has interchanges with:

- Route 218 (17,000 veh/day)
- I-91 (42,000 veh/day)
- Deerfield Road (9,000 veh/day)
- U.S. Route 5 (33,000 veh/day)
- Tolland Turnpike / Chapel Road (13,000 veh/day)
- I-384 (18,000 veh/day)
- I-84 (23,000 veh/day)

I-291 has a clear peaking pattern, with heavy westbound volumes in the morning and heavy eastbound volumes in the evening. In this way, its traffic pattern echoes that of I-84 east of Hartford. Unlike I-84, however, most of this peak period traffic is

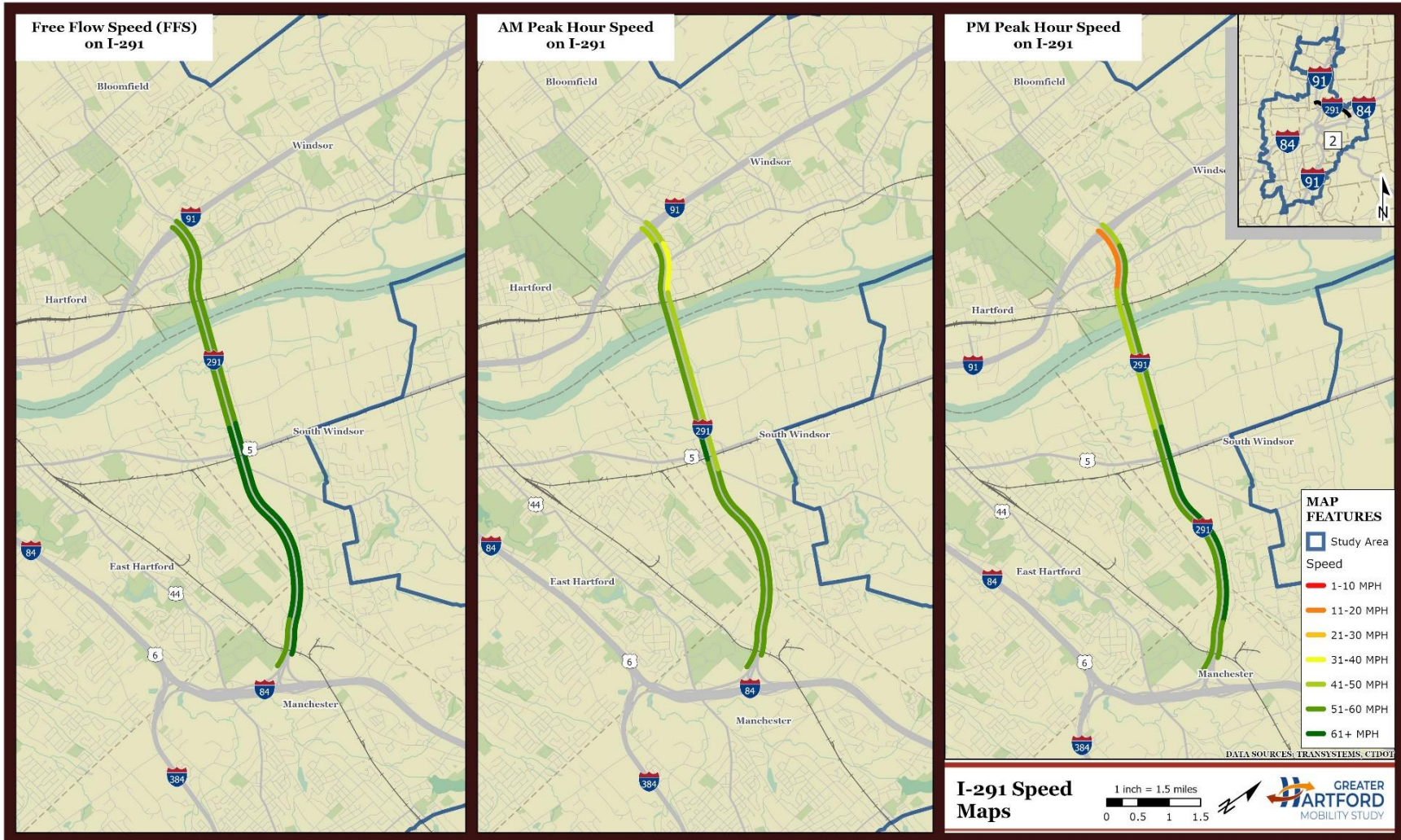
going to or from the north (via I-91) or west (via Route 218), with only a small portion going to or from downtown Hartford.

Congestion on I-291 occurs west of U.S. Route 5, and is confined to the peak periods (see **Figure 2-17**). In the morning, westbound traffic slows down to 39 mph approaching the ramp to I-91 Northbound. The traffic volume on this single-lane ramp exceeds 1,700 vehicles per hour during the morning peak, which is near the ramp's capacity. In the evening, congestion is more severe and occurs in the eastbound direction. Average speeds drop as low as 16 mph at the I-91 interchange (see Figure 2-16). The posted speed limit on I-291 (for sections considered as the Contributing Corridors) ranges between 40-65 mph within the study area.

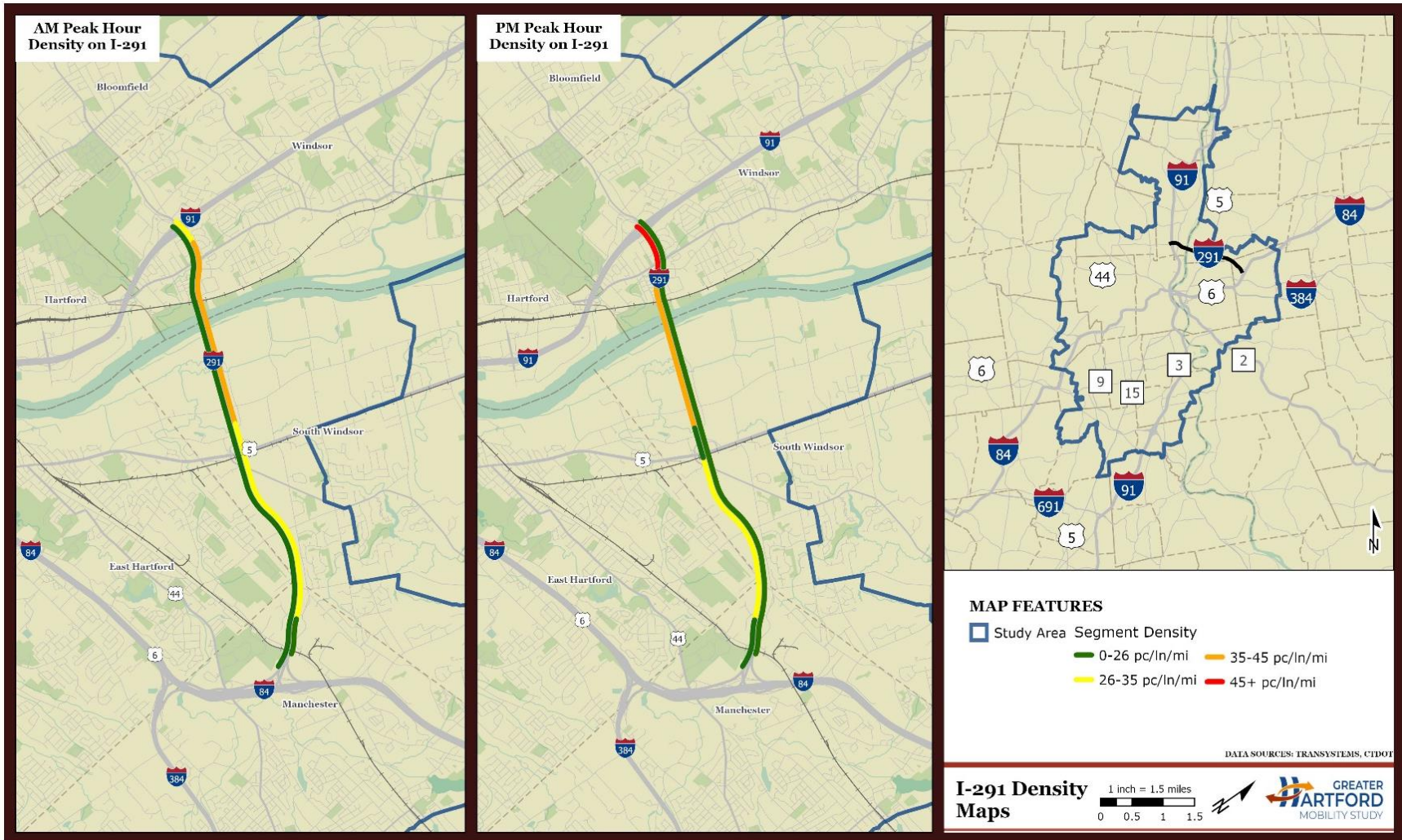
On an average day, I-291 experiences 250 vehicle-hours of delay in the eastbound direction and 200 in the westbound direction. With an approximate commercial vehicle percentage of 6%, the annual cost of delay on I-291 Eastbound is \$2.1 million, and the annual cost of delay on I-291 Westbound is \$1.7 million.

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**Figure 2-16: I-291 Speed Maps**



**Figure 2-17: I-291 Density Maps**

### 2.4.2 I-384

*I-384 is a spur of I-84, running east-west through Manchester and Bolton. It serves both local traffic, which uses I-384 to access I-84 and I-291, and long-distance traffic, which continues east on U.S. Routes 6 and 44.*

I-384 has two lanes in each direction at its eastern end, widening to four lanes in each direction at its junction with I-84, including one HOV lane. Its busiest segment is east of the Spencer Street interchange, with 65,000 vehicles per day. Traffic volumes are slightly higher westbound (53%) than eastbound (47%). Listed from west to east, the freeway has interchanges with:

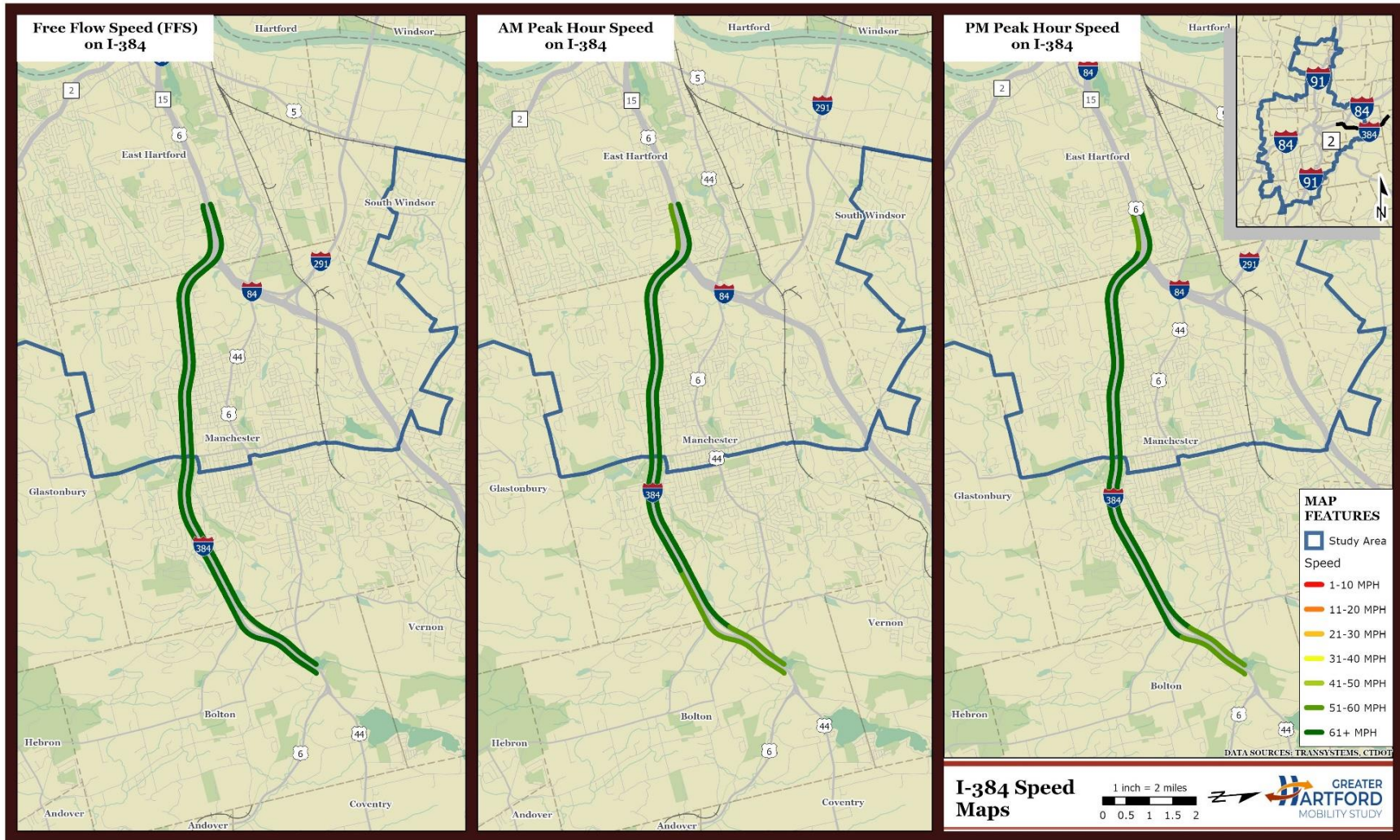
- I-84 HOV Lane (3,000 veh/day)
- I-84 (52,000 veh/day)
- I-291 (18,000 veh/day)
- Buckland Street / Pleasant Valley Road (12,000 veh/day)
- Spencer Street / Cemetery Road (27,000 veh/day)
- Keeney Street (19,000 veh/day)
- Route 83 / Charter Oak Street (22,000 veh/day)
- Wyllys Street / Highland Street (10,000 veh/day)
- Route 85 (5,000 veh/day)
- U.S. Routes 6 & 44 (9,000 veh/day)

Much like the Priority Corridors, I-384 has its heaviest volumes heading into Hartford in the morning peak, and

leaving Hartford in the evening. There are also several employment and retail centers around I-384, especially around the western half of the freeway, and many of the ramps in this area show high volumes throughout the day.

I-384's HOV lanes have a clear volume imbalance, with the westbound lane carrying 2,600 vehicles per day and the eastbound lane carrying only 700. As congestion on I-384 itself is minimal, these drivers could be attempting to avoid morning peak traffic on I-84. Surprisingly, though, HOV traffic on I-84 does not exhibit the same imbalance between morning and evening peaks. It is possible that I-384 Westbound traffic may use the HOV lane because it enters I-84 on the left-hand side, while I-384 itself enters on the right. This offers better access to the high-volume Route 2 and Route 15 interchanges, which are left-hand exits. The posted speed limit on I-384 is 65 mph for the study area Contributing Corridor section.

There is minimal congestion on I-384. Though speeds are reduced during peak periods, they mostly remain over 60 mph (see **Figure 2-18**), and densities (see **Figure 2-19**) are acceptably low as well. On an average day, I-384 experiences 90 vehicle-hours of delay in the eastbound direction and 60 in the westbound direction. With an approximate commercial vehicle percentage of 3%, the annual cost of delay on I-384 Eastbound is \$0.7 million, and the annual cost of delay on I-384 Westbound is \$0.4 million.



**Chapter 1 Figure 2-18: I-384 Speed Maps**



**Figure 2-19: I-384 Density Map**

### 2.4.3 I-691

*I-691 is a freeway connecting I-84 in Cheshire to I-91 and Route 15 in Meriden. In addition to serving long-distance traffic, the freeway also passes north of downtown Meriden and provides access to Midstate Medical Center and the Westfield Mall.*

I-691 has two basic lanes in each direction, with a third lane provided in Meriden between Lewis Avenue and Route 15. Traffic volumes are highest west of the U.S. Route 5 interchange, with an average daily traffic above 86,000 vehicles, split evenly between eastbound and westbound directions. Listed from west to east, the freeway has interchanges with:

- I-84 (62,000 veh/day)
- Route 10 (22,000 veh/day)
- Route 322 (16,000 veh/day)
- Route 71 / Lewis Avenue (21,000 veh/day)
- Colony Street / State Street (11,000 veh/day)
- U.S. Route 5 (18,000 veh/day)
- Route 15 (39,000 veh/day)
- I-91 (37,000 veh/day)

Traffic volumes on I-691 are not heavily directional. Whether in the morning or evening peak, volumes are high in both directions. There is a slight trend towards eastbound traffic in the morning and westbound traffic

in the evening, reflecting commuters heading to and from downtown Meriden, but this trend is much less pronounced than on the other interstates.

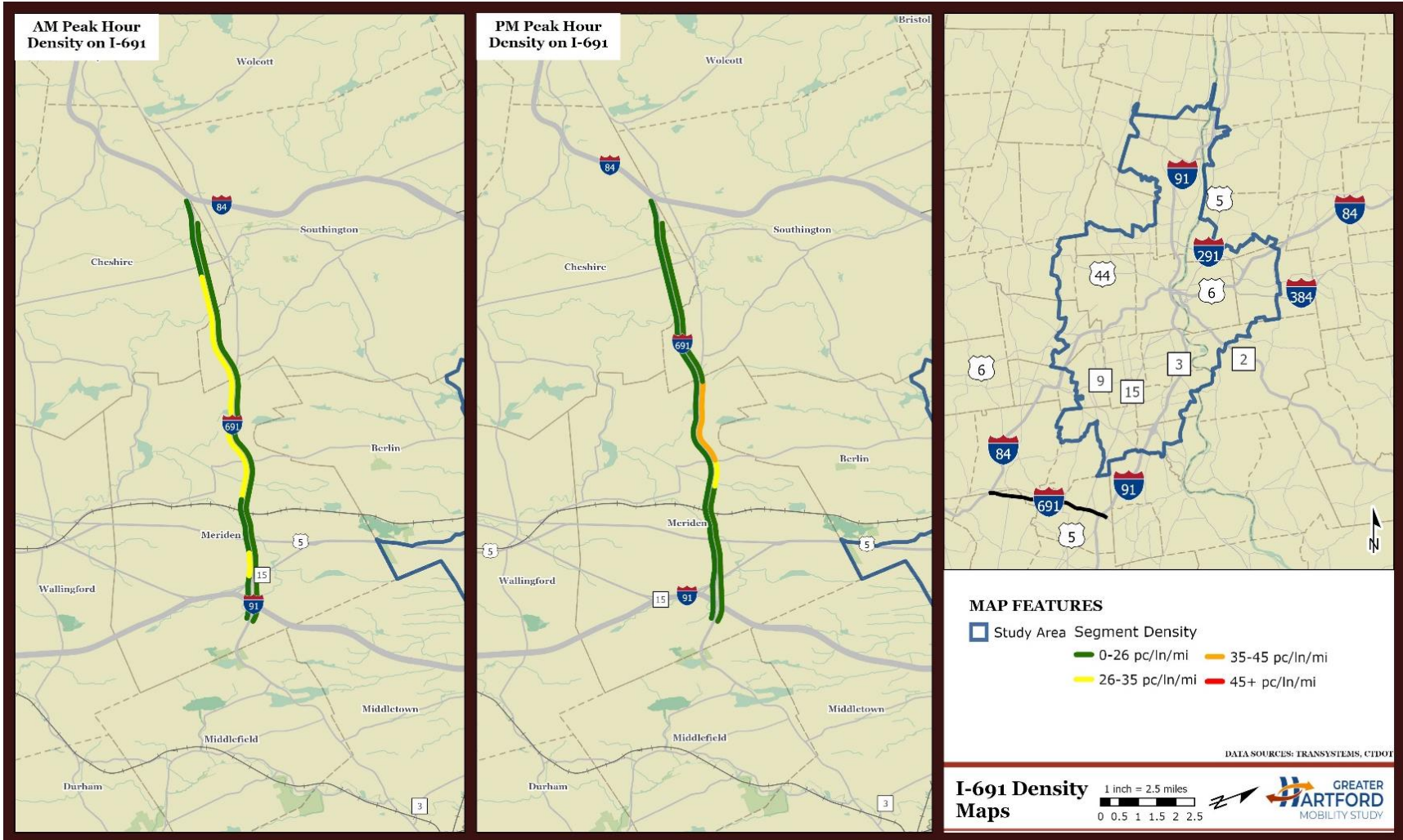
There is little recurring congestion on I-691. Speeds throughout the day are generally above 55 mph, dropping slightly during peak periods and, in the westbound direction, on the uphill grade between Route 71 and Route 322. This segment is the only location on I-691 that regularly operates above 35 pc/ln/mi; the rest of the freeway operates below that threshold. The lowest average speed, 46 mph, occurs during the morning peak at the U.S. Route 5 interchange and coincides with drivers facing directly into the rising sun (see **Figure 2-20**). **Figure 2-21** shows traffic density along I-691 during peak hours.

*The level of service of freeway segments is based on the density of vehicles, which is expressed in passenger cars per lane per mile (pc/ln/mi).*

On an average day, I-691 experiences 290 vehicle-hours of delay in the eastbound direction and 190 in the westbound direction. Assuming a commercial vehicle percentage of 5%, the annual cost of delay on I-691 Eastbound is \$2.3 million, and the annual cost of delay on I-691 Westbound is \$1.5 million.



**Figure 2-20: I-691 Speed Maps**



**Figure 2-21: I-691 Density Map**



#### 2.4.4 Route 3

*Route 3 runs 14 miles from Middletown to East Hartford, but only the northernmost 3.5 miles are included as a Contributing Corridor.*

This covers the portion between I-91 in Wethersfield and Route 2 in East Hartford. This segment is a freeway with one to two lanes in each direction and crosses over the Connecticut River via the Putnam Bridge. This bridge is the only freeway bridge over the Connecticut River between Hartford and Old Saybrook. It is frequently used as an alternative route for traffic bypassing congested segments of I-91 and Route 15. This section of Route 3 also provides local access to Wethersfield and Glastonbury. Route 3 carries 56,000 vehicles a day across the Putnam Bridge, with a nearly even directional split. Listed from south to north, the freeway has interchanges with:

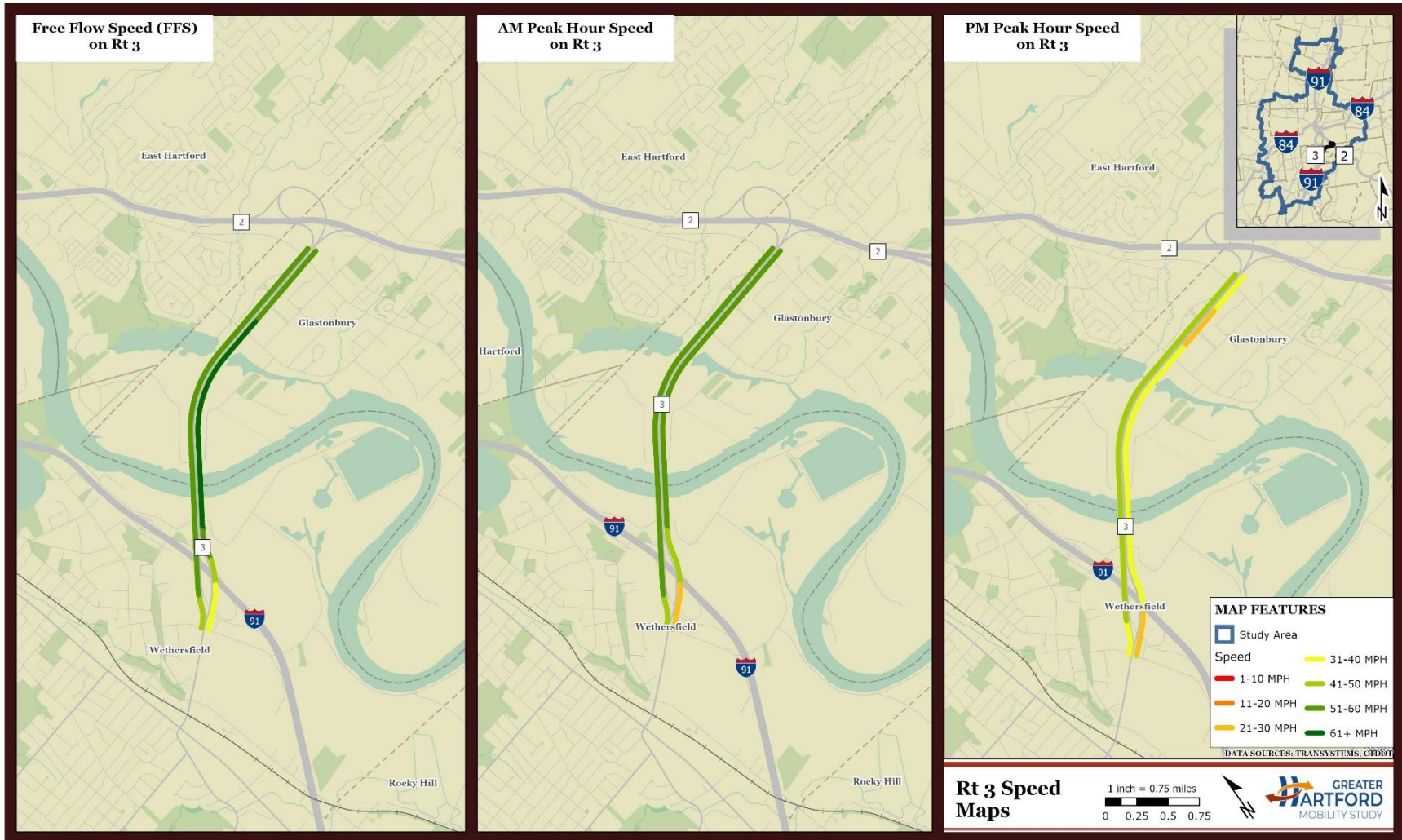
- I-91 (44,000 veh/day)
- Glastonbury Boulevard / Putnam Boulevard (31,000 veh/day)
- Route 2 (50,000 veh/day)

Route 3 runs circumferentially to Hartford, so both peaks should have similar volumes. Southbound volumes are roughly identical in the morning and evening peaks, but northbound volumes are much

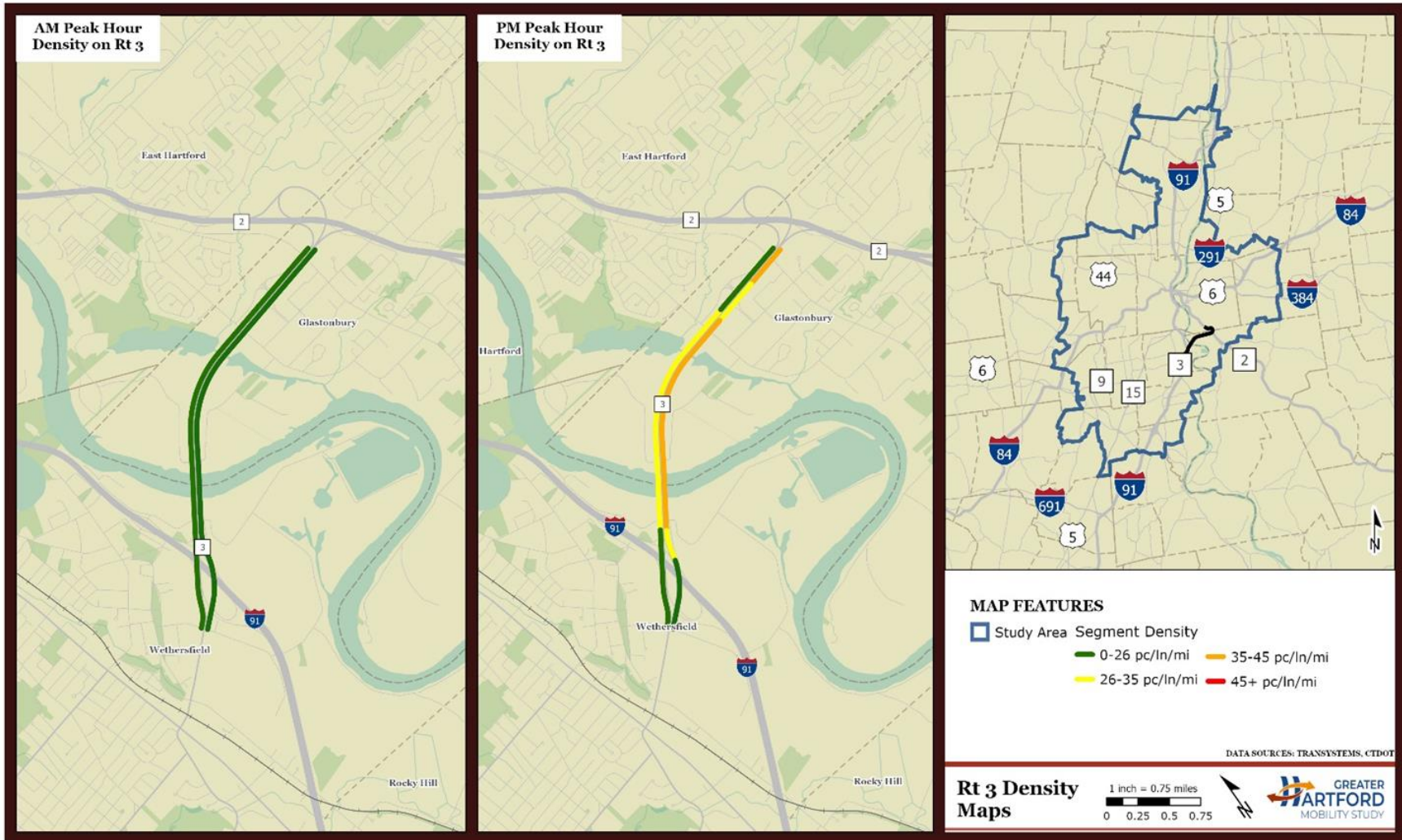
higher in the evening. This is likely due to traffic bypassing the northbound direction of the Charter Oak Bridge during the congested evening peak.

There is very little congestion on Route 3 Southbound, with speeds above 45 mph throughout the day. In the northbound direction, the evening peak is marked by slow speeds north of I-91. Average speeds drop as low as 28 mph at the Glastonbury Boulevard interchange (see **Figure 2-22**). The posted speed limit on Route 3 ranges between 40-55 mph for the study area Contributing Corridor sections. **Figure 2-23** shows traffic density along Route 3 during peak hours.

On an average day, Route 3 north of I-91 experiences 160 vehicle-hours of delay in the northbound direction and 70 in the southbound direction. With an approximate commercial vehicle percentage of 7%, the annual cost of delay on Route 3 Northbound is \$1.4 million, and the annual cost of delay on Route 3 Southbound is \$0.6 million.



**Figure 2-22: Route 3 Speed Maps**



**Figure 2-23: Route 3 Density Maps**

### 2.4.5 Route 9

*Route 9 is 41 miles long, extending from I-95 in Old Saybrook to I-84 in Farmington. Eleven miles of Route 9 are considered to be a Contributing Corridor, from I-91 in Cromwell to its northern terminus.*

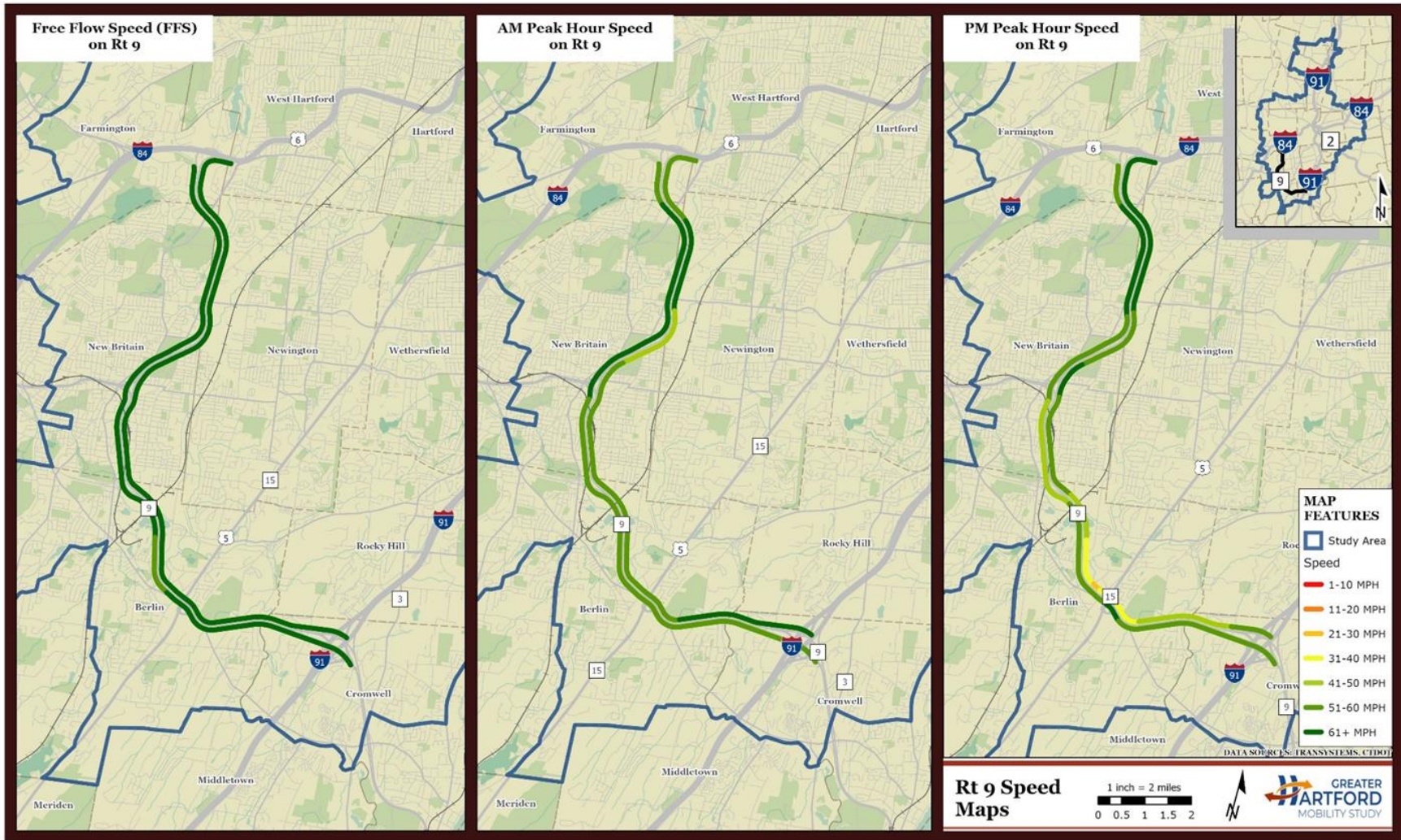
This portion of Route 9 is a freeway with two basic lanes in each direction, and serves several trip purposes. It is an alternate route between I-91 and I-84, provides access to downtown New Britain, and connects several important destinations such as Central Connecticut State University, Westfarms Mall, and Kensington. The busiest portion of Route 9 within the study area, the segment west of Christian Lane, carries nearly 83,000 vehicles per day. The directional split varies by location. Listed from south to north, the freeway has interchanges with:

- I-91 (68,000 veh/day)
- Route 15 / Route 372 (37,000 veh/day)
- Christian Lane (15,000 veh/day)
- SR 571 (Kensington Bypass) (12,000 veh/day)
- Ellis Street (16,000 veh/day)
- Downtown New Britain / Chestnut Street (15,000 veh/day)
- Route 72 (52,000 veh/day)
- Route 174 / Smalley Street (8,000 veh/day)
- Route 175 / Ella Grasso Road (37,000 veh/day)

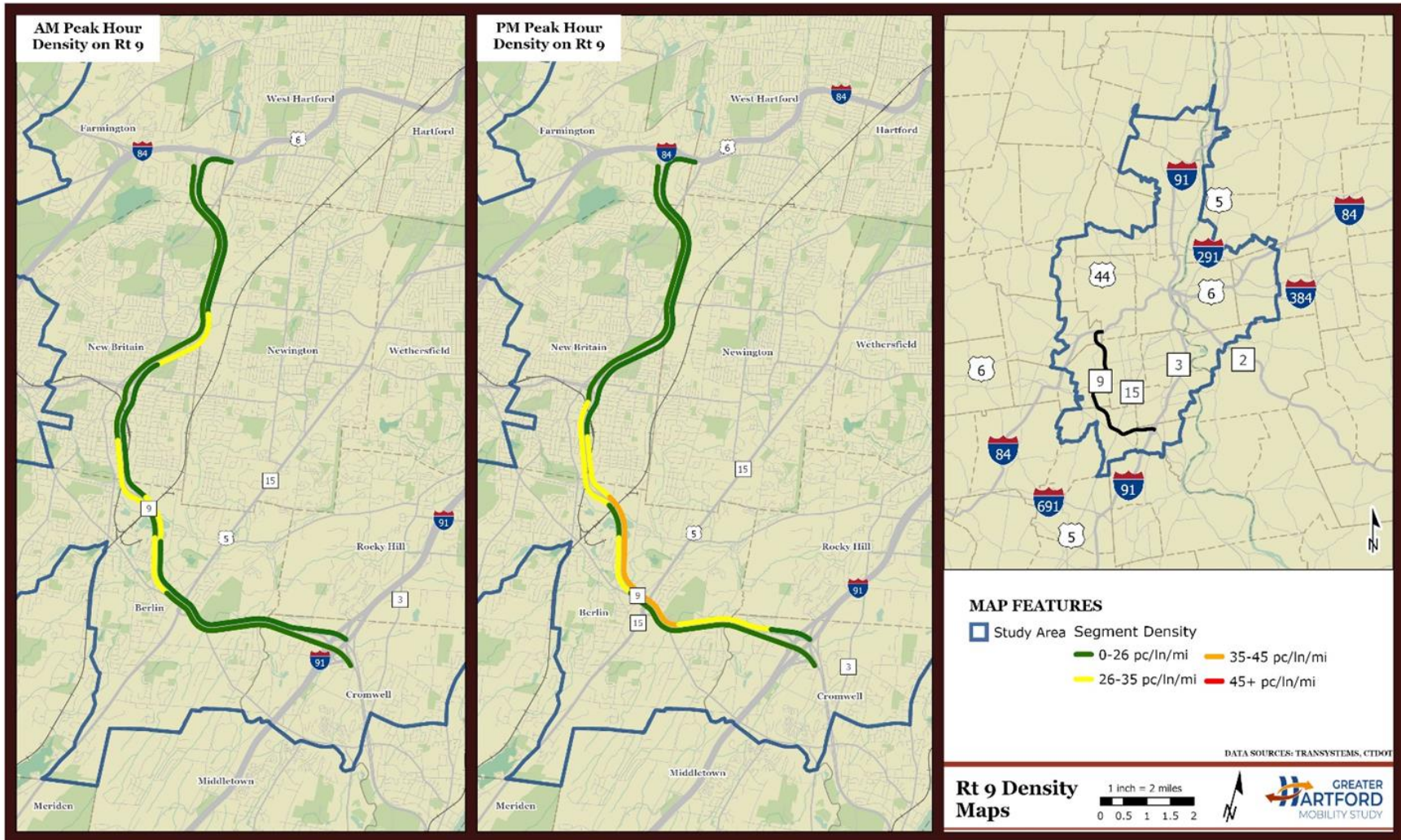
- Route 71 (25,000 veh/day)
- I-84 (48,000 veh/day)

Hourly traffic trends on Route 9 vary by location. North of Route 72, the freeway serves mainly traffic heading to or from Hartford. In the morning peak, northbound volumes are higher, while southbound volumes are heavier in the evening. South of Route 72, volumes are higher during the evening than the morning in both directions. This indicates a significant proportion of non-commuter traffic.

Congestion on Route 9 is limited to peak periods. Northbound, there is delay during the evening peak between Route 372 and Ellis Street, with average speeds dropping to 28 mph. There are also minor slowdowns (48 mph) approaching the off-ramp to Route 175 in the morning peak. On Route 9 Southbound, average speeds drop to 42 mph just south of Route 72 in the evening peak, but rebound south of Ellis Street (see **Figure 2-24**). The posted speed limit on Route 9 is 65 mph. On an average day, Route 9 north of I-91 experiences 410 vehicle-hours of delay in the northbound direction and 320 in the southbound direction. With an approximate commercial vehicle percentage of 4%, the annual cost of delay on Route 9 Northbound is \$3.1 million, and the annual cost of delay on Route 9 Southbound is \$2.5 million.



**Figure 2-24: Route 9 Speed Maps**



**Figure 2-25: Route 9 Density Maps**

#### 2.4.6 Route 15

Route 15 overlaps with U.S. Route 5 for nearly all of this distance. South of Wethersfield, Route 15 is designated the Berlin Turnpike, a two-to-three-lane divided arterial with some interchanges and many signalized intersections. Farther north, Route 15 becomes a freeway, the Wilbur Cross Highway, with one to three lanes in each direction. It crosses the Connecticut River on the Charter Oak Bridge and has interchanges with all three Priority Corridors.

The Berlin Turnpike is the core of a densely developed commercial swath, and provides access to businesses, neighborhoods, and intersecting arterials along its length. It serves as an alternate through route when I-91 is congested. The busiest portion of the Berlin Turnpike is in Wethersfield north of Route 175, where it carries 49,000 vehicles per day. The Wilbur Cross Highway, on the other hand, is a high-volume connection between the Berlin Turnpike, I-91, Route 2, and I-84. The busiest segment of Route 15 is the Charter Oak Bridge, with an average of 81,000 vehicles per day. Volumes are split relatively evenly between northbound and southbound. Listed from south to north, Route 15 has interchanges with:

- Route 9 / Route 372 (28,000 veh/day)
- Route 175 (23,000 veh/day)
- Route 99 (22,000 veh/day)
- I-91 (86,000 veh/day)
- Brainard Road / Airport Road (29,000 veh/day)
- Route 2 (5,000 veh/day)

- U.S. Route 5 / East River Drive (14,000 veh/day)
- Silver Lane (7,000 veh/day)
- I-84 (61,000 veh/day)

Traffic patterns on Route 15 vary by location. On the Berlin Turnpike in Berlin, there is a distinct northbound trend in the morning and southbound trend in the evening, indicating that Route 15 here is used as a commuter route. In Newington, where the Berlin Turnpike is a retail and restaurant hub, volumes are high throughout the day, and peaks are less pronounced, though southbound volumes are still highest in the evening. The southern portion of the Wilbur Cross Highway in Wethersfield once again shows distinct morning and evening peaks of roughly equal magnitude. Finally, between I-91 and I-84, Route 15 is strongly directional, with high southbound volumes in the morning and high northbound volumes in the evening.

The speeds shown in **Figure 2-26** are average speeds along a road segment. On a freeway, slow speeds are indicative of congestion, but this is not necessarily the case for non-freeways. The Berlin Turnpike has numerous signalized intersections, and these signals introduce delay at all times of the day.

Rather than using absolute speed, this document considers congestion on signalized highways to occur when the average speed drops significantly below off-peak speeds. The posted speed limit for the corridor is 55 mph.

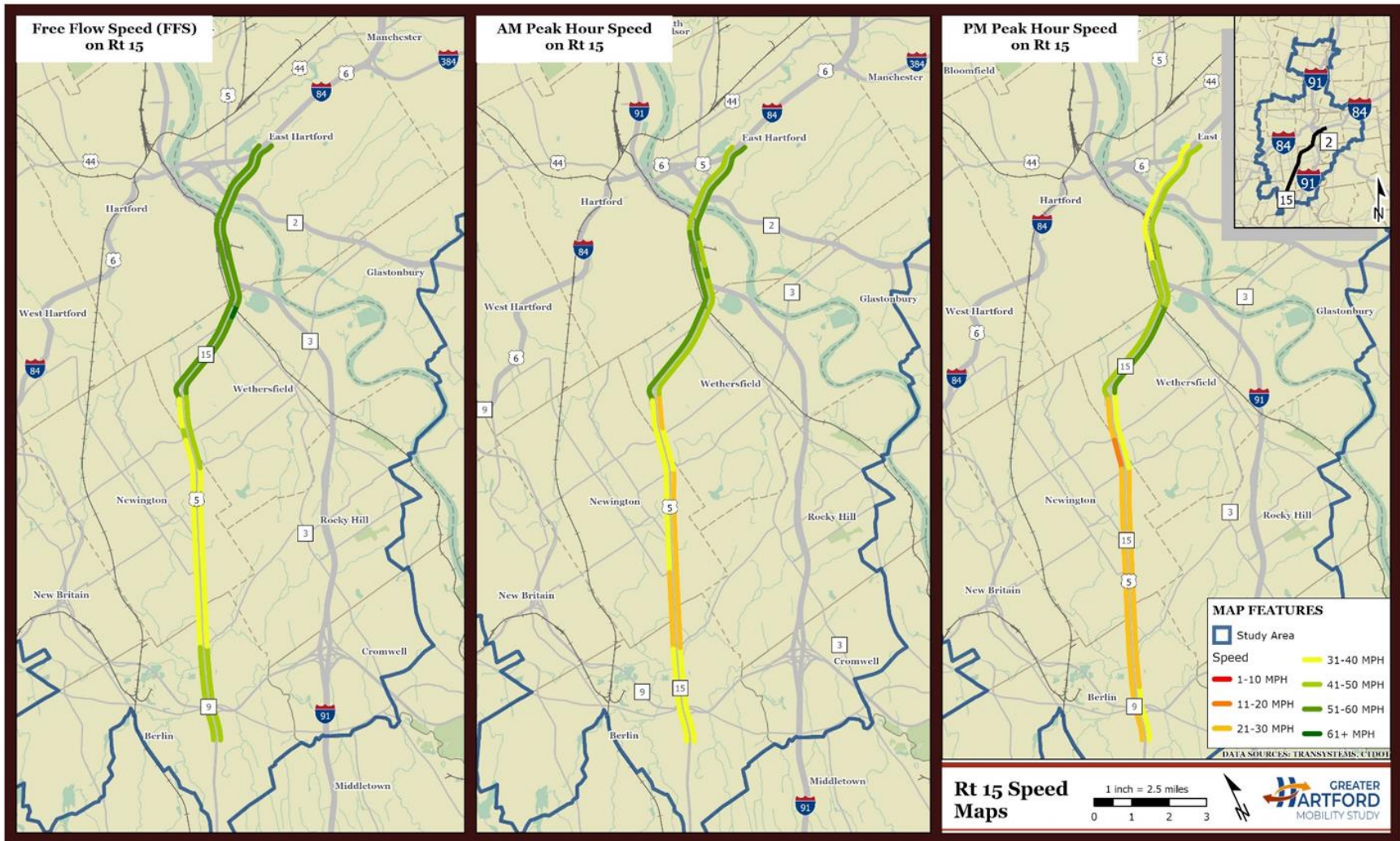
Traffic flow on the Berlin Turnpike is generally steady throughout the day. There is one location where speeds drop by more than 50% during the evening peak: Route 15 Southbound approaching the intersection with Route 287. The offset geometry and high volumes at this signalized intersection result in long southbound queues and average speeds of 17 mph.

On the Wilbur Cross Highway, there are some slowdowns during both peak periods, though densities do not rise above 35 pc/ln/mi. The slowest speeds occur on Route 15 Southbound across the Charter Oak Bridge, where they average 31 mph during the evening peak. This is not due to high volumes on Route 15 itself, however, but rather due to congestion on I-91 and the ramp from Route 15 Southbound to I-91 Southbound, situated at the south end of the bridge.

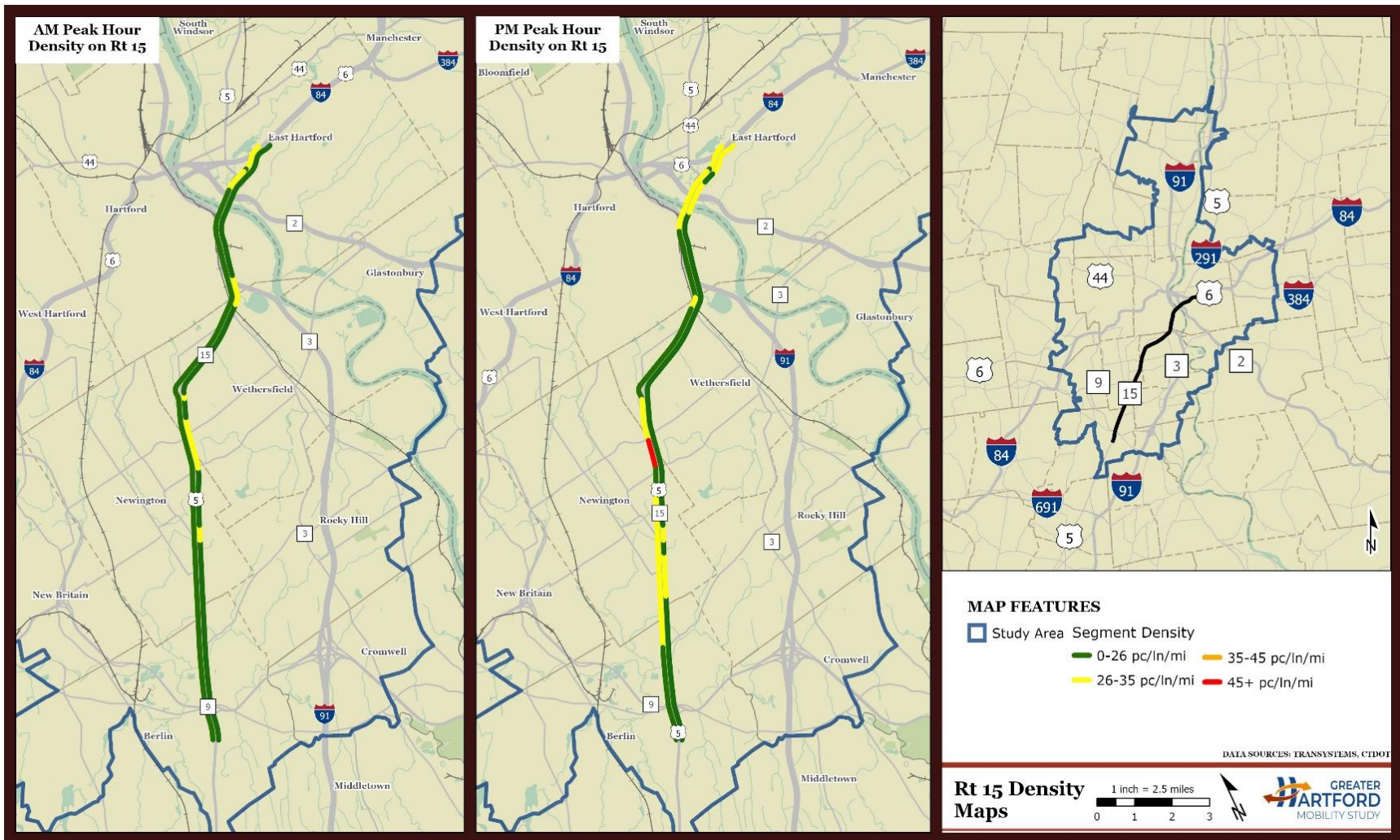
On an average day, Route 15 north of Route 9 experiences 1,030 vehicle-hours of delay in the northbound direction and 1,380 in the southbound direction. With an approximate commercial vehicle percentage of 5%, the annual cost of delay on Route 15 Northbound is \$8.3 million, and the annual cost of delay on Route 15 Southbound is \$11.1 million. 76% of this delay occurs on the Berlin Turnpike, with the remaining 24% on the Wilbur Cross Highway.

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**Figure 2-26: Route 15 Speed Maps**



**Figure 2-27: Route 15 Density Maps**

## 2.5 Corridors for Traffic Collection Traffic Assessment

The Corridors for Traffic Collection include:

- U.S. Route 5 from Route 15 in East Hartford to I-91 Exit 44 in East Windsor,
- U.S. Route 44 from Route 167 in Simsbury to I-84 in Hartford,
- Route 20 from Bradley International Airport to I-91,
- Route 159 from I-91 Exit 34 in Windsor to I-91 Exit 42 in Windsor Locks,
- The entirety of Route 218,
- SR 502 (East River Drive, Silver Lane, Spencer Street) from Route 2 in East Hartford to I-384 in Manchester,
- Asylum Avenue from South Main Street in West Hartford to I-84 in Hartford, and
- Farmington Avenue from South Main Street in West Hartford to Asylum Avenue in Hartford.

Traffic volumes for each Contributing Corridor are given in Appendix 1 - balanced count profile appendix.

### 2.5.1 U.S. Route 5

U.S. Route 5 runs parallel to I-91 throughout Connecticut. In East Hartford and South Windsor, the road is generally a divided highway with two lanes in each direction. In East Windsor, most of U.S. Route 5 is undivided, with one lane in each direction. It is the primary north-south route in these towns, and serves

both local and long-distance trips. When I-91 is heavily congested, U.S. Route 5 serves as a bypass.

Traffic volumes on U.S. Route 5 within the study area are generally around 10,000 vehicles per day in each direction. Southbound volumes are generally higher than northbound volumes. The busiest segment is between I-291 and Chapel Road in South Windsor, where northbound volumes are 12,000 vehicles per day, and southbound volumes are 14,000. Time-of-day traffic patterns vary, with U.S. Route 5 in downtown East Hartford seeing high volumes throughout the day, and segments to the north showing distinct morning and evening peaks.

### 2.5.2 U.S. Route 44

U.S. Route 44 is the primary road connection between Hartford and the towns to its northwest. It provides the only crossing of the Metacomet Ridge in the seven-mile stretch between Route 4 in Farmington and Route 185 in Simsbury. West of Hartford, U.S. Route 44 has two lanes in each direction, along with a median as it passes over Avon Mountain. Its character is largely rural and commercial as it passes through Avon, with increasing density as the road enters West Hartford. Within Hartford, U.S. Route 44's width varies from one to three through lanes in each direction. It passes through the dense Upper Albany and Clay Arsenal neighborhoods, then runs along Downtown North and Downtown before joining I-84 across the Bulkeley Bridge.

Traffic volumes on U.S. Route 44 are relatively high throughout the study area, with daily traffic of around 10,000 vehicles in each direction. They are highest in Avon, just east of U.S. Route 202, with 17,000 vehicles per day in the eastbound direction and 15,000 in the westbound. West of Hartford, U.S. Route 44 has a very strong directional pattern, with eastbound traffic much heavier in the morning and westbound traffic much heavier in the evening. Within Hartford, however, this trend becomes much less evident as U.S. Route 44 is busy throughout the day.

### 2.5.3 Route 20

Route 20 runs east-to-west through Connecticut's northern towns. The easternmost three miles are a freeway with two lanes in each direction, providing high-speed access between Bradley International Airport and I-91, as well as a number of industrial and logistics hubs near the airport. Route 20 also serves as a commuter route for residents of Granby and East Granby.

Route 20 carries traffic volumes ranging from 18,000 vehicles per day in each direction at the west end of the freeway to 28,000 vehicles per day in each direction at the east end. Eastbound volumes are modestly higher than westbound volumes throughout the corridor. Because of the many employment centers along Route 20, commute patterns tend to be inbound in the morning and outbound in the evening, but the airport produces trips throughout the day and well into the

night. As a result, this corridor has a complex traffic pattern that varies by segment.

### 2.5.4 Route 159

Route 159 begins at the Hartford – Windsor town line and continues northward along the west bank of the Connecticut River. It goes through the Wilson, downtown Windsor, and Hayden neighborhoods within the study area, serving mainly residential areas. South of Route 75, Route 159 is divided and has one to two lanes in each direction. North of Route 75, it is mainly undivided, with one lane in each direction.

Traffic volumes on Route 159 are highest between Hartford and Route 75, with around 7,000 vehicles per day in each direction. Daily volumes decrease to 2,000 vehicles in each direction north of Route 75. There is a strong directional trend, with southbound traffic much heavier in the morning peak and northbound traffic in the evening peak. This is consistent with residents of Windsor using Route 159 as a way to get to jobs in Hartford.

### 2.5.5 Route 218

Route 218 is a primarily east-west road beginning at U.S. Route 44 in Bishop's Corner, West Hartford, then heading north and east to end at Route 159 in Windsor. The north-south portion has one lane in each direction, while the east-west portion has two, as well as a median for much of its length. It is the primary connection between major commercial centers in West Hartford

and Bloomfield, as well as the main access route for the Cigna HealthCare campus.

Route 218 is one of the busiest non-freeway roads in Connecticut. Daily traffic volumes generally exceed 10,000 vehicles in each direction, and between Cigna and I-91, volumes can reach nearly twice that value. The busiest segment, just west of I-291, has a combined daily volume of 38,000 vehicles. Traffic volumes are heaviest during the evening peak, especially southbound and westbound, headed away from Cigna. There is a heavy morning peak in the opposite direction as well, indicating that Route 218 is a busy commuter corridor.

#### 2.5.6 SR 502 (East River Drive, Silver Lane, Spencer Street)

SR 502 is an unsigned State-maintained route comprising East River Drive east of Route 2, Silver Lane, and Spencer Street in East Hartford and Manchester. It runs parallel to, and south of, I-84. SR 502 has interchanges with Route 2, Route 15, I-84's HOV lanes, and I-384, and thus serves as the primary connection between the freeway network and local destinations. East River Drive and Spencer Street have two lanes in each direction, while Silver Lane has one to two.

Traffic volumes on SR 502 vary from 1,800 to 14,000 daily vehicles in each direction, with the lowest volumes near the Route 2 interchange and the highest volumes in Manchester east of I-384. Traffic volumes are high

throughout the day, without distinct morning and evening peaks, which reflects the mixed nature of development along the corridor. SR 502 serves local trips rather than through traffic. The major exception to this trend is when there is a special event at Rentschler Field, which has two access points on Silver Lane. Traffic heading to or from the stadium is directed down Silver Lane using special event traffic patterns and signal timing.

#### 2.5.7 Asylum Avenue

Asylum Avenue is a locally maintained east-west road that runs from central West Hartford to Main Street in Hartford. Much of Asylum Avenue is one lane in each direction and undivided, but portions have more lanes or a median, and the easternmost 0.4 miles are one-way westbound. Asylum Avenue serves both local traffic and longer-distance trips between West Hartford and Hartford.

Traffic volumes on Asylum Avenue vary but are generally around 6,000 vehicles per day in each direction. West of Sigourney Street, there is a strong eastbound peak in the morning as commuters head into Hartford, and a strong westbound peak in the evening. East of Sigourney Street, Asylum Avenue serves commuters coming from the east as well, and there is less of a distinction between directions. There are also high volumes mid-day in this area.

### 2.5.8 Farmington Avenue

Farmington Avenue is an east-west road running from Farmington, where it is designated Route 4, to Asylum Avenue in Hartford. The road has one to two lanes in each direction with an intermittent median. Farmington Avenue is a major connection between employment centers in Hartford and the neighborhoods to the west. It is also the primary east-west road in West Hartford Center. As a result, it serves both short- and long-distance trips within the study area.

Traffic volumes on Farmington Avenue vary but are generally around 5,000 vehicles per day in each direction. Farmington Avenue serves mainly eastbound traffic in the morning peak, and mainly westbound traffic in the evening, but given the many uses along its length, its volumes are less directional during the mid-day.

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## 2.6 The Traffic Impact of COVID-19

*As the country moves through the “Early Reaction, Coordinated Response and Long-term Recovery” phases of the pandemic, its impacts on the transportation industry in general and roadway traffic in particular are still being tracked and assessed.*

At the time of writing, the COVID-19 pandemic is still in effect. It has been over a year since the pandemic’s first traffic impacts were felt in mid-March of 2020. As CTDOT has numerous continuous count stations throughout the state, the agency has been able to track the evolution of traffic volumes throughout the pandemic<sup>4</sup>. Trends have also been tracked nationwide<sup>5</sup>.

### 2.6.1 Decrease in Traffic Volume

Traffic volumes in Connecticut decreased by about half during the first weeks of the pandemic in March 2020. As **Figure 2-28** shows, volumes dropped within a three-week period, then began to rise again. By mid-June, they reached 80% of pre-pandemic counts. Traffic counts initially dropped by more on weekends than weekdays, indicating a temporary decrease in non-

essential travel, but the trend eventually inverted, with weekends showing a higher rebound than weekdays during the phased re-opening of restaurants and recreation. As of early 2021, volumes are generally within 10% of pre-pandemic levels.

Nationally, the change in traffic volumes has been heavily dependent on location. Traffic volumes in cities are still substantially lower than pre-pandemic, but volumes in rural areas have instead increased. The net effect is that overall volumes began to exceed pre-pandemic levels in February 2021 and continue to grow. As shown in **Figure 2-29**, while the initial decrease coincided with the beginning of the pandemic, the subsequent rise in cases had little impact on volumes.

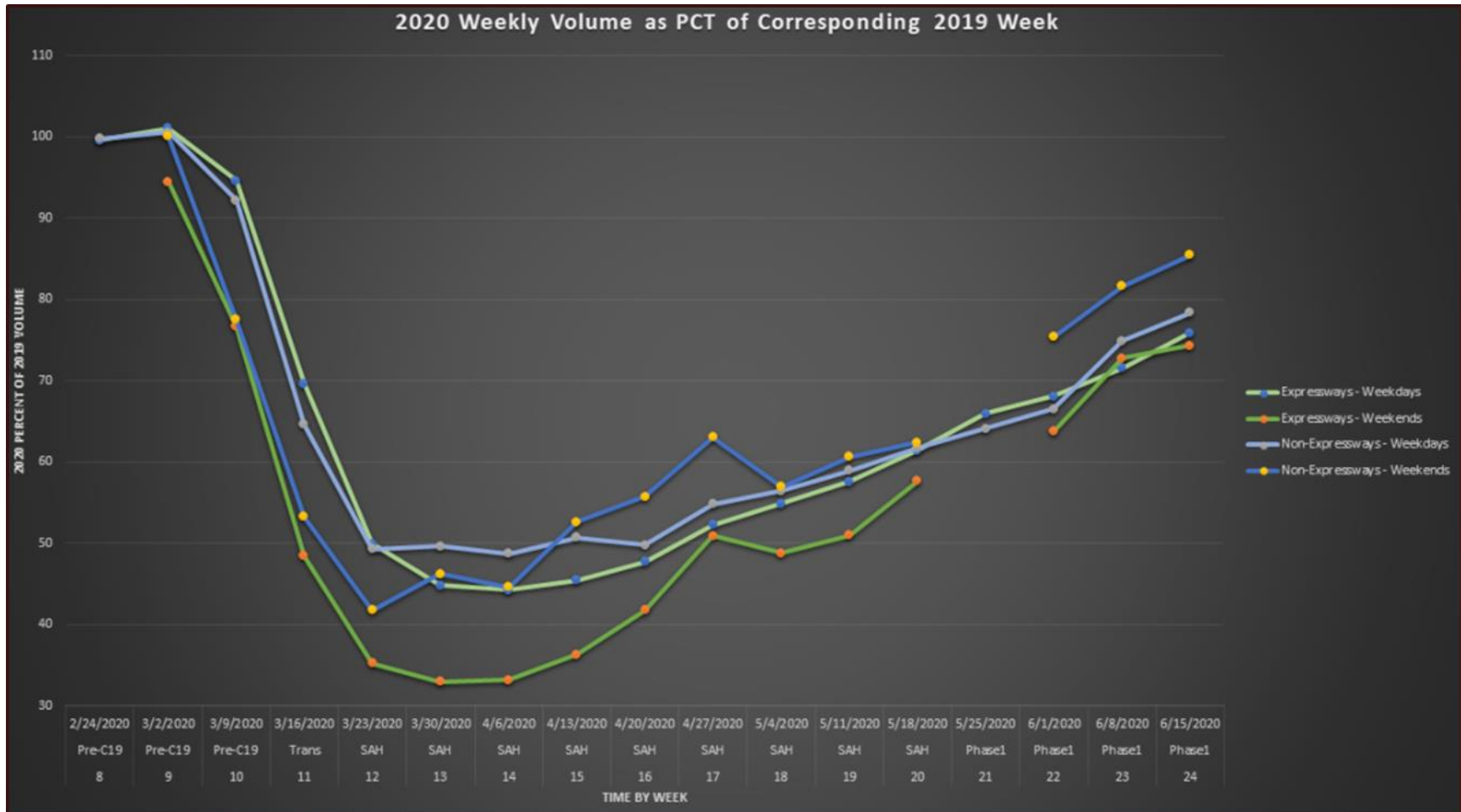
### 2.6.2 Increase in Speeds

Along with the sharp decrease in traffic volumes in March and April of 2020, there was a decrease in congestion, and, simultaneously, apparent decrease in police enforcement. As a result of these two factors, travel speeds increased. In particular, the proportion of traffic going far above the speed limit rose severely, as shown in **Figure 2-30**. As of April, 2021, speeds are still moderately higher than pre-pandemic.

<sup>4</sup> A comparison of traffic counts throughout 2020 is available at [https://portal.ct.gov/DOT/PP\\_SysInfo/Traffic-Monitoring](https://portal.ct.gov/DOT/PP_SysInfo/Traffic-Monitoring), and CTDOT has prepared a full interactive presentation on the change in volumes, speeds, and safety, available at

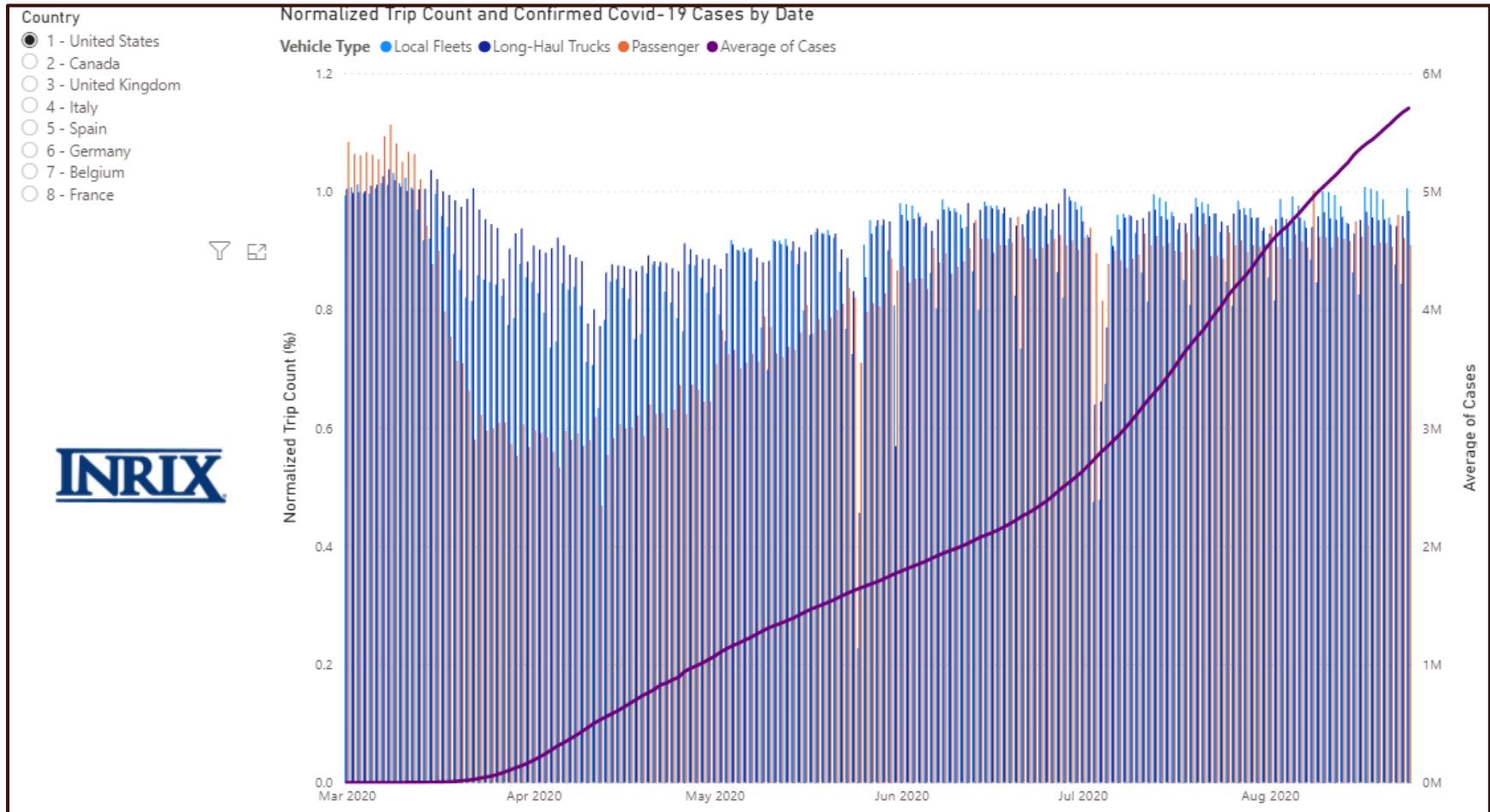
<https://ctdot.maps.arcgis.com/apps/MapSeries/index.html?appid=4426084893454ae289e17c67f72433be>.

<sup>5</sup> INRIX: COVID-19’s Impact on Transportation Trends, <https://inrix.com/covid-19-transportation-trends/>.

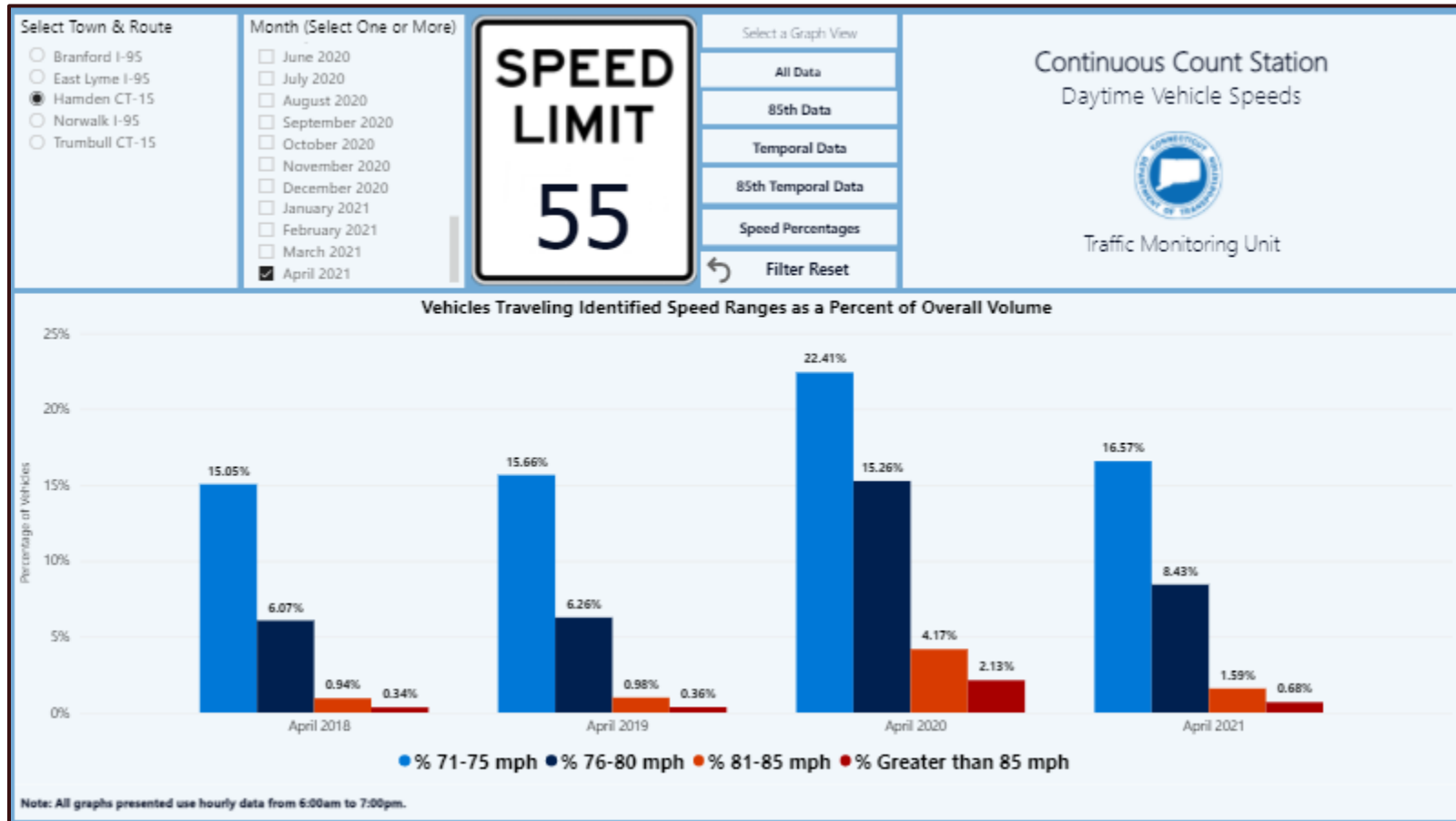


**Figure 2-28: COVID-19-Era Traffic Volumes (CTDOT)**





**Figure 2-29: National Traffic Rebound (INRIX)**



**Figure 2-30: Speeding on Route 15 (CTDOT)**

**2.6.3 Increase in Crash Severity**

The overall number of crashes on Connecticut’s roads decreased proportionally to the decrease in volumes, so there was not a significant change in the crash rate per vehicle mile traveled. The same was true of serious

crashes in 2020. However, there was an overall increase in the number of fatalities year-over-year, suggesting that the higher speeds on the state’s roads may have resulted in increased proportion of fatal crashes.

#### 2.6.4 Decrease in Transit Ridership

During the Stay-At-Home Order, vehicular travel decreased by about 50%. During the same period, Connecticut's bus ridership decreased by 50%, and passenger rail traffic decreased by 80-90%. Express bus lines saw an 85% decrease in ridership, while local bus lines were a more modest 40%.<sup>6</sup> Wary of being in enclosed, shared spaces, transit riders generally switched to private travel or worked from home, when the option was available. Transit operators quickly made changes to their procedures to increase sanitation, but transit reluctance may continue throughout the pandemic.

#### 2.6.5 Increase in Telecommuting

Telecommuting has long been an important component of transportation demand management, but COVID-19 greatly increased its prominence and prevalence. Telecommuting decreases the amount of traffic traveling during peak hours. INRIX found that while overall traffic volumes now exceed those in pre-pandemic years, peak hour volumes in most major cities are still below pre-pandemic levels<sup>7</sup>. This is especially true of the morning peak period, which is affected by both telecommuting and remote learning.

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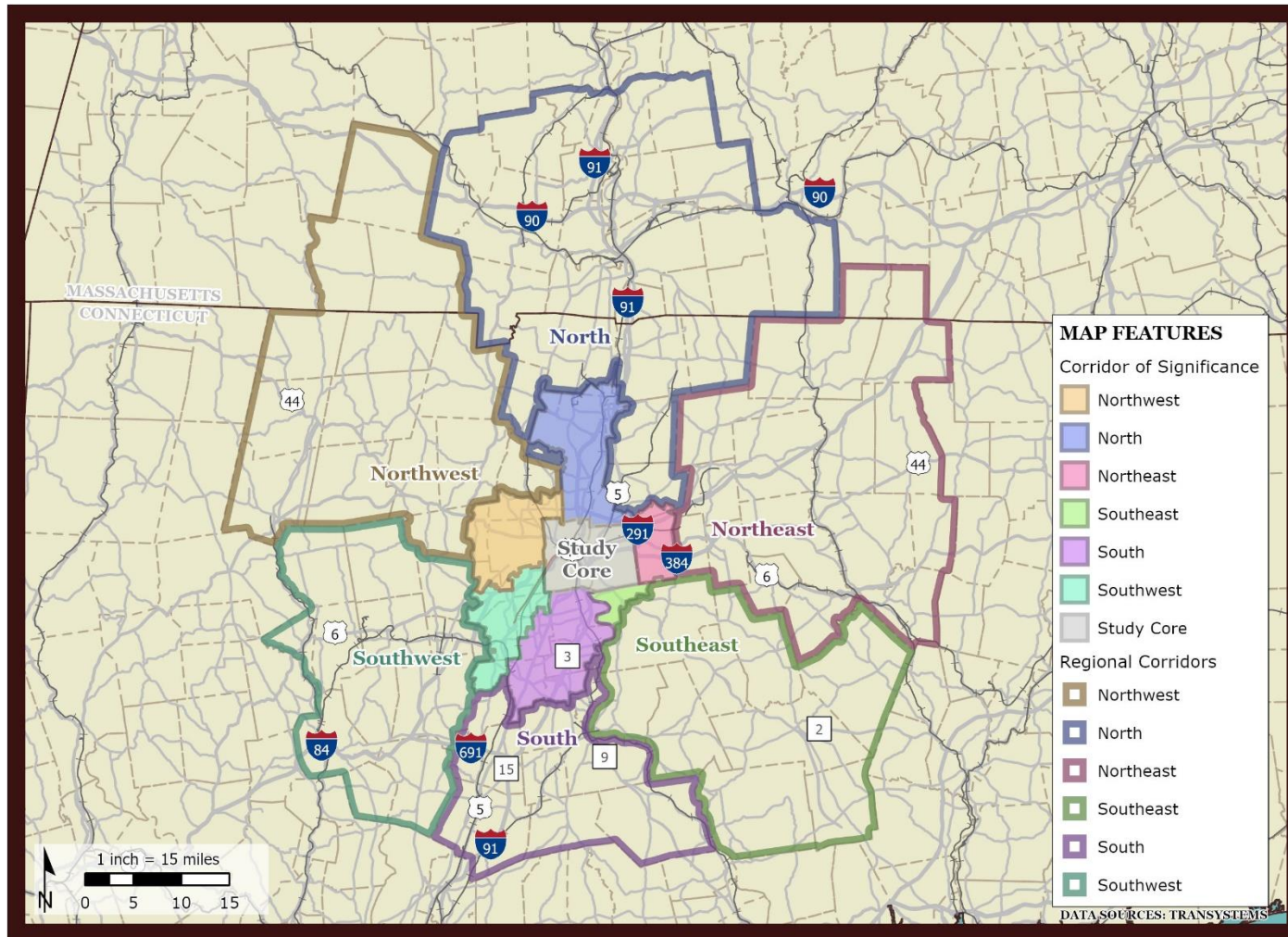
<sup>6</sup> Hartford Courant: Responding to major drop in ridership, DOT proposes reducing service on Hartford commuter routes, free shuttles, <https://www.courant.com/community/hartford/hc-news-hartford-bus-service-changes-20210513-ofhigpignaltm2y66ukz6sjyq-story.html>

#### 2.7 Origin-Destination (OD) Assessment

An OD Study was prepared to support the development of the Greater Hartford Mobility Study (GHMS). The objective of the OD Study was to review and assess the origin-destination patterns associated with travel within the seven Corridors of Significance (COS) and commuter return trips.

The major input to the OD Study was travel data available through the StreetLight Data Insight platform. StreetLight's data metrics are currently derived from two types of locational "Big Data" sources: Navigation-GPS data and Location-Based Services (LBS) data. GPS data are from fleet management systems for trucks while LBS data are from personal smartphone devices for all vehicles. The data are collected, aggregated, and normalized to provide a data base of travel patterns useful for planning and travel analysis. A geographic context for analyzing these data was established using the traffic analysis zone (TAZ) system developed for the Capital Region Council of Governments (CRCOG) regional travel demand model.

<sup>7</sup> INRIX: Morning Traffic Still Down in Major Metro Areas, <https://inrix.com/blog/2021/04/morning-traffic-still-down-in-major-metro-areas/>.



**Figure 2-31: GHMS Study Corridors and Regional Corridors**

Trips are analyzed starting from a regional perspective looking at regional trip movements within the context of their connection to the GHMS Study Area. Origin-destination patterns are evaluated using traditional origin-destination matrices as well as thematic maps used to depict the top origin and destination locations within each of the COS. The analysis uses StreetLight Volumes which represent an estimated number of vehicle trips traveling between origins and destinations.

### 2.7.1 CRCOG Model Area OD Patterns

The region, i.e., the CRCOG model area (see **Figure 2-31** on the previous page), encompasses 64 towns in Connecticut extending as far west as Torrington, Harwinton, and Thomaston on the west; Ashford, Chaplin, and Windham on the east; and, Wallingford, Durham, and Haddam on the south. The model area extends north to include Springfield as well as Easthampton, South Hadley, and Granby in Massachusetts. For the purposes of this analysis, the model area outside of the GHMS Study Area was divided into six corridors (Northern, Northeastern, Southeastern, Southern, Southwestern, and Northwestern).

At the regional scale of analysis trips originate from or are destined to either external zones, the Regional Corridors, or the GHMS Study Area. Since the region cannot extend ad infinitum, external zones represent the points at which the region connects to the world around it. They facilitate the movement of trips into

and out of the region. The Regional Corridors are areas within the region but outside of the GHMS Study Area.

Average daily trip making between these areas is summarized in **Table 2-2**. This exhibit illustrates that:

- The average number of trips originating in the GHMS Study Area on an average weekday (Tuesday – Thursday) is 1,906,662.
- Of this total, 1,434,328 (75 percent) are destined to locations within the GHMS Study Area.
- Conversely, on an average weekday, 1,901,841 trips are destined to the GHMS Study Area.
- Of this total, 77 percent (1,434,328) originate in the GHMS Study Area.

*Internal trips (with both the origin and destination within the GHMS study area) are predominant (75-77%) among the overall GHMS study area related trips.*

**Table 2-2: Regional Daily OD Matrix (2019 Vehicle Trips)**

| Geography |                    | Destinations |                    |                  |                  |
|-----------|--------------------|--------------|--------------------|------------------|------------------|
|           |                    | Externals    | Regional Corridors | GHMS Study       | Total            |
| Origins   | Externals          | 63,092       | 266,930            | 49,368           | 379,390          |
|           | Regional Corridors | 267,441      | 3,847,448          | 418,145          | 4,533,034        |
|           | GHMS Study Area    | 48,777       | 423,557            | <b>1,434,328</b> | <b>1,906,662</b> |
|           | Total              | 379,310      | 4,537,935          | <b>1,901,841</b> | 6,819,086        |

Source: StreetLight Data – 2019 Volumes

In similar fashion, **Table 2-3** is the OD matrix for the AM Peak Period (6:00 AM – 9:00 AM). From the AM Peak Period OD Matrix it can be seen that:

- During the AM Peak Period on an average weekday the number of trips originating in the GHMS Study Area is 279,461.
- Of this total, 220,348 (79 percent) are destined to locations within the GHMS Study Area, i.e., they do not leave the study area.
- Of the remaining trips, 52,184 (19 percent) are destined for locations in one of the regional

corridors while 6,929 (two percent) leave the region entirely.

- Destinations to the GHMS Study Area during the AM Peak Period on an average weekday total 354,495 trips.
- Of these trips, 62 percent (220,348) originate in the Study Area, 34 percent (121,484) originate in one of the Regional Corridors, and four percent (12,663) originate from the externals.

As was true on a daily basis, internal trips are the predominant OD pattern associated with the GHMS Study Area.

**Table 2-3: Regional AM Peak Period OD Matrix (6:00 AM – 9:00 AM)**

| Geography |                    | Destinations |                    |                 |                |
|-----------|--------------------|--------------|--------------------|-----------------|----------------|
|           |                    | Externals    | Regional Corridors | GHMS Study Area | Total          |
| Origins   | Externals          | 8,826        | 41,856             | 12,663          | 63,345         |
|           | Regional Corridors | 62,224       | 607,709            | 121,484         | 791,417        |
|           | GHMS Study Area    | 6,929        | 52,184             | <b>220,348</b>  | <b>279,461</b> |
|           | Total              | 77,979       | 701,749            | <b>354,495</b>  | 1,134,223      |

Regional trip making during the PM Peak Period (3:00 PM – 6:00 PM) is illustrated in **Table 2-4**. During the PM Peak Period:

- The total number of trips during the PM Peak is 52 percent higher than the total number of trips during the AM Peak.
- 70 percent of the trips originating in the GHMS Study Area are destined to the locations in the GHMS Study Area. While this is a smaller percentage of internal trips than during the AM Peak it represents approximately 63 percent more trips.
- Of the remaining GHMS Study Area trip origins during the PM Peak, 27 percent travel to one of the regional corridors while three percent travel outside of the region. In total, this equates to nearly 153,000 trips leaving the Study Area

during the PM Peak compared to approximately 61,000 during the AM Peak.

- There is also 28 percent more trips destined to the Study Area during the PM Peak Period than during the AM Peak Period.
- Of the trips destined to the Study Area during the PM Peak Period 79 percent originate in the Study Area. This is a higher percentage than the AM Peak.
- Conversely, there are a smaller number of trips destined to the Study Area from either the Regional Corridors or the Externals.

**Table 2-4: Regional PM Peak Period OD Matrix (3:00 PM – 6:00 PM)**

| Geography |                    | Destinations |                    |                 |                |
|-----------|--------------------|--------------|--------------------|-----------------|----------------|
|           |                    | Externals    | Regional Corridors | GHMS Study Area | Total          |
| Origins   | Externals          | 13,297       | 75,131             | 9,959           | 98,387         |
|           | Regional Corridors | 59,939       | 966,831            | 85,399          | 1,112,169      |
|           | GHMS Study Area    | 13,485       | 140,194            | <b>359,776</b>  | <b>513,455</b> |
|           | Total              | 86,721       | 1,182,156          | <b>455,134</b>  | 1,724,011      |

Source: StreetLight Data – 2019 Volumes

### 2.7.2 Travel from the Regional Corridors (CRCOG Region Outside of GHMS Study Area) to the GHMS Study Area

The daily distribution of traffic from each of the Regional Corridors to the GHMS Corridors of Significance (COS) is shown in **Table 2-5**. From the Exhibit it can be seen that trips from the Regional Corridors tend to be destined to either the adjacent GHMS COS or Study Core.

- For example, 78 percent (60,782 / 78,599) of daily trips entering the GHMS Study Area from the Northeast Regional Corridor are destined to either the Northeast COS or the Study Core.

- While trips from the Regional Corridors may travel to any of the COS, however, the remaining OD pairs between the Regional Corridors and the COS typically account for less than six percent of entering traffic and range from a low of one percent (the North, Northwest, and Southwest Regional Corridors to the Southeast COS) to a high of 17 percent (the Northwest Regional Corridor to the North COS).



**Table 2-5: Daily Trips from the Regional Corridors to the GHMS Study Area**

| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Trips) |               |               |               |               |               | Study Core    | Total   |
|--------------------|--|---------------|---------------|---------------|---------------|---------------|---------------|---------|
|                    | North                                  | Northeast     | Northwest     | South         | Southeast     | Southwest     |               |         |
| <b>North</b>       | <b>38,769</b>                          | 13,361        | 4,304         | 3,934         | 1,208         | 3,493         | <b>21,757</b> | 86,826  |
| <b>Northeast</b>   | 5,943                                  | <b>38,916</b> | 2,354         | 4,455         | 2,140         | 2,925         | <b>21,866</b> | 78,599  |
| <b>Northwest</b>   | 8,843                                  | 1,476         | <b>15,332</b> | 2,425         | 431           | 6,020         | <b>16,046</b> | 50,573  |
| <b>South</b>       | 1,873                                  | 1,529         | 2,027         | <b>33,676</b> | 1,210         | 9,801         | <b>11,423</b> | 61,539  |
| <b>Southeast</b>   | 1,796                                  | 4,791         | 1,643         | 7,502         | <b>14,685</b> | 2,703         | <b>13,308</b> | 46,428  |
| <b>Southwest</b>   | 3,821                                  | 1,786         | 8,794         | 15,538        | 1,038         | <b>42,501</b> | <b>20,702</b> | 94,180  |
| <b>Total</b>       | 61,045                                 | 61,859        | 34,454        | 67,530        | 20,712        | 67,443        | 105,102       | 418,145 |

| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Row percent) |            |            |            |            |            | Study Core | Total |
|--------------------|--|------------|------------|------------|------------|------------|------------|-------|
|                    | North  | Northeast  | Northwest  | South      | Southeast  | Southwest  |            |       |
| <b>North</b>       | <b>45%</b>                                   | 15%        | 5%         | 5%         | 1%         | 4%         | <b>25%</b> | 100%  |
| <b>Northeast</b>   | 8%   | <b>50%</b> | 3%         | 6%         | 3%         | 4%         | <b>28%</b> | 100%  |
| <b>Northwest</b>   | 17%  | 3%         | <b>30%</b> | 5%         | 1%         | 12%        | <b>32%</b> | 100%  |
| <b>South</b>       | 3%   | 2%         | 3%         | <b>55%</b> | 2%         | 16%        | <b>19%</b> | 100%  |
| <b>Southeast</b>   | 4%   | 10%        | 4%         | 16%        | <b>32%</b> | 6%         | <b>29%</b> | 100%  |
| <b>Southwest</b>   | 4%   | 2%         | 9%         | 16%        | 1%         | <b>45%</b> | <b>22%</b> | 100%  |

The distribution of traffic from each of the Regional Corridors during the AM Peak Period to the GHMS COS is shown in **Table 2-6**. From the Exhibit it can be seen that:

- During the AM Peak Period the predominant pattern is again for traffic from a regional corridor to be destined for the COS to which it is immediately adjacent or the GHMS Study Core.

- While for daily trips this was most true for trips entering the GHMS Study Area from the Northeast Regional Corridor, during the AM Peak it is the South Regional Corridor where the highest proportion of trips (76 percent) are destined to either the South COS or the Study Core.
- The remaining OD pairs, i.e., those not involving the adjacent COS or the Study Core, typically see around five to seven percent of the entering traffic from a regional corridor. The percentage of traffic traveling between these OD can range from a low of one percent to a high of 16 percent.

**Table 2-6: AM Trips from the Regional Corridors to the GHMS Study Area**

| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Trips) |              |              |              |              |               |              | Study Core | Total |
|--------------------|--|--------------|--------------|--------------|--------------|---------------|--------------|------------|-------|
|                    | North                                  | Northeast    | Northwest    | South        | Southeast    | Southwest     |              |            |       |
| <b>North</b>       | <b>8,248</b>                           | 1,848        | 1,263        | 964          | 411          | 825           | <b>8,020</b> | 21,579     |       |
| <b>Northeast</b>   | 1,951                                  | <b>7,056</b> | 867          | 1,616        | 676          | 1,009         | <b>9,908</b> | 23,083     |       |
| <b>Northwest</b>   | 2,197                                  | 278          | <b>3,331</b> | 650          | 130          | 1,809         | <b>6,187</b> | 14,582     |       |
| <b>South</b>       | 426                                    | 315          | 550          | <b>6,665</b> | 308          | 2,230         | <b>5,339</b> | 15,833     |       |
| <b>Southeast</b>   | 725                                    | 1,273        | 803          | 2,229        | <b>3,404</b> | 1,145         | <b>7,455</b> | 17,034     |       |
| <b>Southwest</b>   | 1,203                                  | 393          | 2,831        | 4,662        | 426          | <b>10,051</b> | <b>9,807</b> | 29,373     |       |
| <b>Total</b>       | 14,750                                 | 11,163       | 9645         | 16,786       | 5,355        | 17,069        | 46,716       | 1,21,484   |       |

| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Row percent) |            |            |            |            |            |            | Study Core | Total |
|--------------------|--|------------|------------|------------|------------|------------|------------|------------|-------|
|                    | North  | Northeast  | Northwest  | South      | Southeast  | Southwest  |            |            |       |
| <b>North</b>       | <b>38%</b>                                   | 9%         | 6%         | 4%         | 2%         | 4%         | <b>37%</b> | 100%       |       |
| <b>Northeast</b>   | 8%   | <b>31%</b> | 4%         | 7%         | 3%         | 4%         | <b>43%</b> | 100%       |       |
| <b>Northwest</b>   | 15%  | 2%         | <b>23%</b> | 4%         | 1%         | 12%        | <b>42%</b> | 100%       |       |
| <b>South</b>       | 3%   | 2%         | 3%         | <b>42%</b> | 2%         | 14%        | <b>34%</b> | 100%       |       |
| <b>Southeast</b>   | 4%   | 7%         | 5%         | 13%        | <b>20%</b> | 7%         | <b>44%</b> | 100%       |       |
| <b>Southwest</b>   | 4%   | 1%         | 10%        | 16%        | 1%         | <b>34%</b> | <b>33%</b> | 100%       |       |

The distribution of traffic from each of the Regional Corridors during the PM Peak Period to the GHMS COS is shown in **Table 2-7** and summarized below.

- Similar to the other time periods, during the PM Peak Period the predominant pattern is for traffic from a regional corridor to be destined for the COS to which it is immediately adjacent or the GHMS Study Core.
- In contrast to the AM Peak Period, however, when it was the South Regional Corridor with the highest proportion of trips exhibiting this pattern, during the PM Peak Period it is the Northeast Regional Corridor where 80 percent of trips are destined to either the Northeast COS or the Study Core.
- Also during the PM Peak, in contrast to the daily and AM Peak Period OD patterns, the number of trips from the Regional Corridors tends to more heavily favor the adjacent COS. The one exception to this pattern is the Northwest Regional Corridor. Trips from this regional corridor are almost evenly split between the adjacent COS and the Study Core.
- Finally, the remaining OD pairs, i.e., those not involving the adjacent COS or the Study Core, typically see around five to six percent of the entering traffic from a regional corridor. These OD pairs range from a low of one percent, e.g., the North Regional Corridor to the Southeast COS, to a high of 20 percent for trips between the Southeast Regional Corridor and the South COS.

**Table 2-7: PM Trips from the Regional Corridors to the GHMS Study Area**

| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Trips)       |              |              |              |              |              |              | Study Core | Total |
|--------------------|--|--------------|--------------|--------------|--------------|--------------|--------------|------------|-------|
|                    | North  | Northeast    | Northwest    | South        | Southeast    | Southwest    |              |            |       |
| North              | <b>8,557</b>                                 | 3,685        | 1,012        | 969          | 275          | 775          | <b>3,901</b> | 19,174     |       |
| Northeast          | 942  | <b>8,808</b> | 424          | 830          | 394          | 518          | <b>3,269</b> | 15,185     |       |
| Northwest          | 1,993  | 373          | <b>3,245</b> | 611          | 78           | 1,216        | <b>3,153</b> | 10,669     |       |
| South              | 333  | 391          | 551          | <b>8,156</b> | 307          | 2,342        | <b>1,590</b> | 13,670     |       |
| Southeast          | 294  | 1,060        | 223          | 1,678        | <b>3,097</b> | 421          | <b>1,731</b> | 8,504      |       |
| Southwest          | 549  | 380          | 1,707        | 3,308        | 160          | <b>9,245</b> | <b>2,848</b> | 18,197     |       |
| <b>Total</b>       | 12,668                                       | 14,697       | 7,162        | 15,552       | 4,311        | 14,517       | 16,492       | 85,399     |       |
| Regional Corridors | GHMS CORRIDORS OF SIGNIFICANCE (Row percent) |              |              |              |              |              |              | Study Core | Total |
|                    | North  | Northeast    | Northwest    | South        | Southeast    | Southwest    |              |            |       |
| North              | <b>45%</b>                                   | 19%          | 5%           | 5%           | 1%           | 4%           | <b>20%</b>   | 100%       |       |
| Northeast          | 6%   | <b>58%</b>   | 3%           | 5%           | 3%           | 3%           | <b>22%</b>   | 100%       |       |
| Northwest          | 19%  | 3%           | <b>30%</b>   | 6%           | 1%           | 11%          | <b>30%</b>   | 100%       |       |
| South              | 2%   | 3%           | 4%           | <b>60%</b>   | 2%           | 17%          | <b>12%</b>   | 100%       |       |
| Southeast          | 3%   | 12%          | 3%           | 20%          | <b>36%</b>   | 5%           | <b>20%</b>   | 100%       |       |
| Southwest          | 3%   | 2%           | 9%           | 18%          | 1%           | <b>51%</b>   | <b>16%</b>   | 100%       |       |

In an attempt to get a better understanding of OD patterns associated with travel from the Regional Corridors to the GHMS COS a StreetLight OD analysis was conducted that used selected stations outside of the Study Area as entry points and TAZs within each of the Study Area COS as destinations. These stations, which were assumed to serve specific GHMS COS, are listed in **Table 2-8**.

**Figure 2-32** through **Figure 2-37** illustrate the distribution of daily traffic entering the GHMS Study Area from the stations listed in the above table. (Exhibits for AM and PM peak period traffic as well as weekend traffic appear in **Appendix 2**.) The exhibits present the data both as the number of trips and as a trip density. Trip density is defined as the number of trips divided by the area of the TAZ. TAZs are typically drawn such that in areas where there is less development, or development levels are less dense, TAZs are larger. In more densely developed areas TAZs are smaller. Thus, for the same number of trips a large TAZ will have a relatively low trip density while a small TAZ will have a relatively high trip density. It is anticipated that this measure may be helpful as an indicator of where strategies that promote travel by transit or non-motorized modes may be successful, i.e., have a high trip density. Following each map for GHMS COS, a series of observations have been noted. Overall, the maps reinforce the idea that travelers tend to be destined primarily to the corridor through which they enter the study area and then to a lesser extent the Study Core or a different GHMS Corridor.

**Table 2-2-8: Regional Corridor Stations**

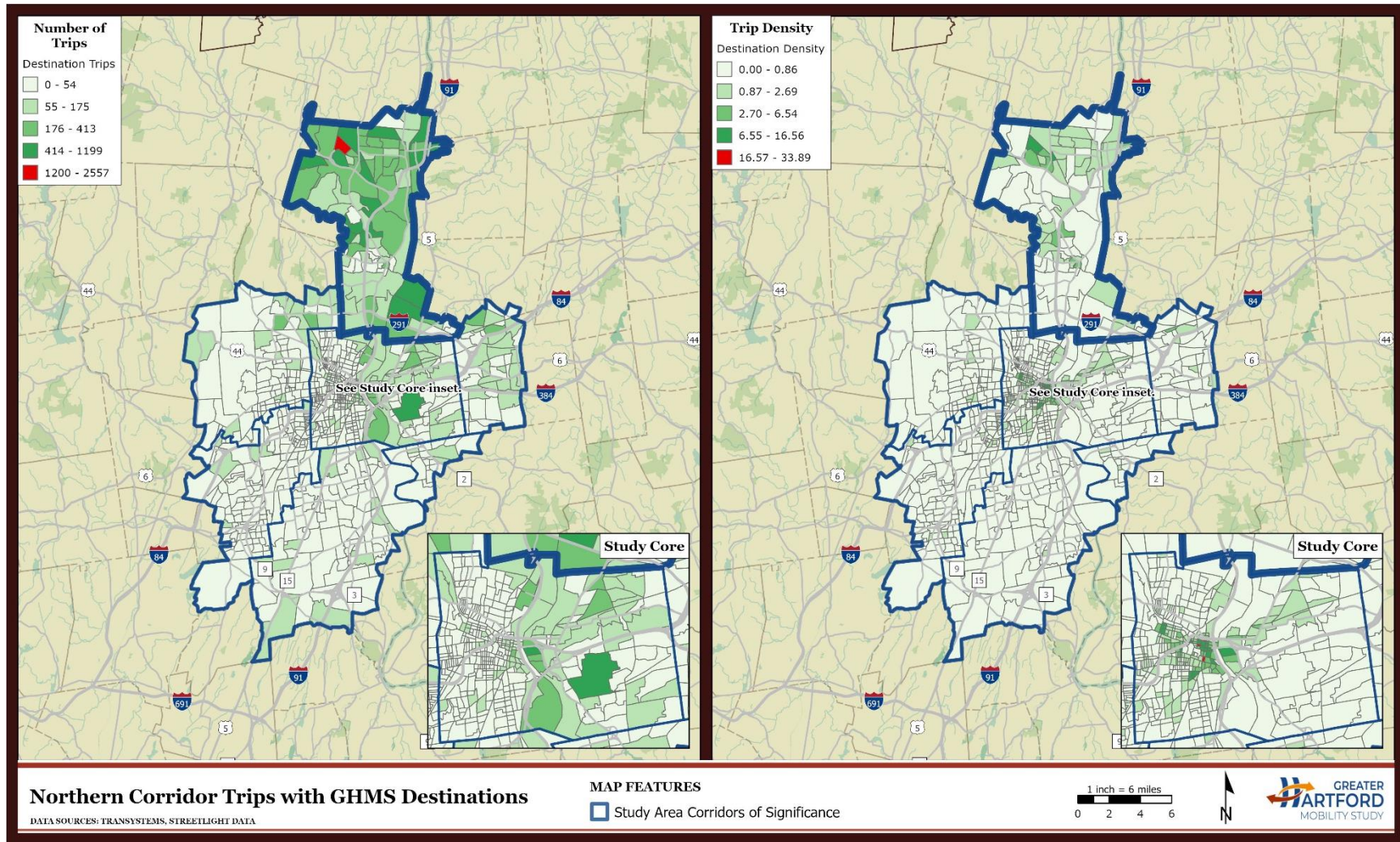
| <b>GHMS Corridor</b> | <b>Station Location</b> |
|----------------------|-------------------------|
| <b>North</b>         | Day Hill Rd             |
|                      | I-91                    |
|                      | Route 75                |
|                      | Seymour Rd              |
|                      | US 5                    |
| <b>Northeast</b>     | I-384                   |
|                      | I-84 HOV                |
|                      | I-84                    |
| <b>Northwest</b>     | Route 185               |
|                      | Route 187               |
|                      | Route 189               |
|                      | US 44                   |
| <b>South</b>         | I-91                    |
|                      | Route 5                 |
|                      | Route 99                |
|                      | Route 9                 |
| <b>Southeast</b>     | New London Turnpike     |
|                      | Route 2                 |
| <b>Southwest</b>     | I-84                    |
|                      | Route 6                 |
|                      | Route 72                |

**Key Observations for Trips from North  
Corridor to GHMS Study Area**

(Figure 2-32)

- Destinations tend to be concentrated in the northern end of the North COS.
- The airport and surrounding employment sites are a major draw.
- Another concentration of trip destinations is seen at the south end of the North COS near the northern boundary of the Study Core along Route 5.
- Within the Study Core, trip destinations tend to be concentrated along the river and to the east especially at Pratt & Whitney.
- Trip density shows a concentration of activity around Bradley International Airport and to the north.
- Within the study core, trip density shows activity more to the west of the river and then along I-84 in the vicinity of the Shoppes at Buckland Hills. Pratt & Whitney as a destination is not evident.

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**Figure 2-32: Northern Corridor Trips with GHMS Destinations**

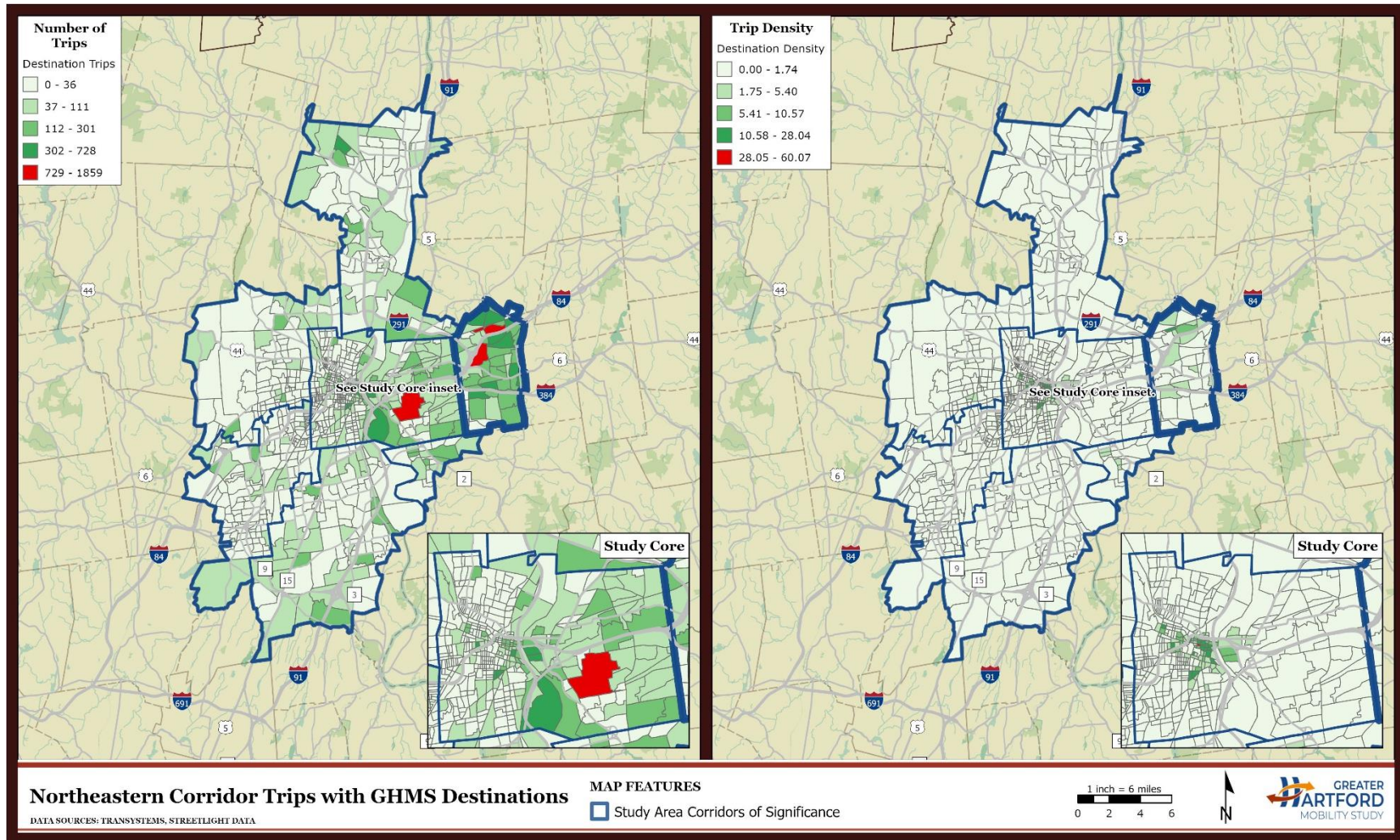
### **Key Observations for Trips from Northeastern Corridor to GHMS Study Area (Figure 2-33)**

- Within the northeastern COS the heaviest concentration of trips is seen on the north along I-84 in South Windsor and Manchester.
- The airport is a relatively large destination for trips entering through the Northeast Corridor.
- Within the Study Core, destinations tend to be concentrated along the river and to the east especially at Pratt & Whitney.
- Trip density reinforces the activity at the north end of the corridor along I-84 in South Windsor and Manchester.
- Within the Study Core, trip density shifts the focus of activity from east of the river to west of the river south of I-84 and west of I-91. Pratt & Whitney shows relatively low trip density.

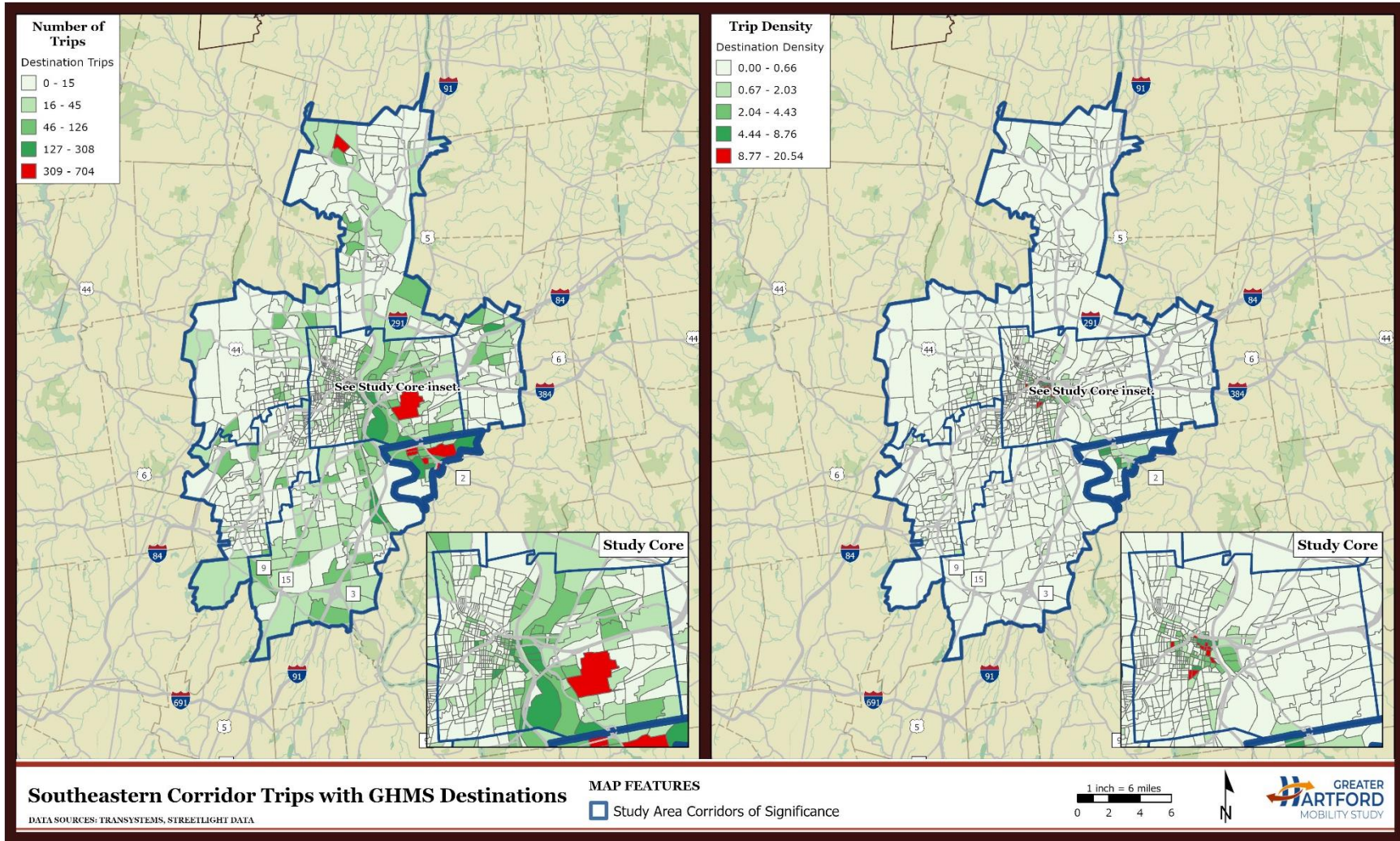
### **Key Observations for Trips from Southeastern Corridor to GHMS Study Area (Figure 2-34)**

- Within the Southeastern COS itself major concentration of trips are destined for areas along CT 2 (Veterans of Foreign Wars Memorial Highway) and the New London Turnpike in the Town of Glastonbury.
- Pratt & Whitney again shows up as a major destination.
- The area including Hartford Brainard Airport, along the Connecticut River just north of the corridor, as well as areas further north along the river are also large attractors.
- Bradley International Airport again attracts a relatively large number of trips.
- Finally, and perhaps due to its small size, the pattern of destinations for trips entering the study area through this corridor appears more dispersed than the other corridors.
- As was the case with trips, trip density is relatively high within the Southeastern COS and areas along CT 2.





**Figure 2-33: Northeastern Corridor Trips with GHMS Destinations**



**Figure 2-34: Southeastern Corridor Trips with GHMS Destinations**

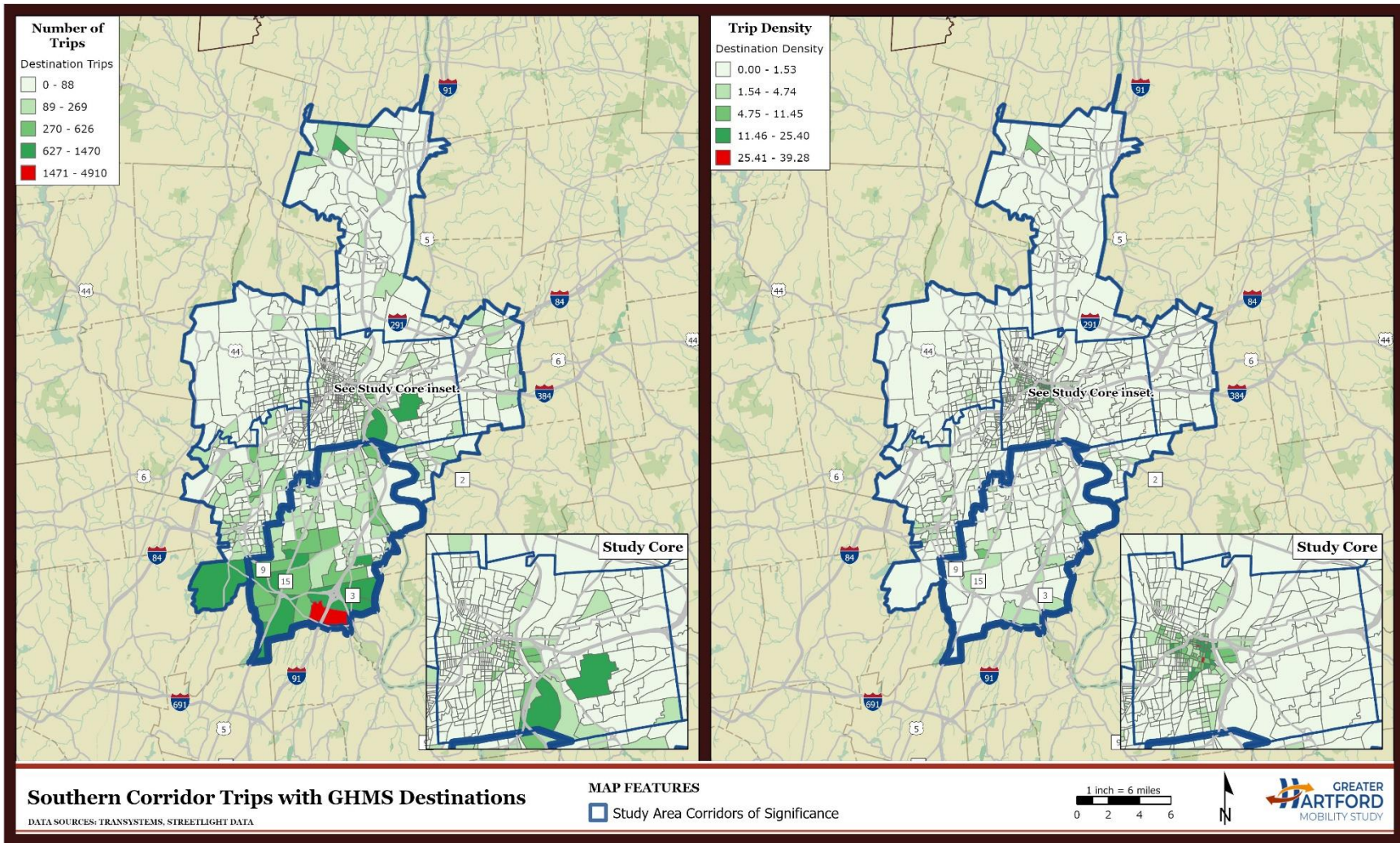
### **Key Observations for Trips from Southern Corridor to GHMS Study Area**

(Figure 2-35)

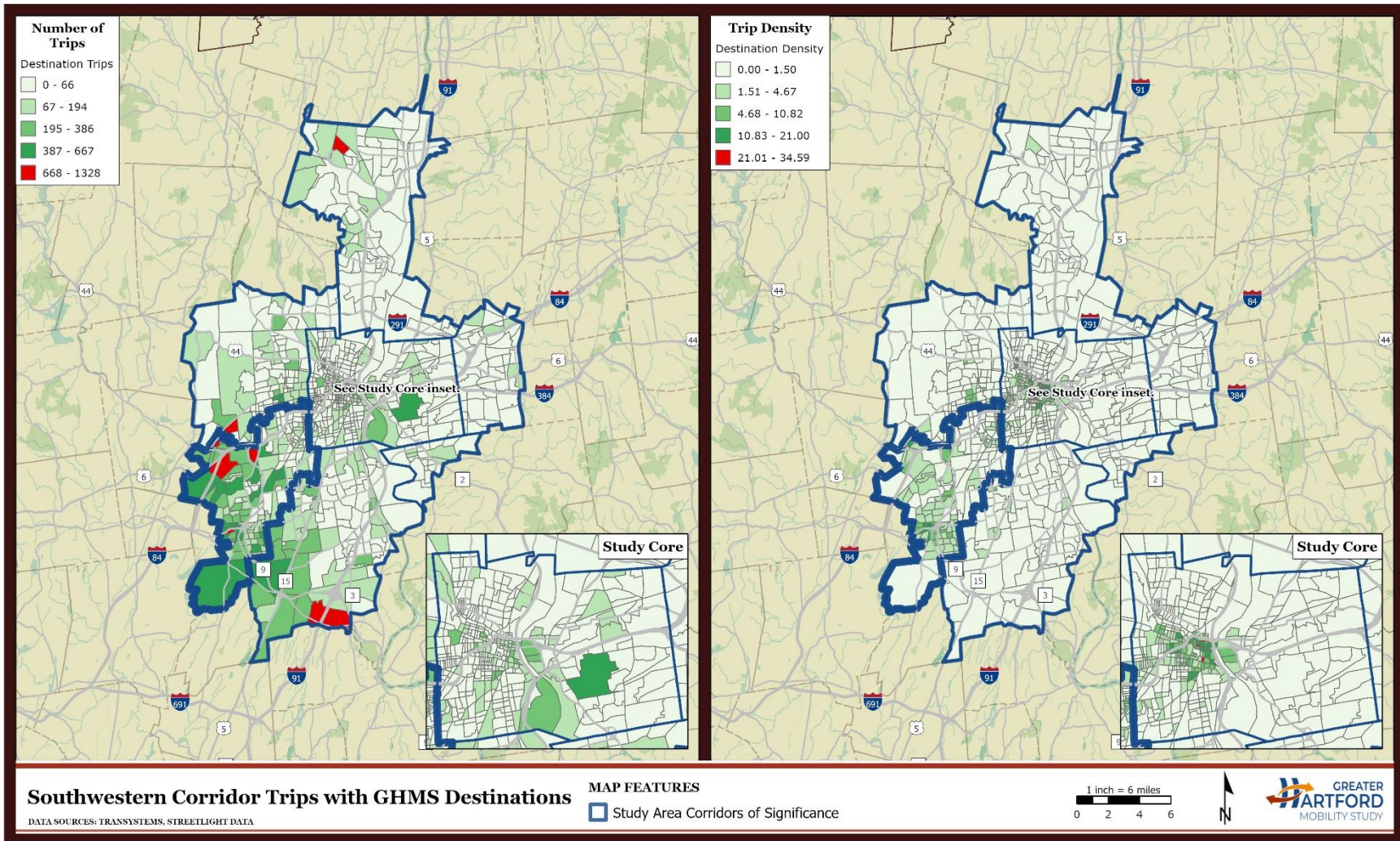
- There is a heavy concentration of trips entering through the South corridor destined for the towns of Berlin, Cromwell, and Rocky Hill. The pattern appears more pronounced than in the Northeast or Southeast COS.
- The most popular destination appears in the southern part of the Southern COS in the Town of Cromwell. This TAZ has a mix of residential and commercial development. The development is concentrated in the south and east of the TAZ along routes 3 and 372.
- Pratt & Whitney, in the Study Core, again shows up as a big destination.
- On the other end of the Study Area, Bradley International Airport is also a draw for trips entering via the South Corridor.
- Trip density again shows activity toward the west central part of the Study Core along the river as well as south of I-84 and west of I-91.

### **Key Observations for Trips from Southwestern Corridor to GHMS Study Area (Figure 2-36)**

- The Town of Cromwell, in the Southern COS, shows as a relatively large destination for trips entering through the Southwestern Corridor.
- Downtown New Britain is a major destination along Route 72.
- Other relatively large destinations can be seen in the northern part of the Southwestern COS including Batterson Park (along I-84), Westfarms Shopping Mall (I-84 and Rte 9), and the University of Connecticut School of Medicine / UConn Health North (north of I-84 and partially in the Northwest Corridor).
- Pratt & Whitney as well as Bradley International Airport and the surrounding area show up as important destinations.
- Trip density reinforces the concentrated activity patterns seen along I-84, Route 72, and Route 9 through the Southwestern COS.
- Within the Study Core, trip density is concentrated along the river and to the west. There also appears to be more activity to the west of I-84.



**Figure 2-35: Southern Corridor Trips with GHMS Destinations**

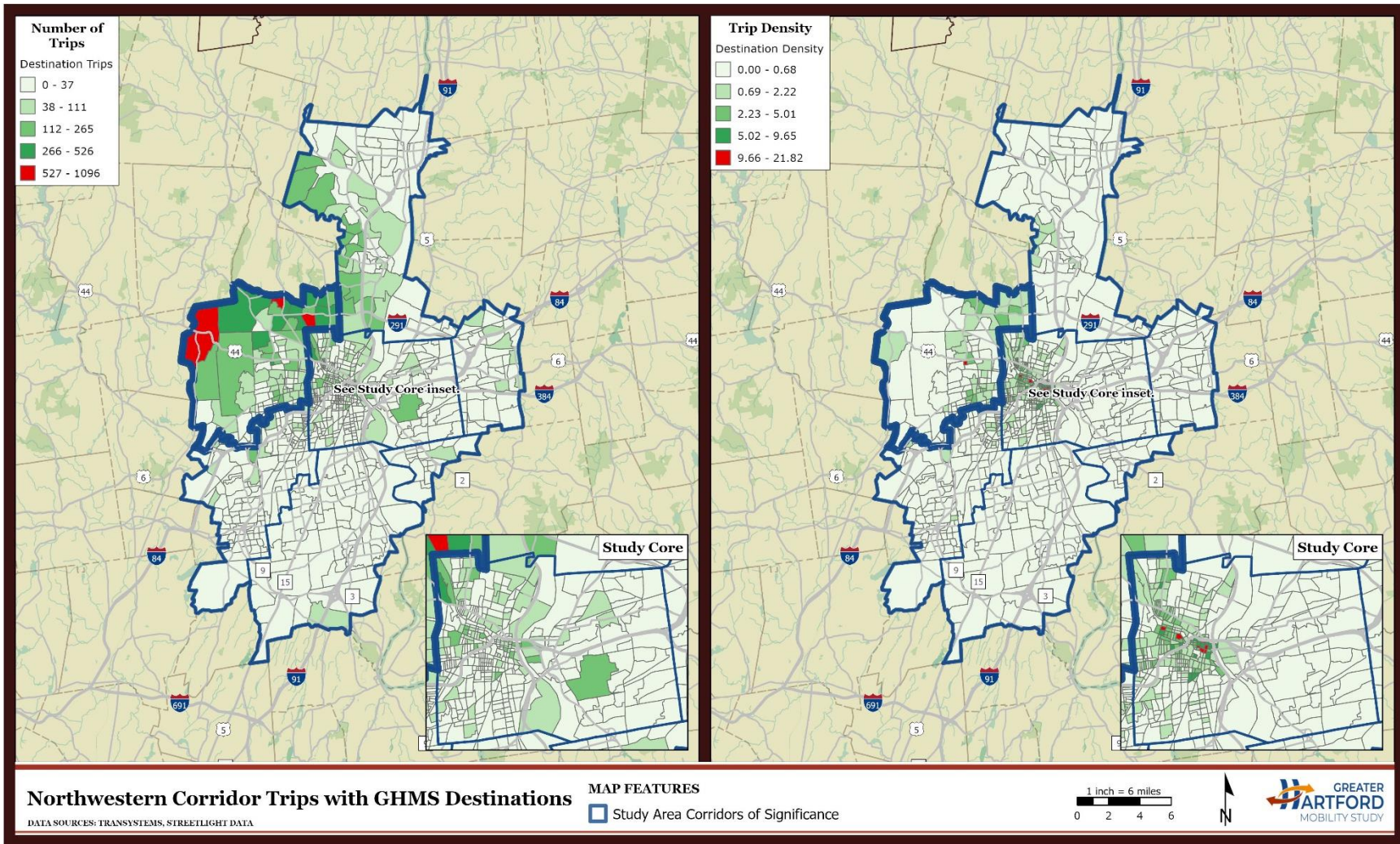


**Figure 2-36: Southwestern Corridor Trips with GHMS Destinations**

**Key Observations for Trips from  
Northwestern Corridor to GHMS Study Area**  
(Figure 2-37)

- As was evident in the Southwest and South corridors there is a heavy concentration of destinations immediately inside the border of the Northwestern COS to the west and north.
- A particularly heavy concentration of destinations can be seen in the Town of Avon along US 44 (Avon Mountain Road) and CT 10 (Waterville Road) as well as in the Town of Bloomfield along CT 218.
- Trip destinations from Northwest Corridor are more prominent in the North COS than in the Study Core.
- Study Core destinations tend to be concentrated on the west side and along the river.
- In contrast to the other corridors, neither Bradley International Airport nor Pratt & Whitney show up a major destination points.
- Trip density tends to shift the focus of activity closer to the study core and the Northwest COS boundary with the North COS.
- Trip density also shows a heavy concentration of trip making within the study core, west of the river, stretching along Route 44.

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**Figure 2-37: Northwestern Corridor Trips with GHMS Destinations**

### 2.7.3 Travel within the GHMS Study Area

**Table 2-9** illustrates the daily OD matrix for travel occurring within the GHMS Study Area.

*For each COS, the predominant share of trips has both the origins and destinations within the same COS (intra-COS trips). As such, localized identification of needs and improvements may be essential for each COS.*

For the seven COS, the percentage of intra-COS trips ranges from a low of 37 percent in the Southeast COS to a high of 71 percent in the Study Core. Further, as seen before, the second most likely destination is the Study Core. With few exceptions, other COS attract five percent or less of trips from a given origin COS

*Nearly three out of every four trips destined for the Study Core originate within the Study Core. This offers an opportunity for strategic improvements focused on bike, pedestrian and transit infrastructure within the Study Core to encourage meaningful mode shift and reduced congestion on key Study Core corridors.*

indicating a radial nature of trips with the study core (for the trips that leave individual COS).

**Table 2-10** is the OD matrix for travel occurring during weekday AM Peak Period (6-9AM) within the GHMS Study Area. Here again, with the exception of the Southeast COS, the largest percentage of trips originating in each COS are destined for the same COS. For the remaining COS the percentage of intra-corridor trips ranges from a low of 41 percent in the Northwest COS to a high of 76 percent in the Study Core. Similar to the daily pattern, with the exception of the Southeast COS, the second most likely destination for each of the COS is the Study Core. With few exceptions, other COS attract six percent or less of trip from a given origin COS.

**Table 2-11** is the OD matrix for travel occurring during PM Peak Period within the GHMS Study Area. The patterns are very similar to those seen previously with most trips originating in a COS being destined for the same COS or the Study Core. The percentage of intra-corridor trips ranges from a low of 34 percent in the Southeast COS to a high of 66 percent in the North COS and the Study Core. Continuing the pattern, second most likely destination for each of the COS is the Study Core. Finally, with few exceptions, other COS attract five percent or less of trips from a given origin COS.



**Table 2-9: Daily OD Matrix for GHMS Study Area COS**

| Origins<br>COS | Destination Corridors of Significance |               |               |                |               |                | Study<br>Core  | Total     |
|----------------|---------------------------------------|---------------|---------------|----------------|---------------|----------------|----------------|-----------|
|                | North                                 | Northeast     | Northwest     | South          | Southeast     | Southwest      |                |           |
| North          | <b>85,698</b>                         | 5,252         | 5,660         | 3,428          | 729           | 2,771          | <b>23,508</b>  | 127,046   |
| Northeast      | 5,245                                 | <b>65,990</b> | 2,046         | 3,311          | 2,281         | 2,296          | <b>28,230</b>  | 109,399   |
| Northwest      | 5,930                                 | 2,167         | <b>59,397</b> | 4,880          | 810           | 19,496         | <b>34,821</b>  | 127,501   |
| South          | 3,456                                 | 3,453         | 4,553         | <b>156,321</b> | 4,105         | 32,927         | <b>35,513</b>  | 240,328   |
| Southeast      | 605                                   | 2,212         | 698           | 3,867          | <b>10,647</b> | 1,000          | <b>10,048</b>  | 29,077    |
| Southwest      | 2,846                                 | 2,419         | 19,258        | 32,951         | 1,117         | <b>103,874</b> | <b>37,498</b>  | 199,963   |
| Study<br>Core  | 24,523                                | 28,459        | 34,341        | 36,136         | 10,735        | 37,628         | <b>429,192</b> | 601,014   |
| <b>Total</b>   | 128,303                               | 109,952       | 125,953       | 240,894        | 30,424        | 199,992        | 598,810        | 1,434,328 |

| Origin<br>COS | Destination Corridors of Significance (row percent) |            |            |            |            |            | Study<br>Core | Total |
|---------------|---|------------|------------|------------|------------|------------|---------------|-------|
|               | North   | Northeast  | Northwest  | South      | Southeast  | Southwest  |               |       |
| North         | <b>67%</b>  | 4%         | 4%         | 3%         | 1%         | 2%         | <b>19%</b>    | 100%  |
| Northeast     | 5%  | <b>60%</b> | 2%         | 3%         | 2%         | 2%         | <b>26%</b>    | 100%  |
| Northwest     | 5%  | 2%         | <b>47%</b> | 4%         | 1%         | 15%        | <b>27%</b>    | 100%  |
| South         | 1%  | 1%         | 2%         | <b>65%</b> | 2%         | 14%        | <b>15%</b>    | 100%  |
| Southeast     | 2%  | 8%         | 2%         | 13%        | <b>37%</b> | 3%         | <b>35%</b>    | 100%  |
| Southwest     | 1%  | 1%         | 10%        | 16%        | 1%         | <b>52%</b> | <b>19%</b>    | 100%  |
| Study<br>Core | 4%  | 5%         | 6%         | 6%         | 2%         | 6%         | <b>71%</b>    | 100%  |

**Table 2-10: OD Matrix for GHMS Study Area COS – AM Peak Period (6:00 AM – 9:00 AM)**

| Origins<br>COS | Destination Corridors of Significance |              |              |               |              |               | Study<br>Core | Total   |
|----------------|---------------------------------------|--------------|--------------|---------------|--------------|---------------|---------------|---------|
|                | North                                 | Northeast    | Northwest    | South         | Southeast    | Southwest     |               |         |
| North          | <b>13,068</b>                         | 617          | 1,113        | 545           | 148          | 404           | <b>5,332</b>  | 21,227  |
| Northeast      | 775                                   | <b>6,010</b> | 448          | 553           | 327          | 405           | <b>5,560</b>  | 14,078  |
| Northwest      | 874                                   | 272          | <b>8,792</b> | 587           | 178          | 2,740         | <b>7,864</b>  | 21,307  |
| South          | 831                                   | 563          | 1,246        | <b>20,690</b> | 713          | 5,470         | <b>10,123</b> | 39,636  |
| Southeast      | 102                                   | 205          | 74           | 401           | <b>1,008</b> | 157           | <b>1,503</b>  | 3,450   |
| Southwest      | 534                                   | 309          | 3,035        | 4,403         | 226          | <b>13,865</b> | <b>7,991</b>  | 30,363  |
| Study<br>Core  | 3,982                                 | 3,185        | 4,460        | 4,053         | 1,332        | 4,588         | <b>68,687</b> | 90,287  |
| Total          | 20,166                                | 11,161       | 19,168       | 31,232        | 3,932        | 27,629        | 107,060       | 220,348 |

| Origin<br>COS | Destination Corridors of Significance (row percent) |            |            |            |            |            | Study<br>Core | Total |
|---------------|---|------------|------------|------------|------------|------------|---------------|-------|
|               | North   | Northeast  | Northwest  | South      | Southeast  | Southwest  |               |       |
| North         | <b>62%</b>  | 3%         | 5%         | 3%         | 1%         | 2%         | <b>25%</b>    | 100%  |
| Northeast     | 6%  | <b>43%</b> | 3%         | 4%         | 2%         | 3%         | <b>39%</b>    | 100%  |
| Northwest     | 4%  | 1%         | <b>41%</b> | 3%         | 1%         | 13%        | <b>37%</b>    | 100%  |
| South         | 2%  | 1%         | 3%         | <b>52%</b> | 2%         | 14%        | <b>26%</b>    | 100%  |
| Southeast     | 3%  | 6%         | 2%         | 12%        | <b>29%</b> | 5%         | <b>44%</b>    | 100%  |
| Southwest     | 2%  | 1%         | 10%        | 15%        | 1%         | <b>46%</b> | <b>26%</b>    | 100%  |
| Study<br>Core | 4%  | 4%         | 5%         | 4%         | 1%         | 5%         | <b>76%</b>    | 100%  |

**Table 2-11: OD Matrix for GHMS Study Area COS – PM Peak Period (3:00 PM – 6:00 PM)**

| Origins<br>COS | Destination COS |               |               |               |              |               | Study<br>Core  | Total   |
|----------------|-----------------|---------------|---------------|---------------|--------------|---------------|----------------|---------|
|                | North           | Northeast     | Northwest     | South         | Southeast    | Southwest     |                |         |
| North          | <b>19,673</b>   | 1,602         | 1,458         | 976           | 182          | 702           | <b>5,111</b>   | 29,704  |
| Northeast      | 1,150           | <b>16,106</b> | 432           | 769           | 552          | 473           | <b>5,494</b>   | 24,976  |
| Northwest      | 1,616           | 655           | <b>14,880</b> | 1,561         | 188          | 5,084         | <b>7,339</b>   | 31,323  |
| South          | 780             | 1,042         | 1,027         | <b>39,597</b> | 1,051        | 8,463         | <b>6,943</b>   | 58,903  |
| Southeast      | 186             | 640           | 195           | 1,064         | <b>2,436</b> | 284           | <b>2,369</b>   | 7,174   |
| Southwest      | 640             | 707           | 4,750         | 9,067         | 294          | <b>25,222</b> | <b>7,817</b>   | 48,497  |
| Study<br>Core  | 7,057           | 9,319         | 10,505        | 13,151        | 3,437        | 11,396        | <b>104,334</b> | 159,199 |
| Total          | 31,102          | 30,071        | 33,247        | 66,185        | 8,140        | 51,624        | 139,407        | 359,776 |

| Origin<br>COS | Destination COS (row percent) |            |            |            |            |            | Study<br>Core | Total |
|---------------|-------------------------------|------------|------------|------------|------------|------------|---------------|-------|
|               | North                         | Northeast  | Northwest  | South      | Southeast  | Southwest  |               |       |
| North         | <b>66%</b>                    | 5%         | 5%         | 3%         | 1%         | 2%         | <b>17%</b>    | 100%  |
| Northeast     | 5%                            | <b>64%</b> | 2%         | 3%         | 2%         | 2%         | <b>22%</b>    | 100%  |
| Northwest     | 5%                            | 2%         | <b>48%</b> | 5%         | 1%         | 16%        | <b>23%</b>    | 100%  |
| South         | 1%                            | 2%         | 2%         | <b>67%</b> | 2%         | 14%        | <b>12%</b>    | 100%  |
| Southeast     | 3%                            | 9%         | 3%         | 15%        | <b>34%</b> | 4%         | <b>33%</b>    | 100%  |
| Southwest     | 1%                            | 1%         | 10%        | 19%        | 1%         | <b>52%</b> | <b>16%</b>    | 100%  |
| Study<br>Core | 4%                            | 6%         | 7%         | 8%         | 2%         | 7%         | <b>66%</b>    | 100%  |

**Figure 2-38** through **Figure 2-44** further explore these OD patterns. Each exhibit shows, by means of thematic plots, trips originating from the TAZ in a

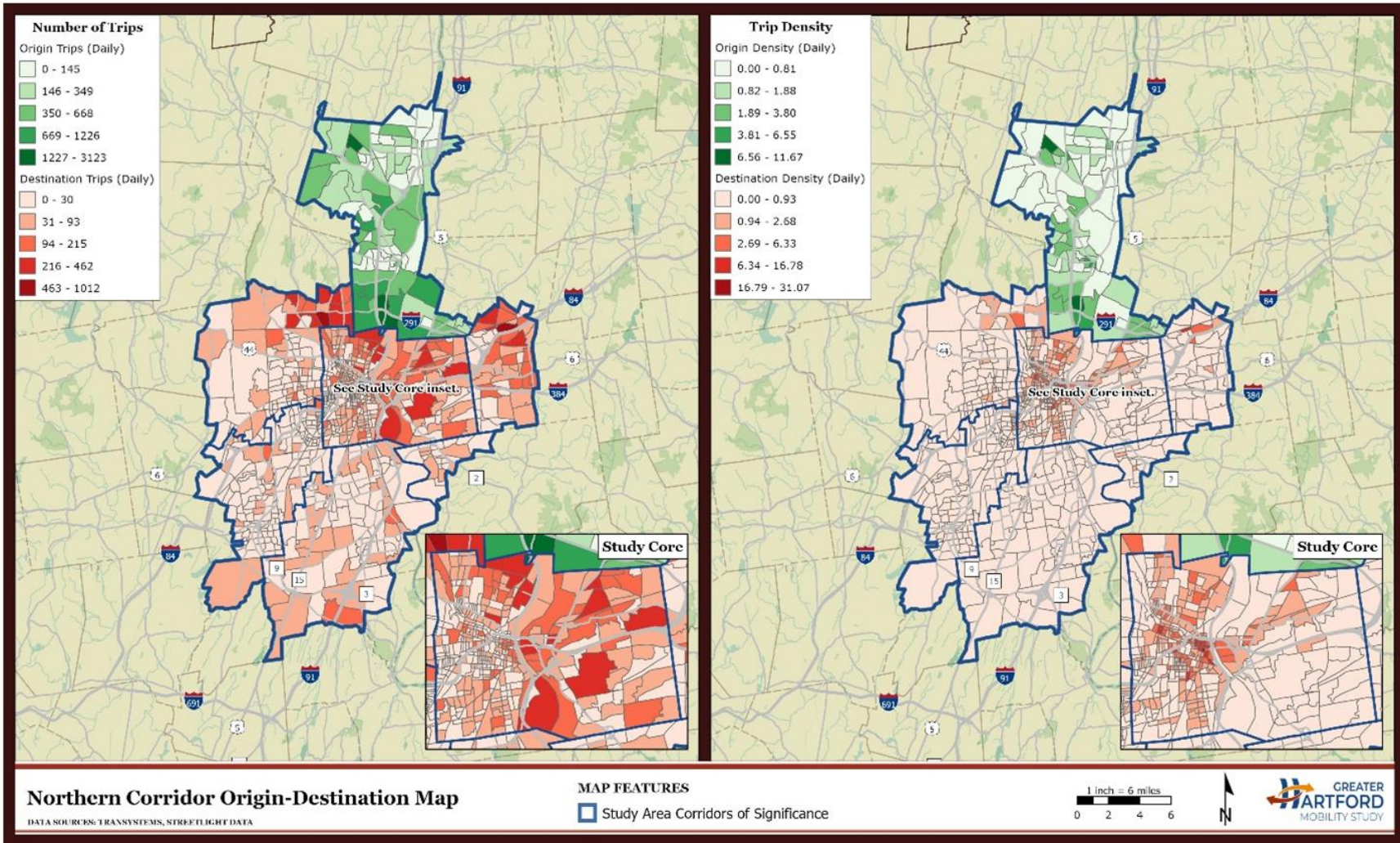
specific COS (green color) and the destination TAZ within the other study area COS (red color).

**Key Observations for Trips from North  
COS to Other GHMS COS**  
(Figure 2-38)

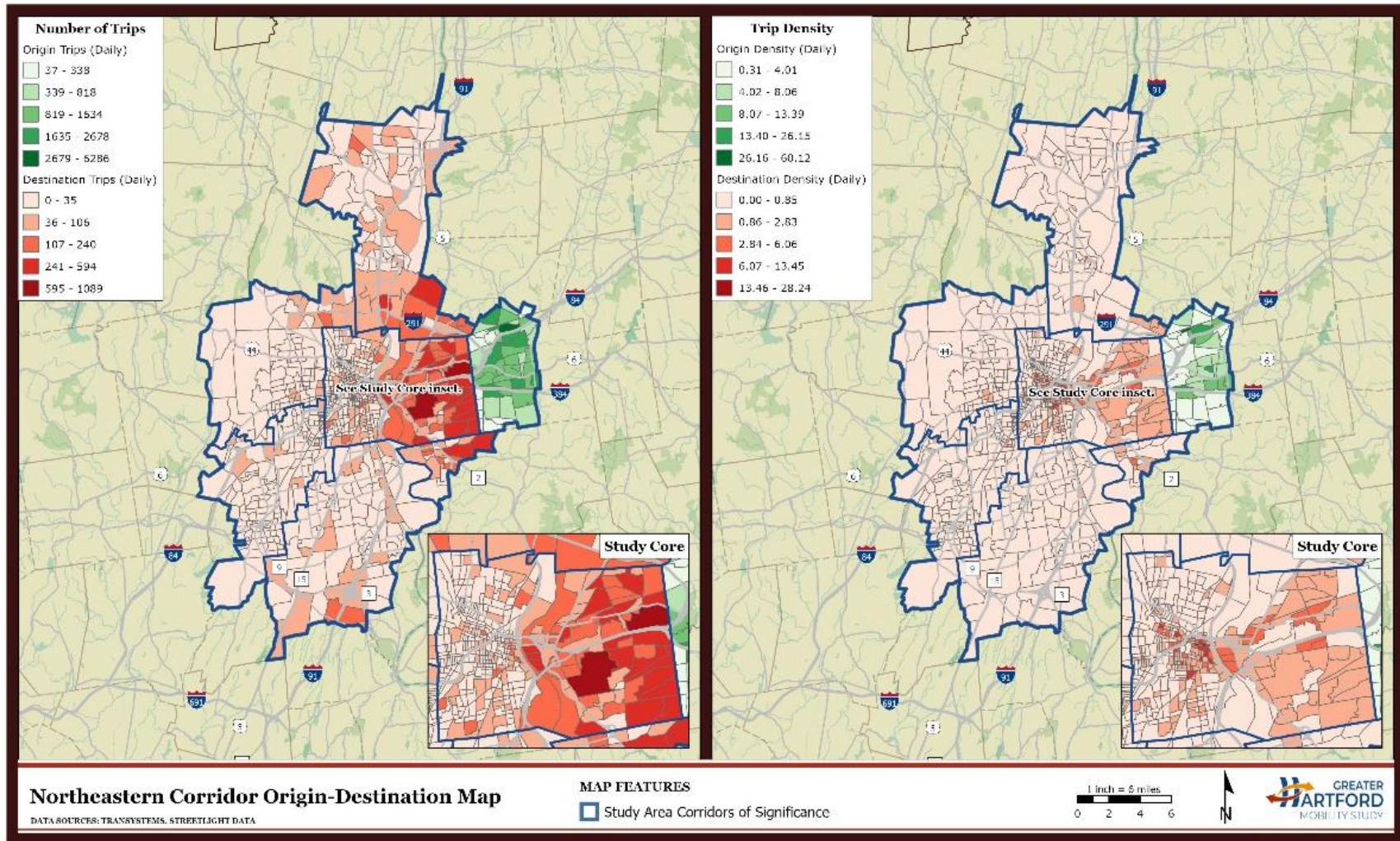
- High concentration of trips originates in the north end of the COS in the vicinity of Bradley International Airport and in the south end of the COS where the land use is largely residential.
- Destinations tend to be centered in the north end of the Northwest COS, in the Town of Bloomfield, where there is a mix of residential, commercial, and recreational land uses including the COPACO shopping center, an office /industrial park east of COPACO, and the CIGNA campus to the west.
- In the Study Core concentrations of destinations can be seen in the northwest, at the hospitals, along the river, and to the east including Pratt & Whitney and Hartford Brainard Airport.
- Northeast COS area in and around the Shoppes at Buckland Hills, in the Town of Manchester, is a big destination.

**Key Observations for Trips from  
Northeast COS to Other GHMS COS**  
(Figure 2-39)

- High concentration of trip origins in the northern and central parts of the COS near the Buckland Hills Mall and the area south of I-84. Origin trip density shows higher in the south and to a lesser extent in the north of the COS.
- Commuting patterns seems to focus more on Hartford and the eastern part of the Hartford CBD.
- It appears like there are a lot of shopping trips from East Hartford shopping in Manchester.
- Relatively high concentration of trips going to the Southeast COS (Glastonbury) and the North COS in the area between the river and US 5.



**Figure 2-38: North COS OD Map**



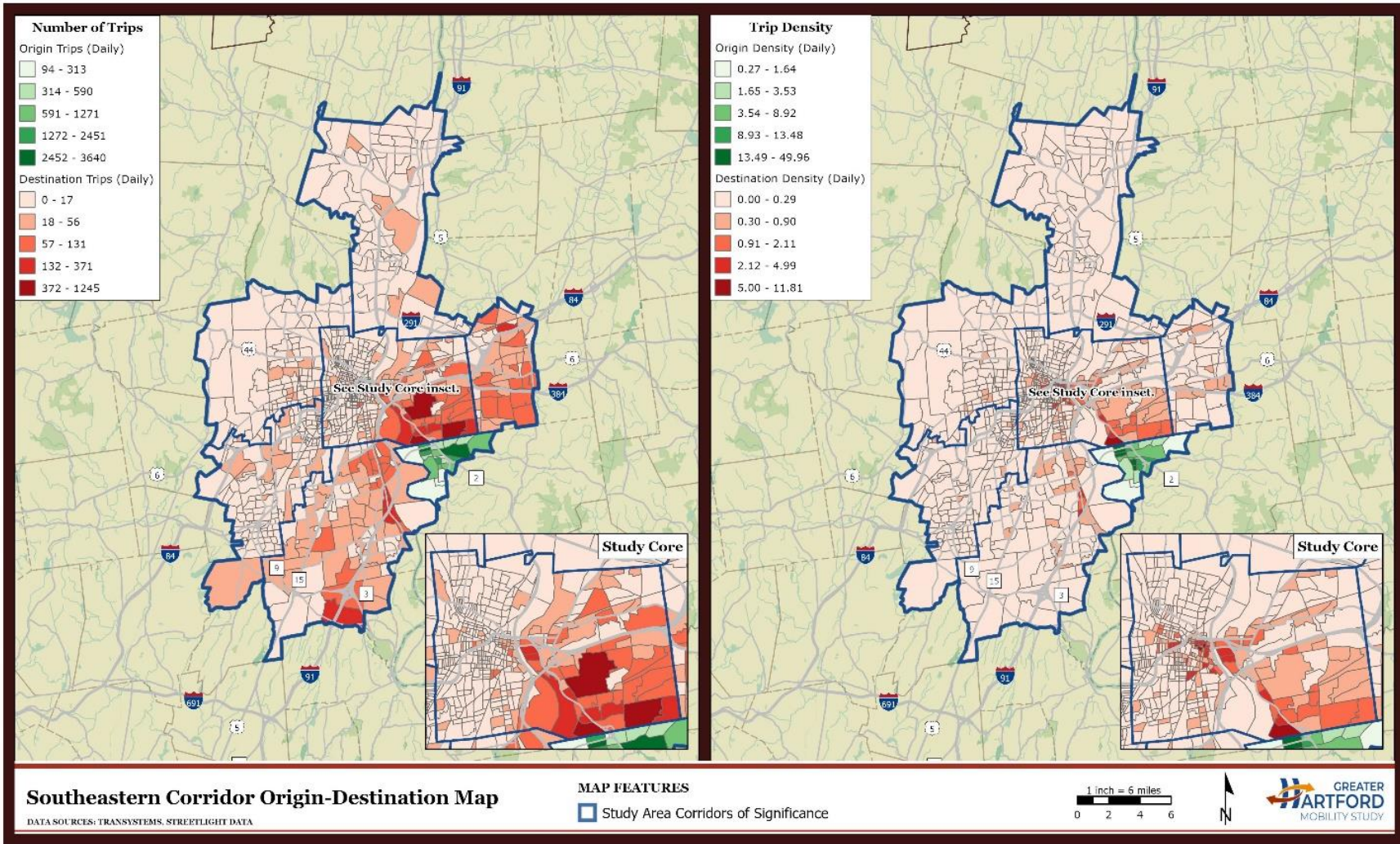
**Figure 2-39: Northeast COS OD Map**

**Key Observations for Trips from  
Southeast COS to Other GHMS COS**  
(Figure 2-40)

- A relatively large number and density of trips are commuting trips to Pratt & Whitney / Founders Plaza area in East Hartford.
- Trips into the Study Core tend to be concentrated in the east.
- The Day Hill Road TAZ, just south of CT 20 and west of I-91, is very large and shows a relatively high number of trip destinations but it drops off the density map. Most likely a lot of these trips are destined to the same location.
- There is a relatively high number of trips heading for the Northeast and South COS as well as in the Study Core west of the river.
- The origins look to be concentrated in a mixed residential commercial area east of CT 2 and then a commercial area south of CT 3 and west of CT 2. The office complexes on Hebron Ave do not show up as one might expect. Important destinations include Hartford Hospital again and Rocky Hill's Walmart.

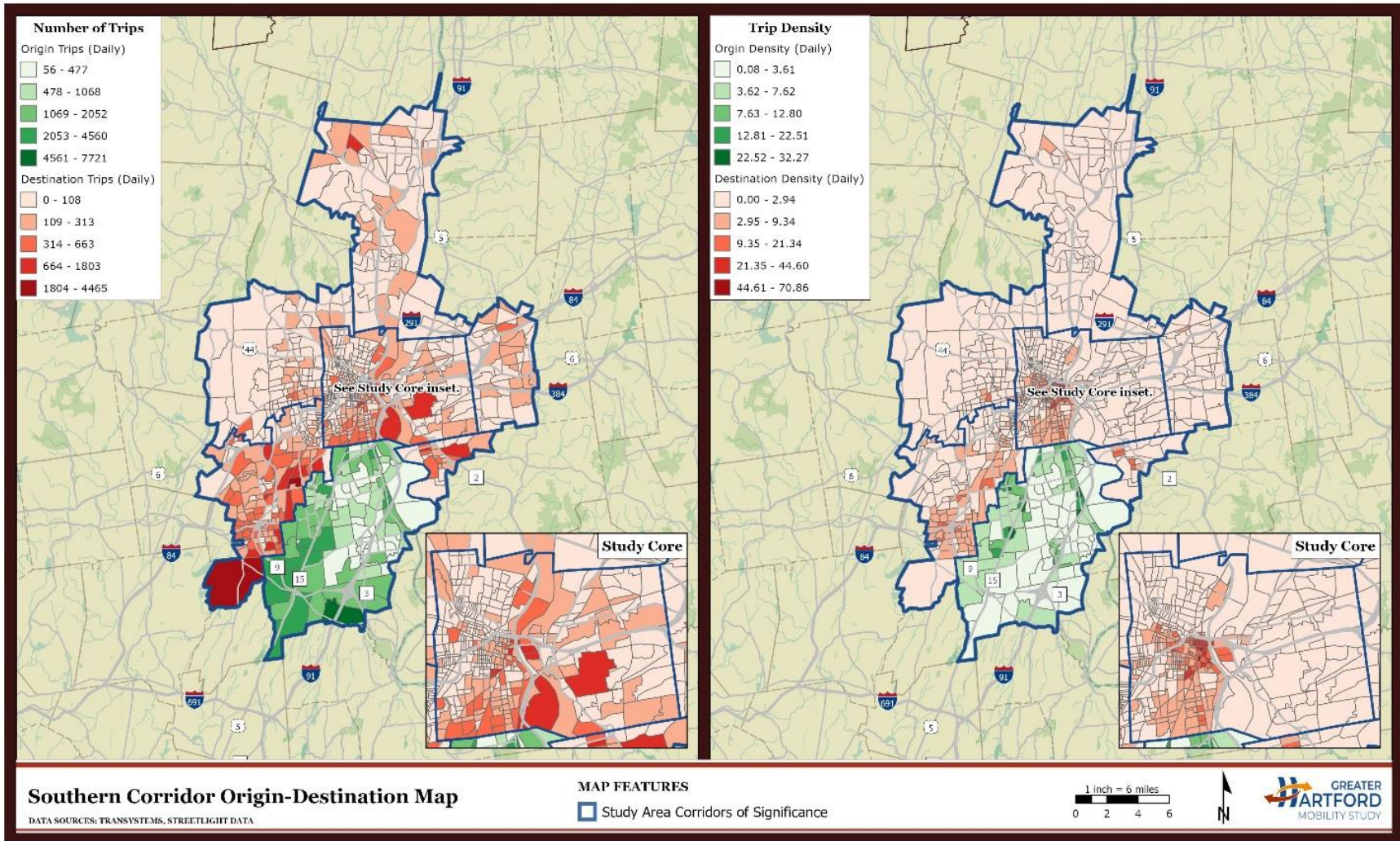
**Key Observations for Trips from South  
COS to Other GHMS COS**  
(Figure 2-41)

- Higher concentration of trip origins at TAZs with apartment complexes vs TAZs with more single-family residences.
- Large number of trips going to New Britain.
- Significant trips destined to the Study Core, presumably commuters, in south Hartford, along the river, at Pratt & Whitney, the Hartford Brainard Airport, and the Buckland Hills Mall in Manchester.
- Most of the origin TAZs are heavily commercial areas on Route 15 and Route 99, along with the office/industrial park in Rocky Hill.
- The Walmarts in Rocky Hill and Newington are also key destinations. This may be due to either commuters going to/from New Britain or New Britain residents doing their shopping in Newington.



**Figure 2-40: Southeast COS OD Map**





**Figure 2-41: South COS OD Map**

**Key Observations for Trips from  
Southwest COS to Other GHMS COS**

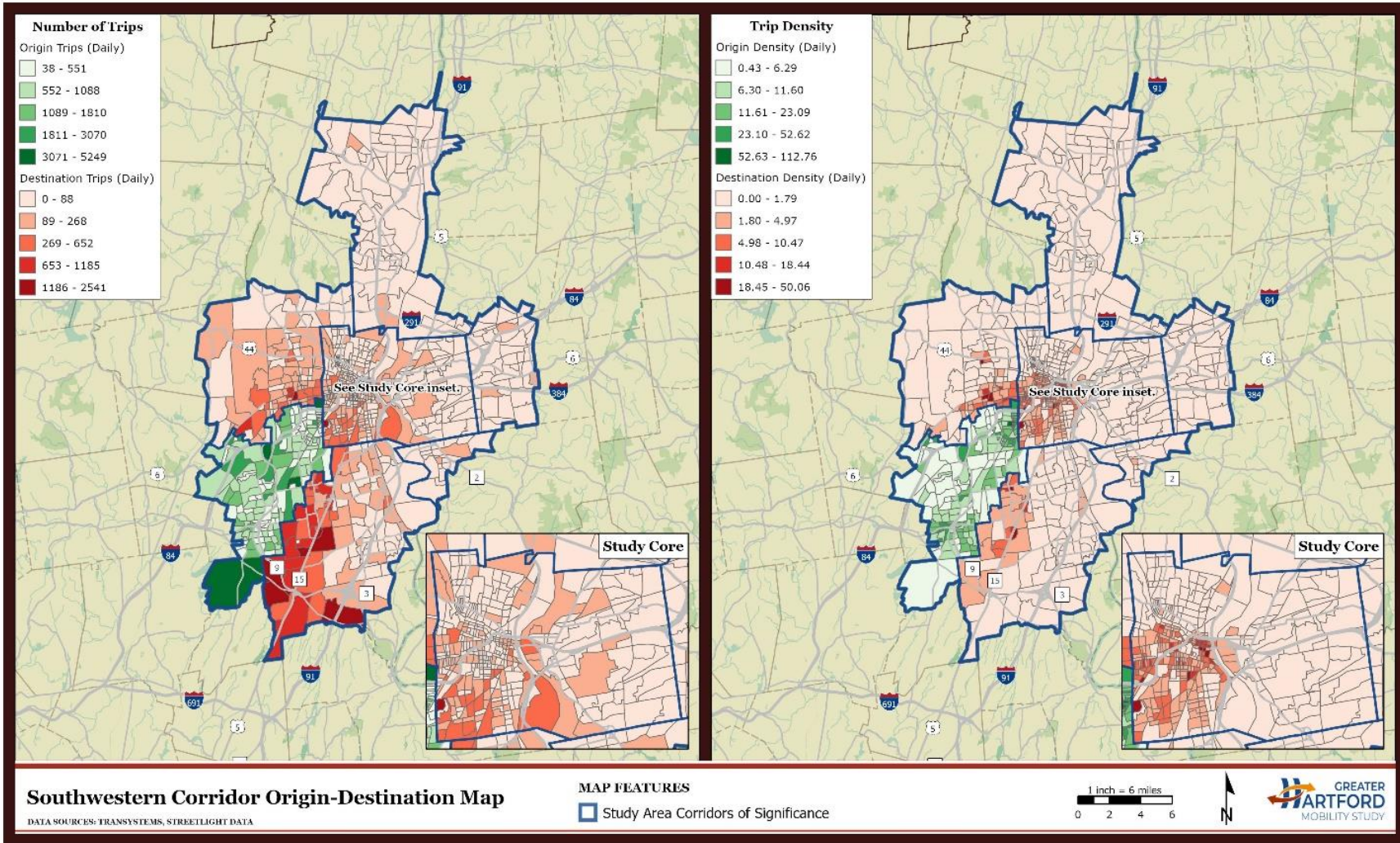
(Figure 2-42)

- Relatively high number and density of trips destined right across the COS border into the South and Northwest COS as well as the Study Core.
- The river seems to present a barrier to trip making
- Appears to be many retail trips
- The Walmarts in Hartford and Newington stand out pretty strongly, as does BJ's, Newington's downtown core, Blueback Square, and Westfarms Mall.
- Hartford Hospital is also a major destination.
- Relatively high trip destination density in the Northwest COS in the vicinity of the West Hartford town center.
- Relatively high number of trips and trip density in the South COS in New Britain.

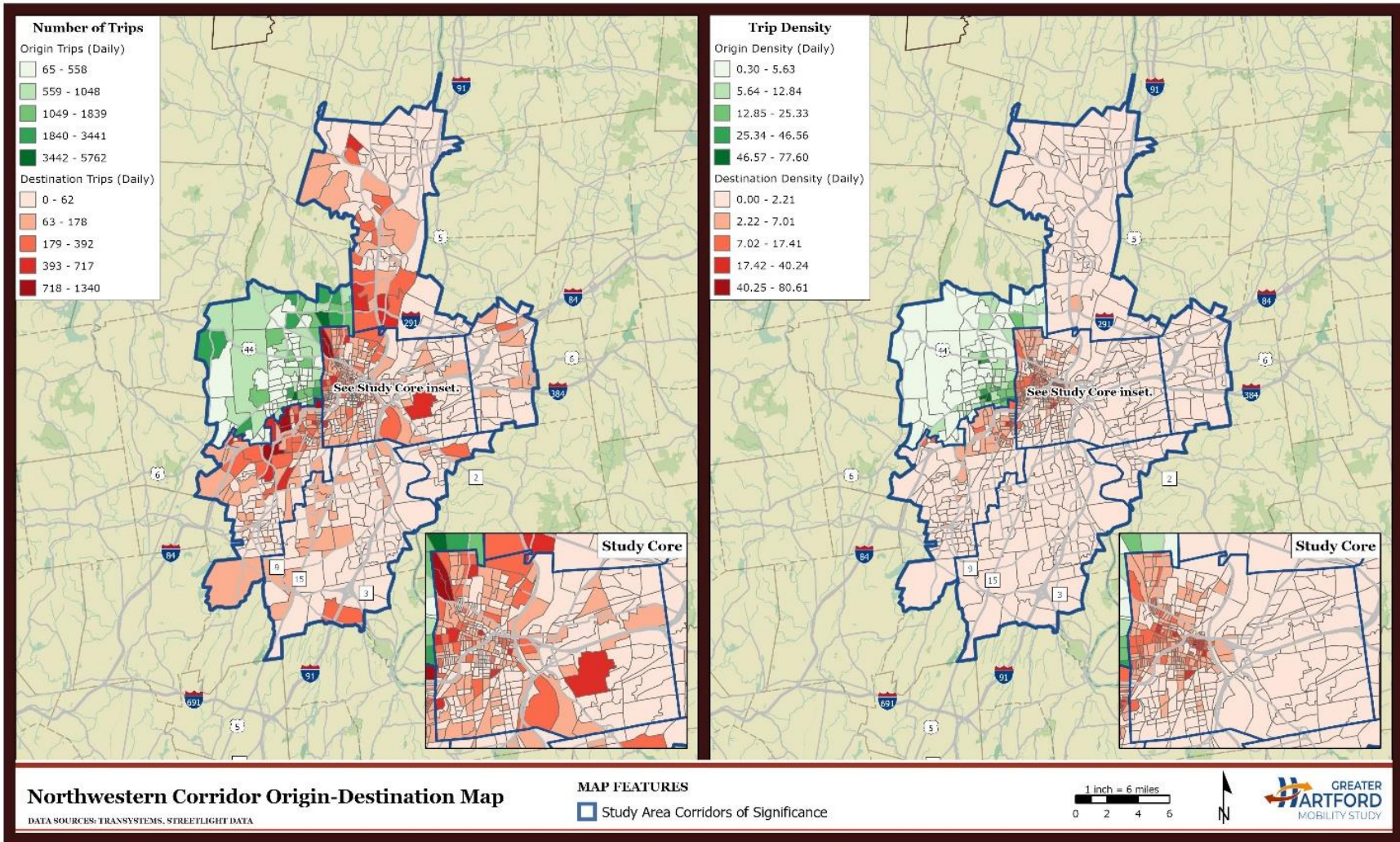
**Key Observations for Trips from  
Northwest COS to Other GHMS COS**

(Figure 2-43)

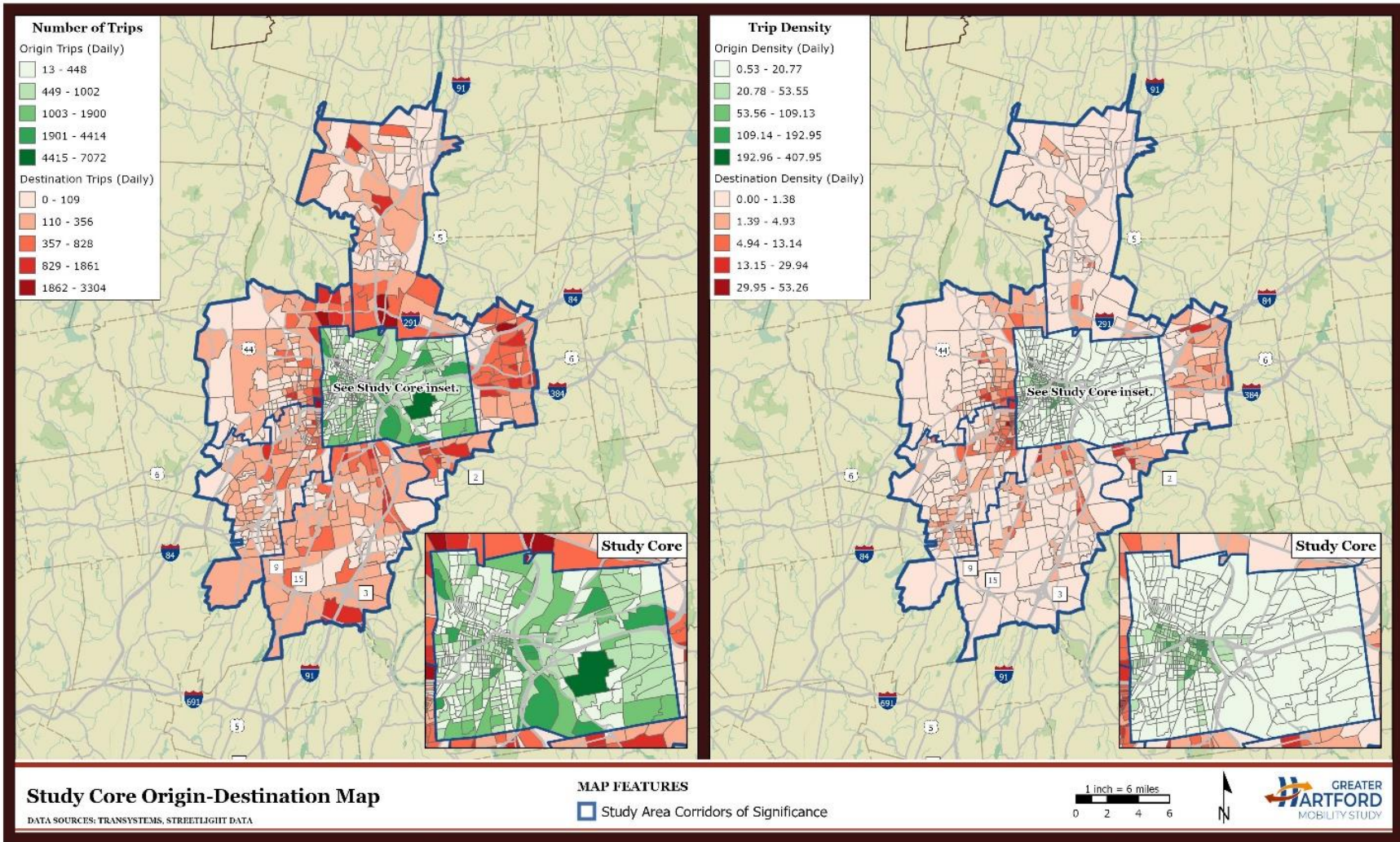
- Relatively high number of destinations across the COS border in the North and Southwest COS as well as the Study Core.
- In the North COS the destination is largely single family residential in the Town of Windsor.
- In the Southwest COS the destinations are largely residential but also include a golf course and high school (in the Town of West Hartford) as well as Westfarms Shopping Mall in the Town of Farmington.
- In the Study Core the destination includes the University of Hartford and a number of other schools.
- There are also a lot of shorter trips into the north end of Hartford and commuting into the CBD and insurance companies.
- The concentration of origins in the north end of the COS, in the Town of Bloomfield, is a mix of residential, commercial, and recreational land uses including the COPACO shopping center, an office /industrial park east of COPACO, and the CIGNA campus to the west.



**Figure 2-42: Southwest COS OD Map**



**Figure 2-43: Northwest COS OD Map**



**Figure 2-44: Study Core OD Map**

### Key Observations for Trips from Study Core to Other GHMS COS

(Figure 2-44)

- Trip origins are concentrated west of the river especially in the vicinity of employment centers such as Pratt & Whitney and Hartford Brainard Airport as well as residential areas in East Hartford along Tolland and School Streets and in Mayberry Village.
- There appears to be a lot of relatively short trips with destinations just outside the Study Core
- These trips are likely focused on retail / service employment in those area.
- There is also a high level of trip making associated with Hartford Hospital, The Hospital of Saint Francis, and Connecticut Children's Medical Center west of the river in Hartford.

### 2.8 Existing Condition Traffic Assessment – Key Takeaways

- ❖ Traffic movement is primarily influenced by commuting-related directional traffic flows in (AM peak) and out (PM peak) of the study core.
- ❖ The annual cost of delay / congestion for the study area Primary Corridors (I-84, I-91 and Route 2) is approximately \$200 million.
- ❖ Traffic density and congestion on Primary Corridors is concentrated mostly around the study core during peak periods. It will be important to understand COVID-19 pandemic's long-term impacts on traffic trends and congestion based on variables such as teleworking, off-peak traffic dispersion etc.
- ❖ While congestion is a function of volume to capacity (v/c) ratio, other factors such as geometric deficiencies, lane continuity and lane balance (discussed later in the Highway Assessment chapter) also contribute to the recurring congestion. The I-91 and I-84 interchange in the study core is a major congestion hotspot due to capacity, lane continuity, lane balance issues and contributes to significant congestion in the study core.

- ❖ The annual cost of delay / congestion for the study area Contributing Corridors is approximately \$36 million.
- ❖ Nearly 3 out of every 4 trips destined for the Study Core originate within the Study Core. While predominant trips have both the trip ends within the Study Core, a significant portion of these trips rely on the Primary Corridors to access their destinations. This offers an opportunity for strategic improvements focused on bike, pedestrian and transit infrastructure within the Study Core to encourage meaningful mode shift and reduced congestion on key Study Core corridors.
- ❖ For each COS, the predominant share of trips has both the origins and destinations within the same COS (intra-COS trips). As such localized identification of needs and improvements may be essential for each COS.
- ❖ During the AM Peak Period, the largest OD pairs (excluding intra-COS trips) are from the South COS, the Southwest COS, and the Northwest COS to the Study Core. The same OD pairs show largest reverse trip pattern during the PM Peak Period.
- ❖ The pattern of destinations from the Northeast and Southeast COS tend to be more dispersed than the other COS with a higher concentration of trip destinations in East Hartford in the Study Core.

## 3 Highway Facilities Assessment

### 3.1 Introduction

This chapter focuses on summarizing existing conditions analysis of key geometric considerations such as existing horizontal and vertical alignments, stopping sight distances, interchange spacing, lane continuity and lane balance on the Priority Corridors within the GHMS Study Area (I-84, I-91, and Route 2). The analysis includes a review of roadway geometrics vs. posted speed limit, horizontal sight distance restrictions and interchange spacing. These highway design elements can have a significant impact on free flow speeds and mobility within the study area.

The existing conditions analysis also includes review and analysis of highway crash data along the Primary and Contributing Corridors (defined earlier in the Chapter 2) to assess crash rates along roadway segments, identify hotspot locations for safety improvement and understand potential correlation between crash hotspots and geometric deficiencies.

A high-level assessment of bridge structures with spans greater than 20 feet and that carry or cross over the Priority and Contributing Highway Corridors has been completed, especially for ongoing CTDOT bridge rehabilitation projects to identify opportunities for mobility enhancement in line with the GHMS vision and goals.

*Analysis focused on identifying highway geometric deficiencies and crash hotspots, with a focus on understanding potential correlation between the two and their impact on traffic flow and mobility.*

### 3.2 Roadway Geometric Review

Geometric criteria for the design of new highways is fundamentally based on anticipated 85<sup>th</sup> percentile running speeds. Since this is an existing conditions analysis, it is generally acceptable to use the posted speed limit to determine if any geometric features do not meet minimum requirements. The posted speed limit for I-84 and I-91 varies between 50 mph and 65 mph (see **Figure 3-1**). The posted speed limit will be used to obtain the minimum design criteria for horizontal curvature and stopping sight distance.

AASHTO recommends interchange spacing of 1 mile in urban areas. CTDOT recommends 2,000 feet between an on-ramp and an off-ramp. This minimum distance can vary if a traffic analysis requires a longer distance to provide better traffic operations. For the purposes of this study, interchanges where ramp spacing is under 2,000 feet will be identified as deficient.



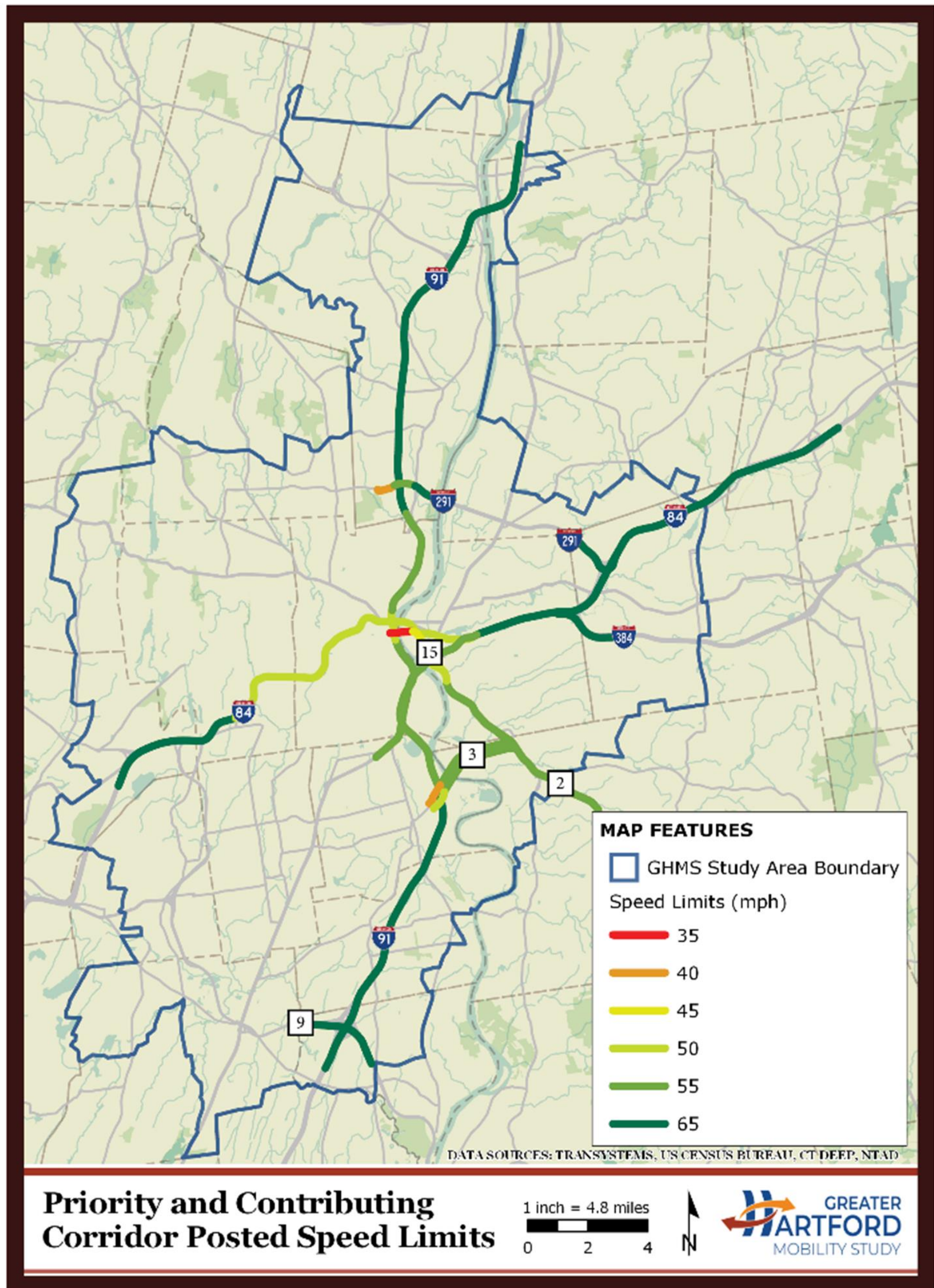


Figure 3-1: Priority and Contributing Corridors Posted Speed Limits

### 3.2.1 I-84



As shown in **Figure 3-1**, the study limits for I-84 begin in Farmington, just south of U.S. Route 6 (milepost 53.8), and end in Vernon, just east of Interchange 65 westbound ramps (M.P. 74.3). The posted speed limit varies between 50 mph (west of Hartford) and 65 mph (east of Hartford).

East of the U.S. Route 6 on-ramp in Farmington, the outside lane for I-84 eastbound drops at the Route 9 off-ramp. Two lanes continue eastbound for

*The corridor has three basic lanes in each direction except for sections in Farmington and Hartford, which have two basic lanes in each direction.*

approximately 1,600-feet until they merge with the left-hand on-ramp from Route 4. The outside lane on I-84 eastbound also drops in Hartford approximately one mile west of the I-91 interchange. The third lane reemerges on the Bulkeley Bridge, east of the I-91 interchange. On I-84 westbound, the outside lane is dropped at Interchange 50 (I-91 South/U.S. Route 44). Two lanes continue on I-84 westbound for approximately 2,200-feet until the merge with the I-91 ramps. These three locations violate the basic principle

of lane continuity as defined in AASHTO's "A Policy on Geometric Design of Highways and Streets".

The horizontal alignment is considered curvilinear from the western study limit through the Route 15 interchange in East Hartford. This is likely due to the urban environment and minimizing adverse impacts during its construction. This section of I-84 also includes several closely spaced interchanges (see **Table 3-1**), some with left-hand ramps. The interchange types lack consistency and include split and half interchanges. Closely spaced interchanges combined with a curvilinear alignment create a highly complex corridor, which may be a contributing factor to higher than average crash rates.

I-84 between Interchange 46 (Sisson Avenue) and the Bulkeley Bridge was the subject of a recent E.I.S. study, which identified several roadway deficiencies including closely spaced interchanges, constrained weaves, stopping sight distance, and roadway geometry.

The I-84 horizontal alignment east of Route 15 is more typical of an interstate with long horizontal curves separated by long tangents. This type of alignment allows drivers to process directional signage and make decisions without constantly adjusting their vehicle to stay on alignment. This section of I-84 includes eastbound and westbound HOV lanes from Interchange 58 (East Hartford) to Interchange 64/65 (Vernon).

**Table 3-1: I-84 Deficient Ramp Spacing**

| <b>I-84 Closely-Spaced Interchange Ramps (Minimum Distance = 2,000')</b> |                         |
|--|-------------------------|
| <b>I-84 Eastbound Locations</b>  | Available Distance (ft) |
| Route 9 NB off-ramp to 84 to Interchange 40 off-ramp                     | 1,485                   |
| Interchange 47 on-ramp to Interchange 48A off-ramp                       | 1,000                   |
| Interchange 48 on-ramp to Interchange 49 off-ramp                        | 1,180                   |
| I-91 SB off-ramp to 84 to Interchange 53 off-ramp                        | 860                     |
| East River Drive on-ramp to Interchange 55 off-ramp                      | 580                     |
| <b>I-84 Westbound Locations</b>  | Available Distance (ft) |
| Interchange 40 on-ramp to Interchange 39A off-ramp                       | 1,450                   |
| Interchange 48 on-ramp to Interchange 47 off-ramp                        | 1,040                   |
| Interchange 49 on-ramp to Interchange 48 off-ramp                        | 550                     |
| Route 44 on-ramp to Interchange 51 off-ramp                              | 1,570                   |
| Route 5 on-ramp to Interchange 56 off-ramp                               | 1,200                   |

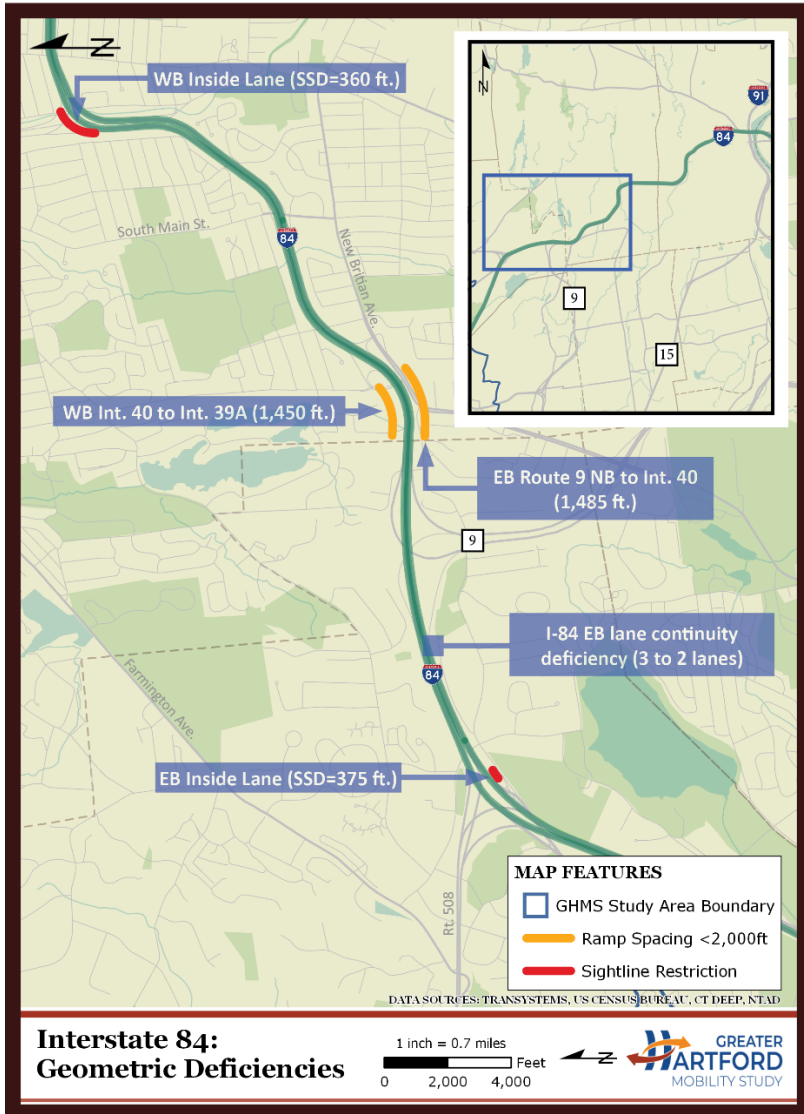
Sightline restrictions were evaluated for the mainline travel lanes. HOV and ramp lanes were excluded. The available sight distance in some areas was slightly below the required

distance for the posted speed limit, however, they were not documented in this evaluation because mobility is likely not affected. The following locations are depicted in **Table 3-2**.

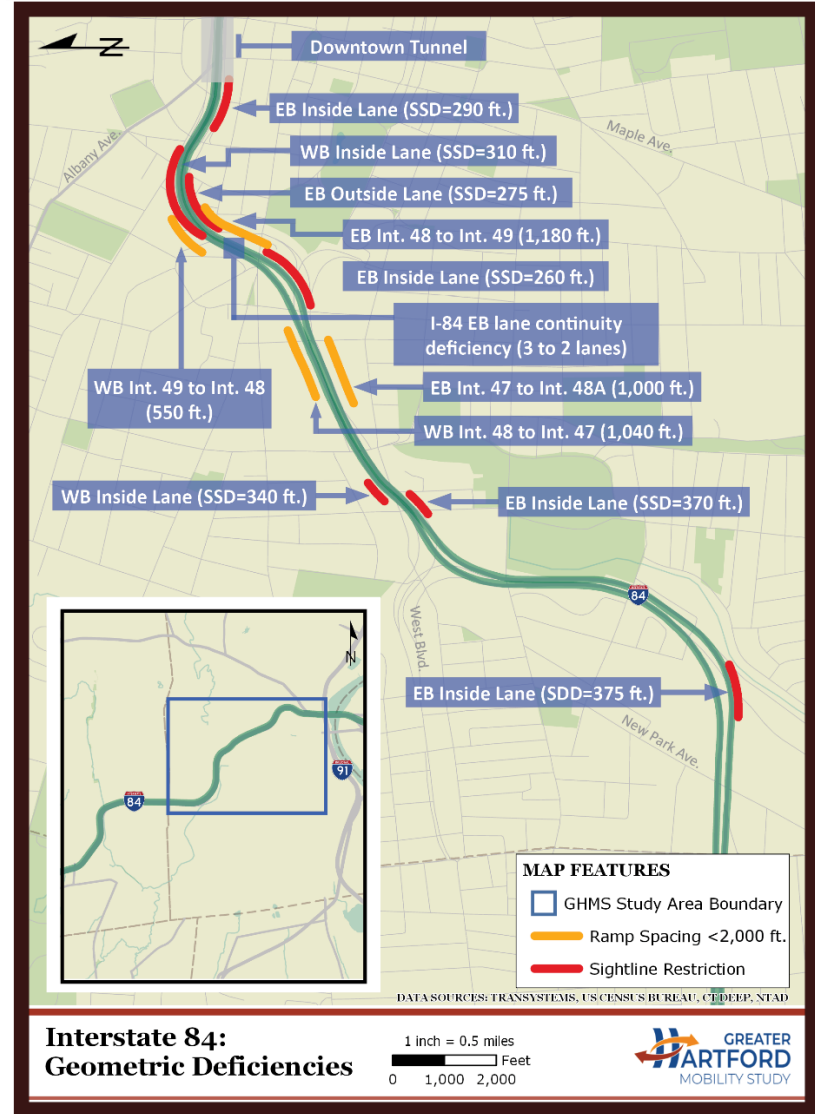
**Table 3-2: I-84 Horizontal Sightline Restrictions**

| <b>I-84 Eastbound Locations</b>        | <b>Posted Speed Limit (mph)</b> | <b>Required SSD (ft)</b> | <b>Available SSD (ft)</b> |
|--|---------------------------------|--------------------------|---------------------------|
| Inside lane at Interchange 45 WB Ramp  | 50                              | 425                      | 375                       |
| Inside lane over Laurel Street         | 50                              | 425                      | 370                       |
| Inside lane east of Broad Street       | 50                              | 425                      | 260                       |
| Outside lane west of High Street       | 50                              | 425                      | 275                       |
| Inside lane at Downtown Tunnel         | 50                              | 425                      | 290                       |
| Outside lane at Roberts Street bridge  | 65                              | 645                      | 400                       |
| <b>I-84 Westbound Locations</b>        |                                 |                          |                           |
| Inside lane at EB on-ramp from Route 4 | 50                              | 425                      | 375                       |
| Inside lane at Interchange 43 ramps    | 50                              | 425                      | 360                       |
| Inside lane at Capitol Avenue bridge   | 50                              | 425                      | 340                       |
| Inside lane east of Interchange 48     | 50                              | 425                      | 310                       |
| Inside lane east of Bulkeley Bridge    | 50                              | 425                      | 310                       |

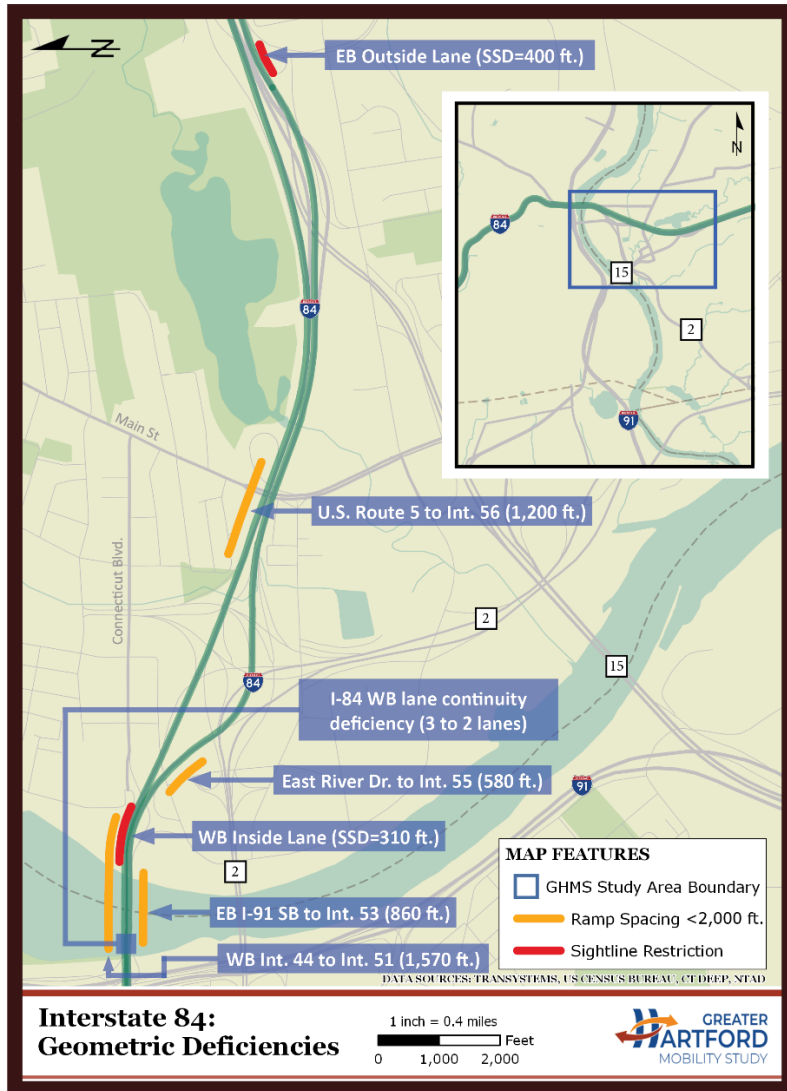
**Figure 3-2** through **Figure 3-4** show the identified lane balance, lane continuity, ramp spacing and horizontal sight distance related deficiencies for the I-84 corridor within the GHMS study area.



**Figure 3-2: Identified I-84 Deficiencies**



**Figure 3-3: Identified I-84 Deficiencies**



**Figure 3-4: Identified I-84 Deficiencies**

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### 3.2.2 I-91



As shown on **Figure 3-1**, the study limits for I-91 begin in Middletown, just south of Interchange 22 (Route 9) (M.P. 26.3), and end in East Windsor, just north of Interchange 45 (Route 140) (M.P. 51.4).

There are three basic lanes in each direction and the posted speed limit varies between 65 mph (northern and southern sections) and 55 mph (Hartford area).

The corridor has three basic lanes except for a section in Hartford. I-91 northbound drops the inside lane approximately 1,000-feet south of Interchange 32A-32B (Trumbull Street/I-84 West). The inside lane drop becomes a collector-distributor road that provides an off-line weave with the Whitehead Highway northbound on-ramp. The 2-lane section of I-91 northbound continues to the downtown collector-distributor merge, approximately 0.8 miles. I-91 southbound approaches the downtown Hartford area with a 4-lane section. The outermost lane is an auxiliary lane that drops at Interchange 32A-32B (Trumbull Street/I-84 West). The third lane drops approximately 400-feet north of Interchange 31 (State Street) and continues south until the merge with the I-84 on-ramp, approximately 1,800-feet. These two locations violate the basic principle of lane continuity as defined in AASHTO's "A Policy on Geometric Design of Highways and Streets".

From the southern study limit to just south of Interchange 25-26 (Route 3), I-91 is a divided highway

with a grass/wooded median of varying widths. Approximately 1,000-feet south of Interchange 25-26, the grass median is replaced with a concrete median.

The horizontal alignment is mostly tangential from the southern study limit to Interchange 25-26 (Route 3 - Putnam Bridge). Interchange spacing is consistent through this section, although the interchange types vary.

The horizontal alignment from Interchange 25-26 to Interchange 29 (Route 15 - Charter Oak Bridge) includes curves that meet the minimum design requirements for the posted speed limit. However, the I-91 southbound alignment just north of Interchange 29 includes a curve with a higher than average crash rate. This is likely due to the horizontal radius, which is less than the minimum required radius for the posted speed limit. The existing pavement markings for this simple horizontal curve are complex and abrupt, requiring a driver to make multiple unexpected adjustments.

The horizontal alignment from downtown Hartford to Interchange 45 (Route 140), meets or exceeds the minimum horizontal curve radius requirements for the posted speed limit. This section includes a concrete median with paved shoulders. There are northbound and southbound HOV lanes between the downtown area and Interchange 38. The interchange spacing is consistent, although most are less than the minimum recommended spacing of 1 mile in urban areas (see **Table 3-3**).

Sightline restrictions were evaluated for the mainline travel lanes. HOV and ramp lanes were excluded. The available sight distance in some areas was slightly below the required distance for the posted speed limit, however, they were not documented in this evaluation

because mobility is likely not affected. These locations are depicted in **Table 3-4**.

**Figure 3-5** and **Figure 3-6** show the identified deficiencies for the I-91 corridor within the GHMS study area.

**Table 3-3: I-91 Deficient Ramp Spacing**

| <b>I-91 Closely-Spaced Interchange Ramps (Minimum Distance = 2,000')</b> |                         |
|--|-------------------------|
| <b>I-91 Southbound Locations</b>   | Available Distance (ft) |
| Interchange 26 on-ramp to Interchange 25S off-ramp                       | 690                     |
| Interchange 27 on-ramp to Interchange 28 off-ramp                        | 1,540                   |
| Interchange 29 on-ramp to Interchange 29A off-ramp                       | 420                     |
| Interchange 42 on-ramp to Interchange 41 off-ramp                        | 1,470                   |
| Interchange 45 on-ramp to Interchange 44 off-ramp                        | 800                     |

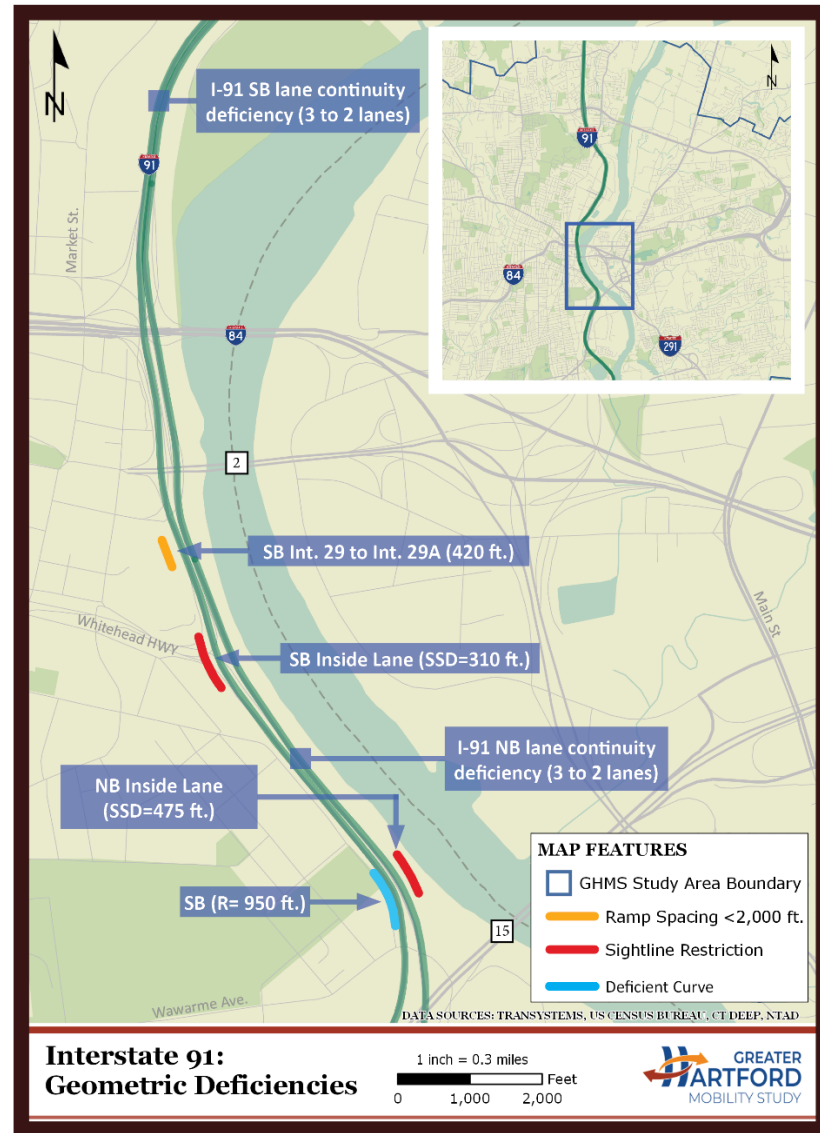
**Table 3-4: I-91 Horizontal Sightline Restrictions**

| <b>I-91 Northbound Locations</b>         | <b>Posted Speed Limit (mph)</b> | <b>Required SSD (ft)</b> | <b>Available SSD (ft)</b> |
|--|---------------------------------|--------------------------|---------------------------|
| Inside lane at Route 99                  | 65                              | 645                      | 480                       |
| Inside lane at Wethersfield Cove Inlet   | 55                              | 495                      | 450                       |
| Inside lane north of Interchange 29      | 55                              | 495                      | 475                       |
| Inside lane at Interchange 40            | 65                              | 645                      | 560                       |
| Inside lane at Interchange 44            | 65                              | 645                      | 570                       |
| <b>I-91 Southbound Locations</b>         |                                 |                          |                           |
| Inside lane at Interchange 32            | 55                              | 495                      | 310                       |
| Inside lane west of Dexter Coffin Bridge | 65                              | 645                      | 470                       |





**Figure 3-5: Identified I-91 Deficiencies**



**Figure 3-6: Identified I-91 Deficiencies**

## 2

As shown on **Figure 3-1**, the study limits for Route 2 begin in East Hartford at the I-84 interchange (M.P. 0.0) and end in Glastonbury, east of Interchange 8 (Route 94) (M.P. 6.3). There are two basic lanes in each direction and the posted speed limit varies between 50 mph and 55 mph.

The Route 2 horizontal alignment generally includes long tangents between curves that meet or exceed the minimum design requirements for the posted speed limit. However, there is a reverse horizontal curve with a short tangent in the vicinity of Interchange 5B. This alignment is not indicative of the Route 2 corridor and, therefore, may not meet driver expectations. This portion of the Route 2 corridor also includes a very short westbound weave section (350'), which adds complexity and additional bits of information drivers need to process while negotiating the non-typical horizontal alignment (see **Table 3-5**).

The Route 2 alignment also includes a 'broken-back' horizontal curve (two successive curves in the same direction with a short tangent separating them) approximately 800-feet west of the eastbound split with Route 17. These curves are adjacent to a concrete median barrier with a narrow shoulder, which limits the horizontal stopping sight distance in the eastbound direction. Broken-back curves are not desirable because they are difficult to negotiate, especially when they are located within a decision-making area.

Route 2 includes several non-conventional and incomplete interchanges with half diamonds, three-quarter diamonds, and single ramps, which do not meet driver expectations. In general, full interchanges are preferred because it allows drivers to have full directional access.

CTDOT is expecting to start construction on State Project No. 42-317 (Resurfacing, Bridge, and Safety Improvements on Route 2 in the town of East Hartford)

*State Project No. 42-317 will permanently close the Exit 5B ramps, which would help with safety and operational improvements.*

in January 2022. This project will permanently close the Exit 5B ramps, which include the Cambridge Street westbound on-ramp and the Sutton Avenue eastbound off-ramp. This section of Route 2 has been identified as an area that exhibits a higher than normal crash rate and would benefit from safety and traffic operational improvements.

The closure of the Sutton Avenue eastbound off-ramp allows for extension of the High Street acceleration lane to provide additional length for safe merging maneuvers. The closure of the Cambridge Street westbound on-ramp will allow for the extension of the Main Street deceleration lane and eliminates the unsafe weaving operation that exists currently.

The available sight distance in some areas was slightly below the required distance, however, they were not

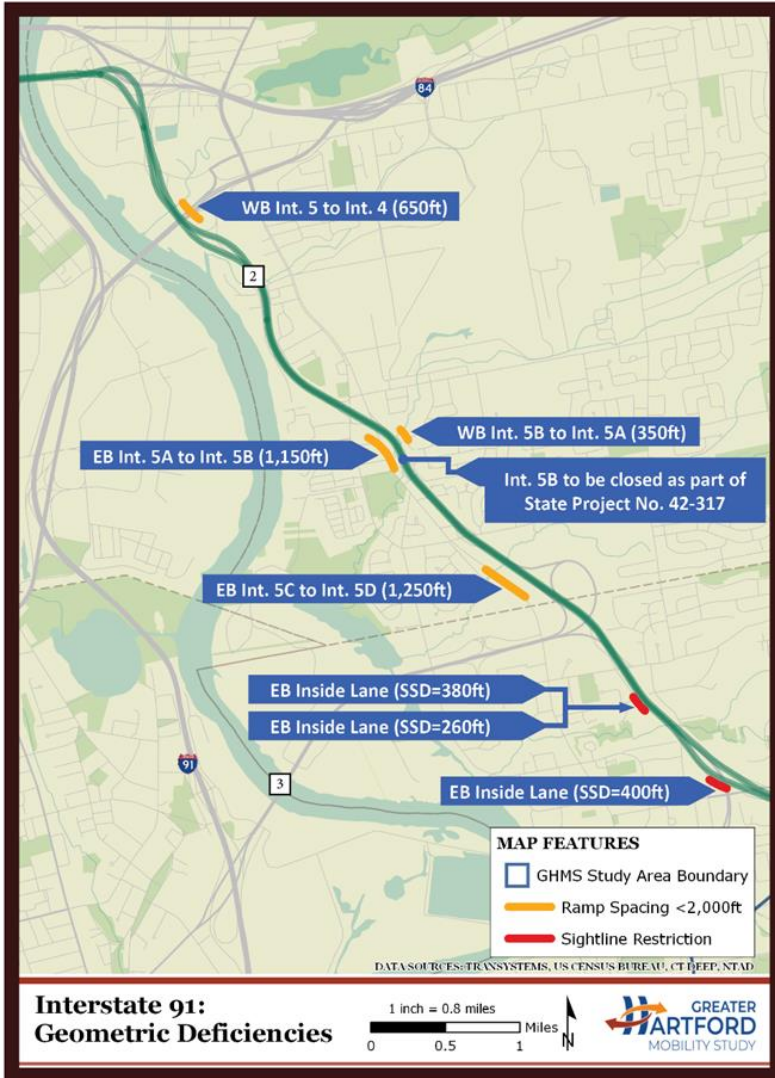
documented in this evaluation because mobility is likely not affected.

**Table 3-5: Route 2 Deficient Ramp Spacing**

| <b>Route 2 Closely-Spaced Interchange Ramps (Minimum Distance = 2,000')</b> |                         |
|---|-------------------------|
| <b>Route 2 Eastbound Locations</b>  | Available Distance (ft) |
| Interchange 5A on-ramp to Interchange 5B off-ramp                           | 1,150                   |
| Interchange 5C on-ramp to Interchange 5D off-ramp                           | 1,250                   |
| <b>Route 2 Westbound Locations</b>  |                         |
| Interchange 5 on-ramp to Interchange 4 off-ramp                             | 650                     |
| Interchange 5B on-ramp to Interchange 5A off-ramp                           | 350                     |
| Interchange 49 on-ramp to Interchange 48 off-ramp                           | 550                     |
| Route 44 on-ramp to Interchange 51 off-ramp                                 | 1,570                   |
| Route 5 on-ramp to Interchange 56 off-ramp                                  | 1,200                   |

**Table 3-6: Route 2 Horizontal Sightline Restrictions**

| <b>Route 2 Eastbound Locations</b>     | <b>Posted Speed Limit (mph)</b> | <b>Required SSD (ft)</b> | <b>Available SSD (ft)</b> |
|--|---------------------------------|--------------------------|---------------------------|
| Inside lane west of Route 17 split     | 55                              | 495                      | 380                       |
| Inside lane west of Route 17 split     | 55                              | 495                      | 260                       |
| Inside lane at Route 17 bridge parapet | 55                              | 495                      | 400                       |



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**Figure 3-7: Identified Route 2 Deficiencies**

### 3.3 Highway Safety Analysis – Priority Corridors

Highway safety is sometimes perceived as a binary option – either a road meets design standards and is safe, or it does not meet standards and is unsafe. In reality, safety is the result of more than just road design: driver behavior, weather, congestion, distraction, and other factors influence the rate at which crashes occur. Crashes often have more than one root cause, making it difficult or impossible to determine why they occurred.

The highway safety analysis in this chapter uses statistical methods to look for locations with abnormally high crash rates and to identify the potential causes.

*Rather than simply looking at the number of crashes on a road segment, the analysis considered length of the segment and amount of traffic using it. As a result, crash rates are reported in crashes per hundred million vehicle miles travelled (HMVMT).*

Crash data was collected from January 2015 through December 2019, a five-year period, in order to provide a large sample size and increase statistical significance.

#### 3.3.1 I-84 Crash Rate

The crash rates on I-84 are shown on **Figure 3-1**. These rates are shown in more detail in bar charts on the following pages, where each bar represents a 0.1-mile segment of the freeway.

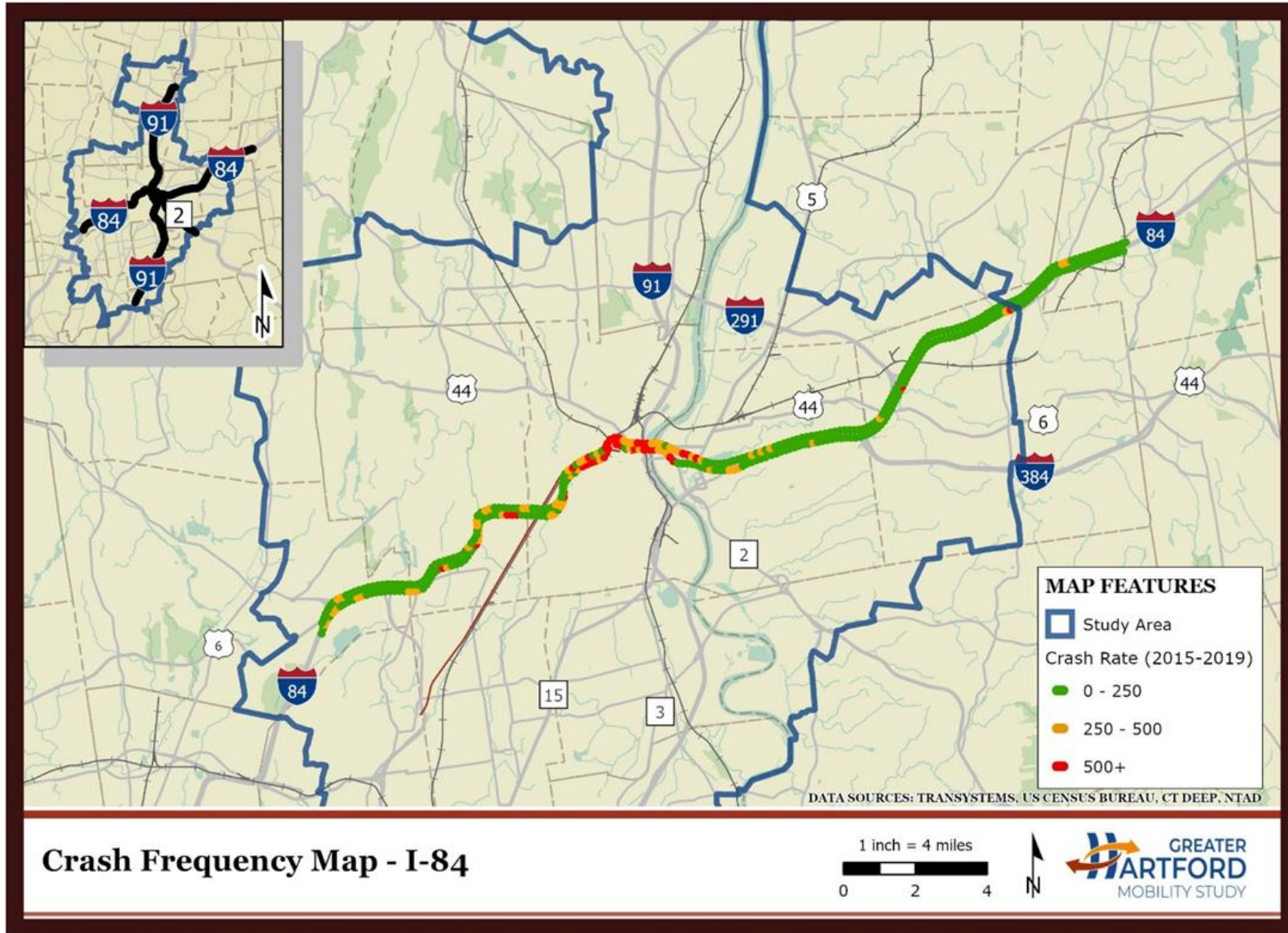
*A high incidence of crashes on I-84 Eastbound correlate both with the areas of recurring congestion and known geometric deficiencies.*

Crash rates on I-84 Eastbound (see **Figure 3-9**) show a high incidence of crashes in areas where recurring congestion is frequent. In particular, the highest crash rates occur between Flatbush Avenue (MP 59.9) and the Route 2 interchange (MP 63.4). This section of I-84 has a number of geometric elements that may result in higher crash rates, including a left-hand off-ramp, narrow shoulders, sharp radii, and limited sight distance. In addition, the close spacing of ramps in this area, the weaving introduced by the lane configuration, and the reduction from three basic lanes to two all tend to contribute to higher crash rates. The highest crash rates coincide with the sharp curve north of Union Station (MP 61.8), where many of these contributing factors exist.

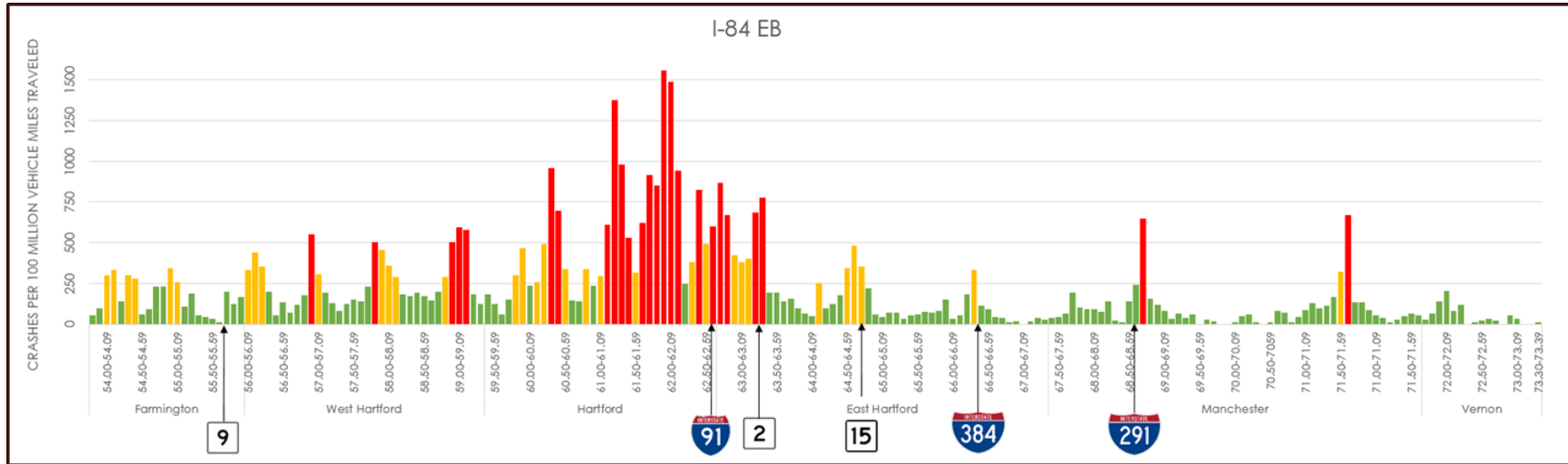
Outside of this central segment, crash rates above 500 per hundred million vehicle miles traveled (HMVMT) occur at the interchanges with South Main Street, Park Road, and Caya Avenue in West Hartford, as well as Buckland Street and Route 30 in Manchester. As the crash data includes crashes that occur on ramps, ramp queueing is a likely contributing factor. In the case of the Route 30 interchange, ramp queues sometimes extend onto I-84 itself, resulting in a high-speed differential between through and exiting traffic. For the segment in West Hartford, there are two-sided weaves due to the left-hand off- and on-ramps at the Park Road interchange. This area also has sharp curvature on I-84.

Crash rates on I-84 Westbound (see **Figure 3-10**) are dominated by a cluster of high-incident segments between U.S. Route 5 in East Hartford (MP 63.8) and Sisson Avenue (MP 60.8). This area is a focal point of congestion during both peak periods, and also contains a number of geometric deficiencies such as left-hand ramps, narrow shoulders, and sharp radii. In addition, the close spacing of ramps in this area, the weaving introduced by the lane configuration, and the reduction from three basic lanes to two all tend to contribute to higher crash rates. The highest frequency of crashes occurs around the weave between the High Street on-ramp and the Asylum Street off-ramp (MP 61.8). This area experiences frequent congestion and coincides with a sharp curve.

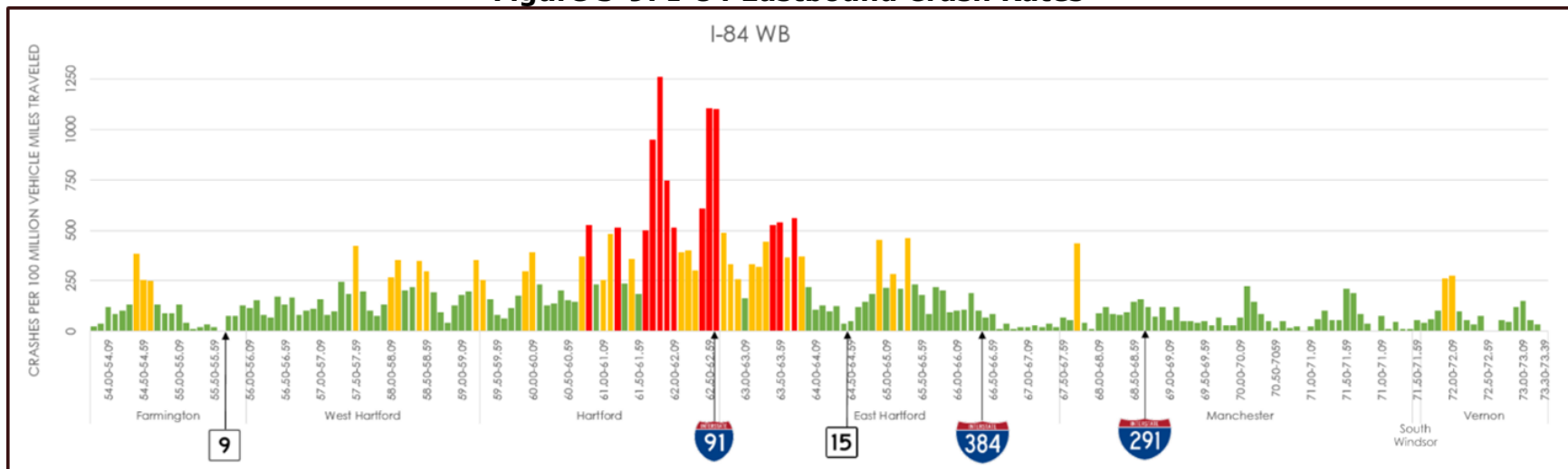
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**Figure 3-8: I-84 Crash Frequency Map**



**Figure 3-9: I-84 Eastbound Crash Rates**



**Figure 3-10: I-84 Westbound Crash Rates**



### 3.3.2 I-91 Crash Rate

The crash rates on I-91 are shown on **Figure 3-11**. These rates are shown in more detail in bar charts on the following pages, where each bar represents a 0.1-mile segment of the freeway.

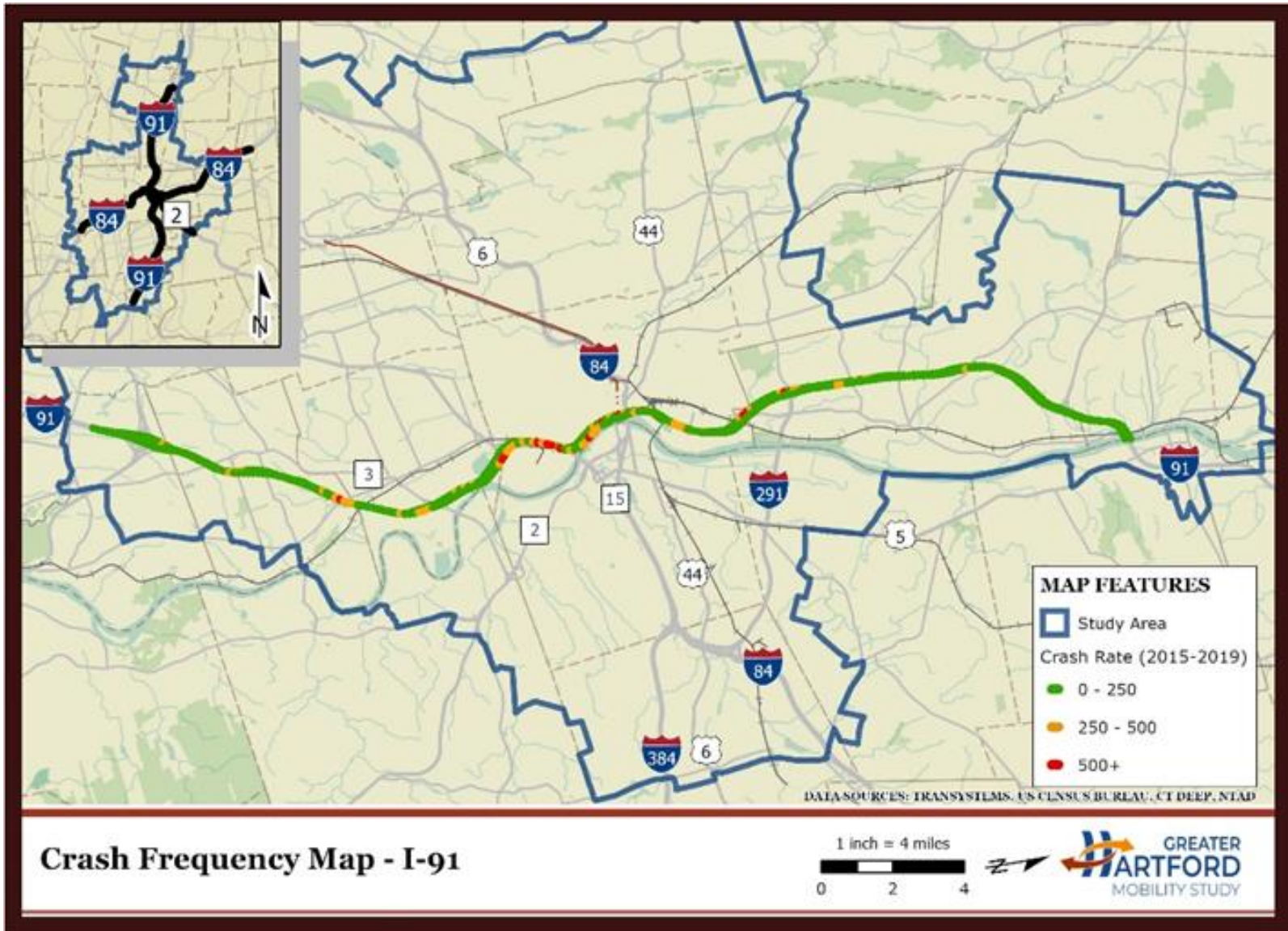
Crash rates on I-91 Northbound are generally low outside of Hartford, but there is a large spike in Hartford's South Meadows at the Route 15 interchange (see **Figure 3-12**). This is due to queues at the ramp to Route 15 Northbound (MP 36.8), which persist for hours each day and frequently extend a mile to the south. The speed differential between nearly stopped traffic in the right lane and moving traffic in the left two lanes, as well as aggressive driver behavior near the ramp, result in a high potential for crashes.

Other locations with high crash rates are at the Route 99 off-ramp in Rocky Hill, the Brainard Road lane drop in Hartford, and the three lane drops at the Whitehead Highway and I-91 Northbound Collector/Distributor Road in Hartford.

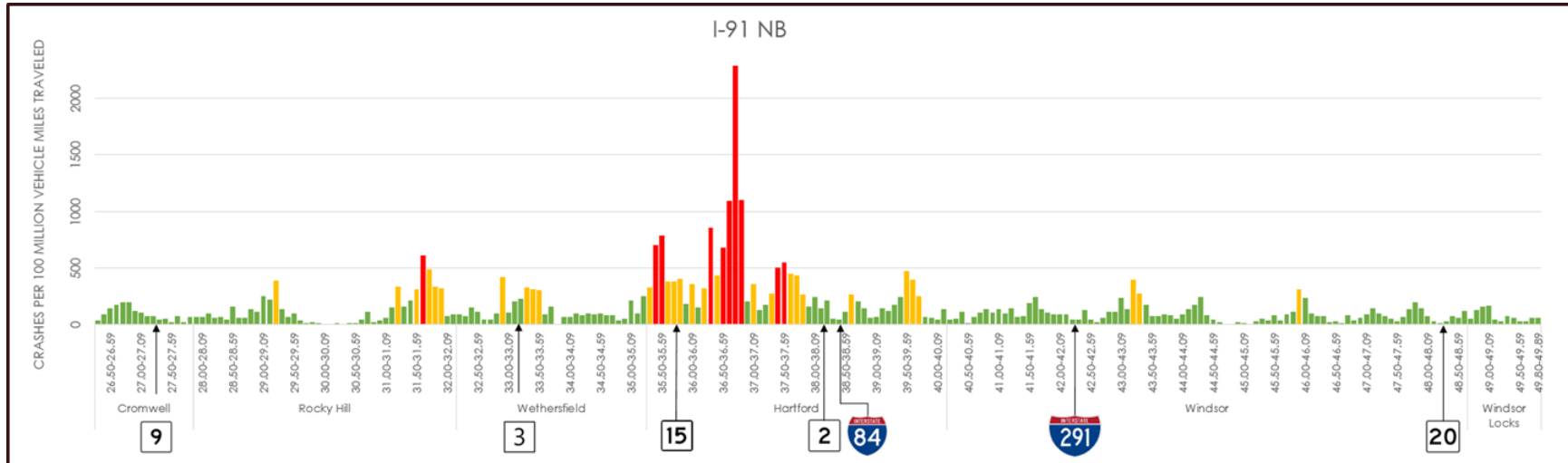
*Crash rates on I-91 Northbound are generally low outside of Hartford, but there is a large spike in Hartford's South Meadows at the Route 15 interchange.*

Crash rates on I-91 Southbound are highest from I-291 (MP 42.2) to the Whitehead Highway (MP 37.9) – see **Figure 3-13**. This area corresponds with recurring congestion, including queues on the ramp to I-84 Westbound (MP 38.9), as well as a left-hand off-ramp to I--84 Eastbound (MP 38.5) and a left-hand on-ramp from the HOV lane (MP 40.1). I-91 Southbound is reduced from three to two basic lanes at the I-84 interchange, and ramp spacing is very close, with several weaves introduced by the lane configuration.

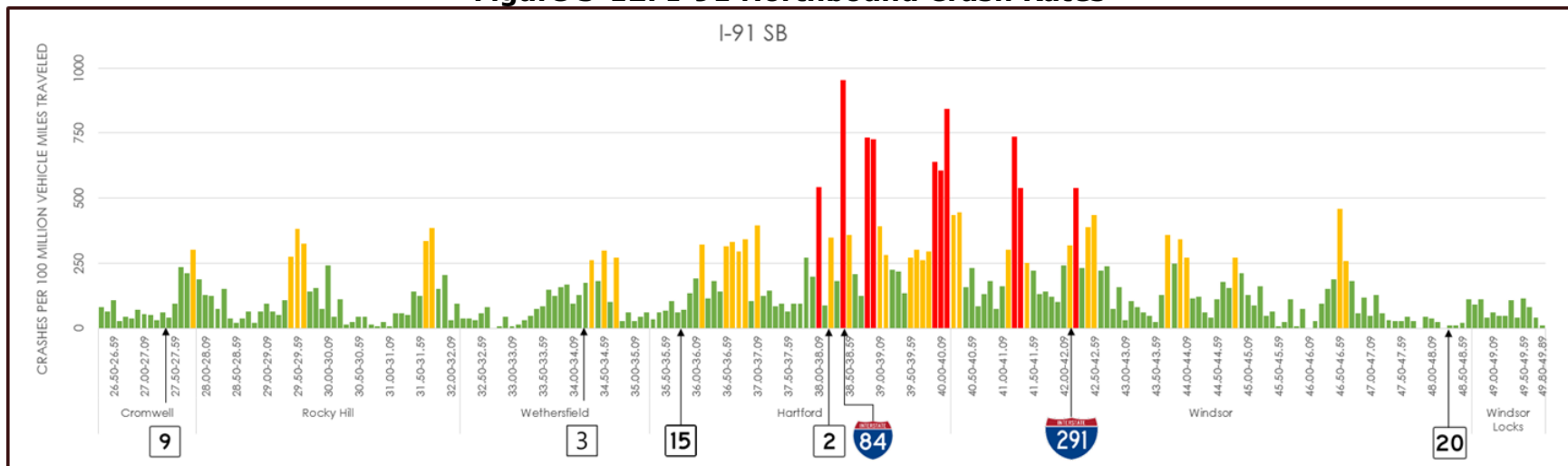
*The I-91 Southbound section just north of the Route 15 interchange (MP 37.0) has a higher crash rate due to a complex right-hand curve, with severe crash damage evident on the median barrier.*



**Figure 3-11: I-91 Crash Frequency Map**



**Figure 3-12: I-91 Northbound Crash Rates**



**Figure 3-13: I-91 Southbound Crash Rates**

### 3.3.3 Route 2 Crash Rate

The crash rates on Route 2 are shown on **Figure 3-14**. These rates are shown in more detail in bar charts on the following pages, where each bar represents a 0.1-mile segment of the freeway.

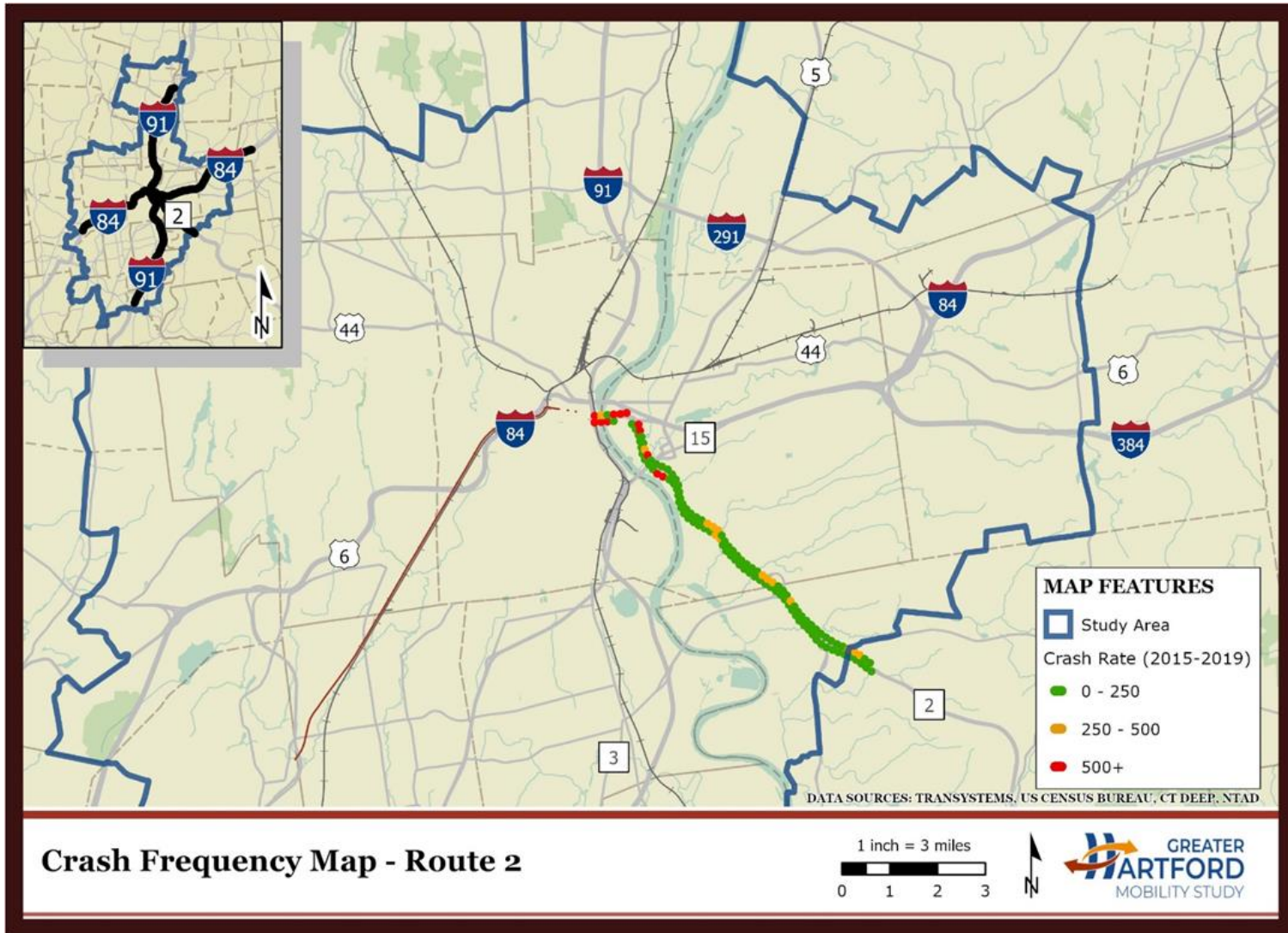
Crash rates on Route 2 Eastbound are highest between State Street (MP 0) and the I-84 interchange (MP 0.7) – see **Figure 3-15**. There are numerous eastbound off-ramps in this area, and it also serves as a transition between urban driving in downtown Hartford and freeway driving in East Hartford. Route 2 is reduced from three lanes to one at MP 0.5. This area was also under construction for several years as bridges at the I-84 interchange were replaced. Ramp closures and detours may have contributed to the high crash rate.

*Eastbound Route 2 segments with higher crash rates have lane continuity, lane balance and geometric deficiencies such as closely spaced ramps with inadequate spacing.*

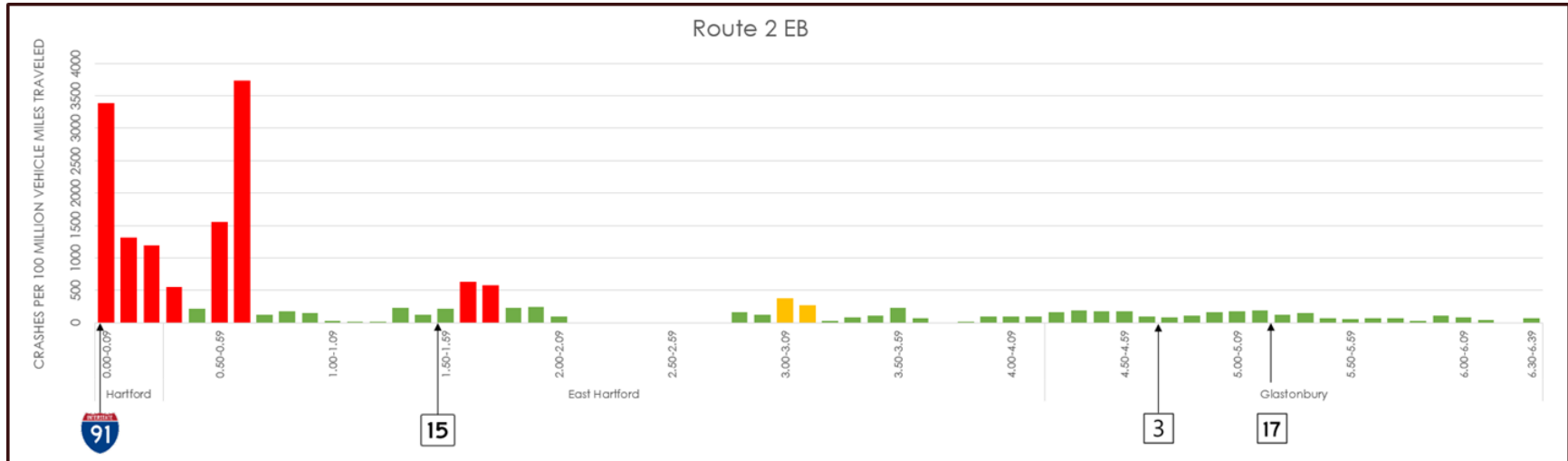
Farther east, at MP 1.7, there is another segment with high crash rates. This is a complex area as well, with a left-hand lane reduction followed by a right-hand off-ramp and a left-hand on-ramp.

Crash rates on Route 2 Westbound are similar to the eastbound direction (see **Figure 3-16**). The highest crash rates are in a cluster around the west end of the freeway, including the I-84 interchange (MP 0.7) and the traffic signal at State Street (MP 0). A number of factors contribute to the high crash rate here: poor lane balance, numerous ramps close together, weaving, recurring congestion, and narrow shoulders. The recent construction activity also affects rates here.

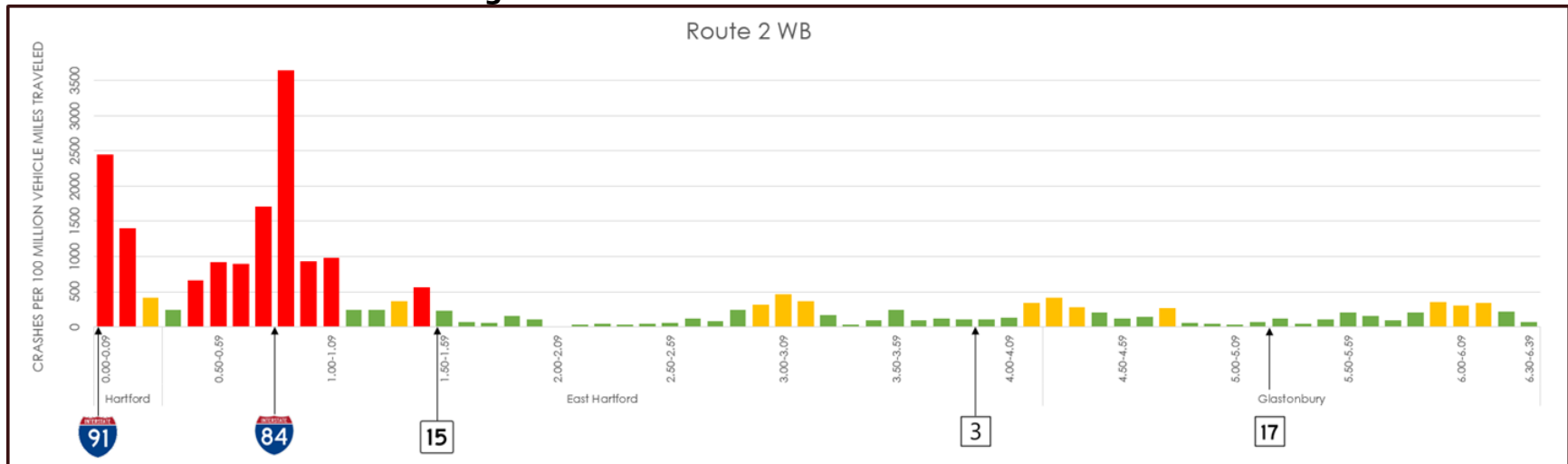




**Figure 3-14: Route 2 Crash Frequency Map**



**Figure 3-15: Route 2 Eastbound Crash Rates**



**Figure 3-16: Route 2 Westbound Crash Rates**

### 3.4 Safety Analysis – Other Corridors

The crash rates on Contributing Corridors within 1 mile of Priority Corridors are shown on **Figure 3-17**. Crash rates below 250 per HMVMT are shown in green, those between 250 and 500 per HMVMT are yellow, and rates above 500 per HMVMT are shown in red. These rates are shown in more detail in bar charts on the following pages, where each bar represents a 0.1-mile segment of the freeway.

#### 3.4.1 I-291 at I-91 and I-84

Crash rates on I-291 Eastbound (**Figure 3-18**) are the highest at the two ends of the freeway. At the western end, this corresponds with an area of recurring congestion. At the eastern end, the I-291 ramp to I-84 Eastbound combines with the collector/distributor road containing traffic from I-384 and U.S. Route 6/44, then merges into I-84.

On I-291 Westbound (**Figure 3-19**), high crash rates correspond with the western end of the freeway, where I-291 drops from two basic lanes to one. There is recurring congestion here in the morning peak period, which may contribute to the increased crash rates.

#### 3.4.2 I-384 at I-84

Crash rates on I-384 Eastbound are generally low (**Figure 3-20**). The only location where they exceed 500 per HMVMT is at the off-ramp to Spencer Street. As the crash rate includes crashes that occur on the ramp itself, these contribute to the high rate here, and do not necessarily indicate a safety concern on I-384 itself.

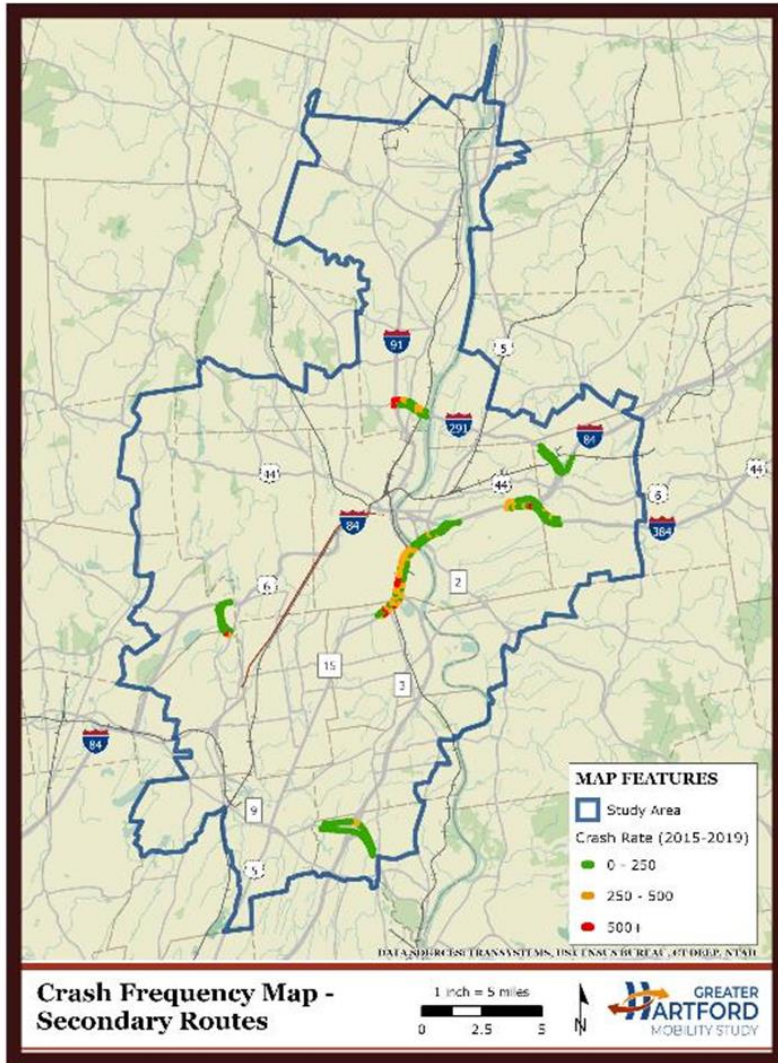
Crash rates on I-384 are below 500 per HMVMT (**Figure 3-21**). This segment of the freeway does not experience any recurring congestion, has full shoulders, and has a simple lane configuration with no weaving.

#### 3.4.3 Route 3 at I-91 and Route 2

Crash rates on Route 3 Northbound show a high incidence of crashes on the westernmost portion of the corridor, west of I-91 (**Figure 3-22**). This segment of Route 3 is an undivided road with traffic signals. The potential for crashes is greatly increased here as there is no median to separate directional traffic, left-turning traffic must yield to opposing through traffic (potential for angled crashes), and rear-end crashes are more likely due to traffic stopping at signals.

The freeway portions of Route 3 have much lower crash rates. One segment above 500 crashes per HMVMT is at the I-91 interchange, corresponding with a left-hand off-ramp and a lane reduction from two basic lanes to one. The other location with an elevated crash rate is at the northern end of the freeway where Route 3 goes around a compound left-hand curve and merges with Route 2 Westbound.

Crash rates on Route 3 Southbound show a similar trend to the northbound direction, with few crashes on the freeway segments and higher rates on the undivided segments (**Figure 3-23**). The crash rates at MP 11.20-11.29 correspond to the left-hand off-ramp to I-91 SB. Other high-crash locations occur at traffic signals along Route 3.



**Figure 3-17: Secondary Route Crash Frequency Map**

#### 3.4.4 Route 9 at I-91 and I-84

Crash rates on Route 9 Northbound are all below 500 per HMVMT in the vicinity of I-91 and I-84 (**Figure 3-24**).

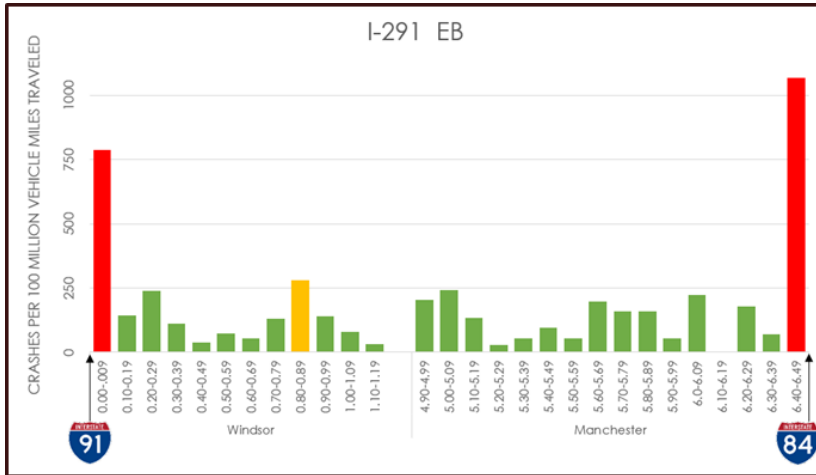
In the southbound direction (**Figure 3-25**), there is one location with an elevated crash rate: at the off-ramp to Route 71 in New Britain. There do not appear to be any geometric or operational deficiencies in this area, nor is there recurring congestion, so the cause of these crashes is unclear. It may be due to crashes on the off-ramp itself contributing to the overall crash rate.

#### 3.4.5 Route 15 at I-91, Route 2, and I-84

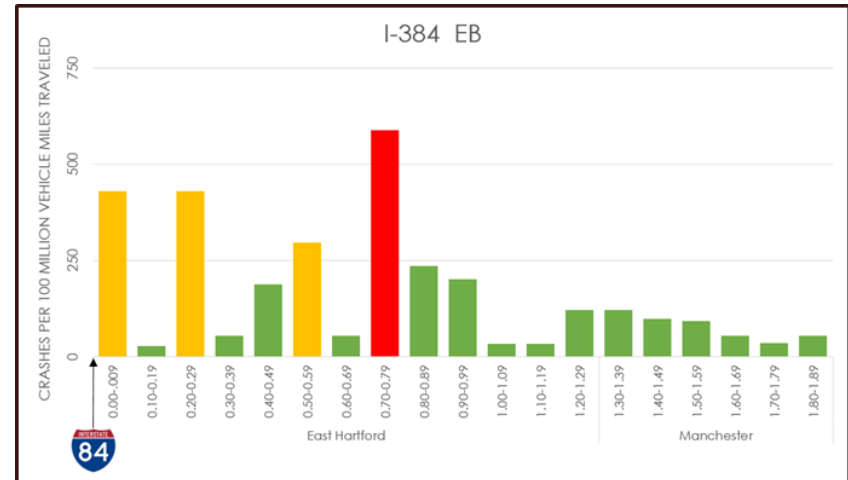
Crash rates on Route 15 Northbound are generally below 500 per HMVMT, except at the Route 99 interchange in Wethersfield (**Figure 3-26**). Both in advance of the off-ramp and at the on-ramp, rates are slightly above 500, indicating potential operational issues at this interchange.

Crash data on Route 15 Southbound shows two locations with elevated crash rates (**Figure 3-27**). The first is at the I-91 interchange, where Route 15 is reduced from two lanes to one, with a lane dropping to Brainard Road. There is also a low-speed on-ramp from I-91 Northbound that enters in this area. Farther south, the stop-controlled on-ramp from Route 99 is another high-crash location. Average speeds here are 50 to 60 mph and entering traffic must accelerate to this speed in a short distance.

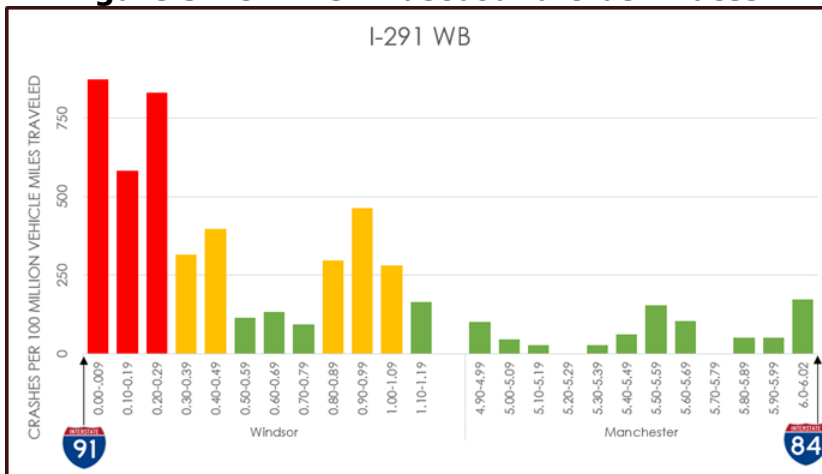




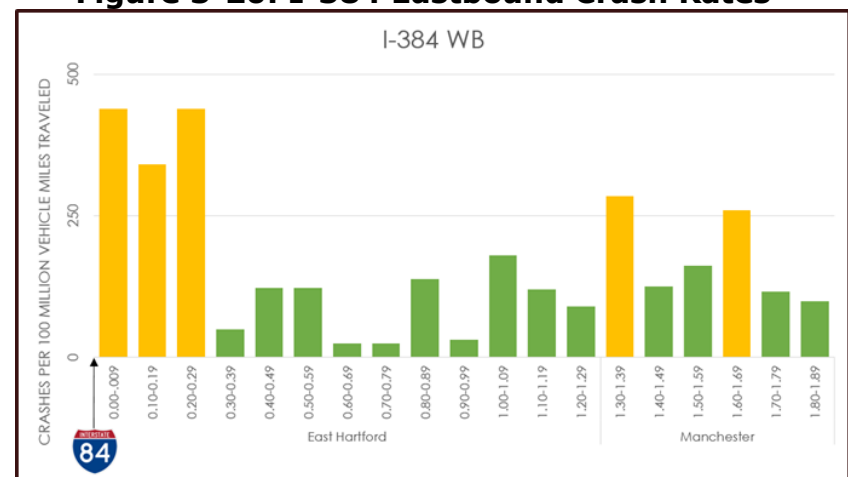
**Figure 3-18: I-291 Eastbound Crash Rates**



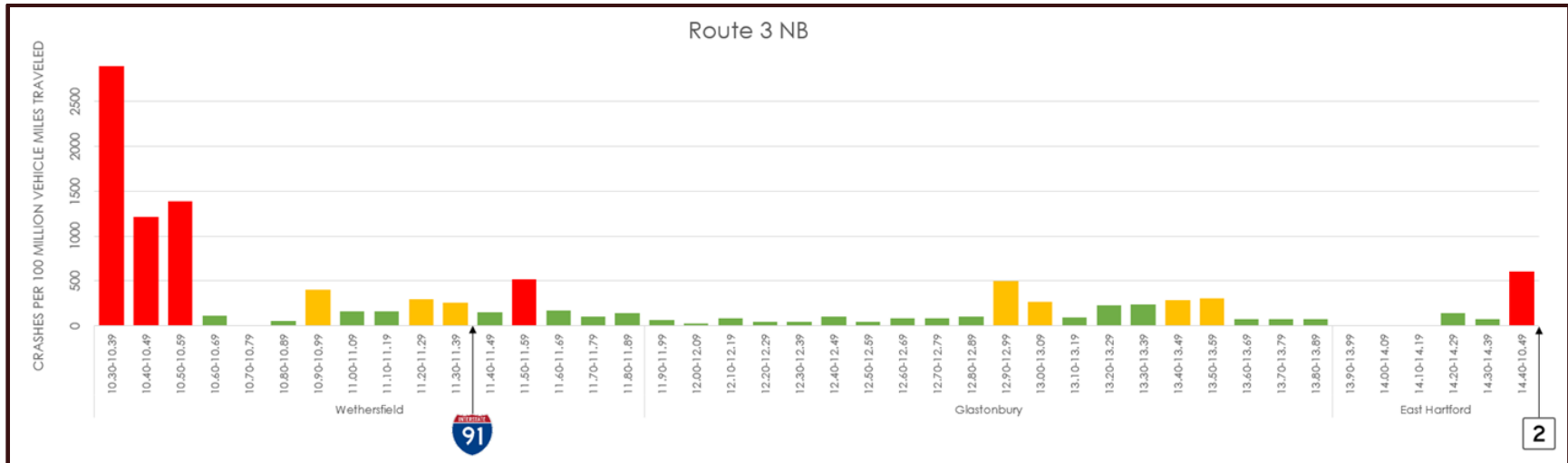
**Figure 3-20: I-384 Eastbound Crash Rates**



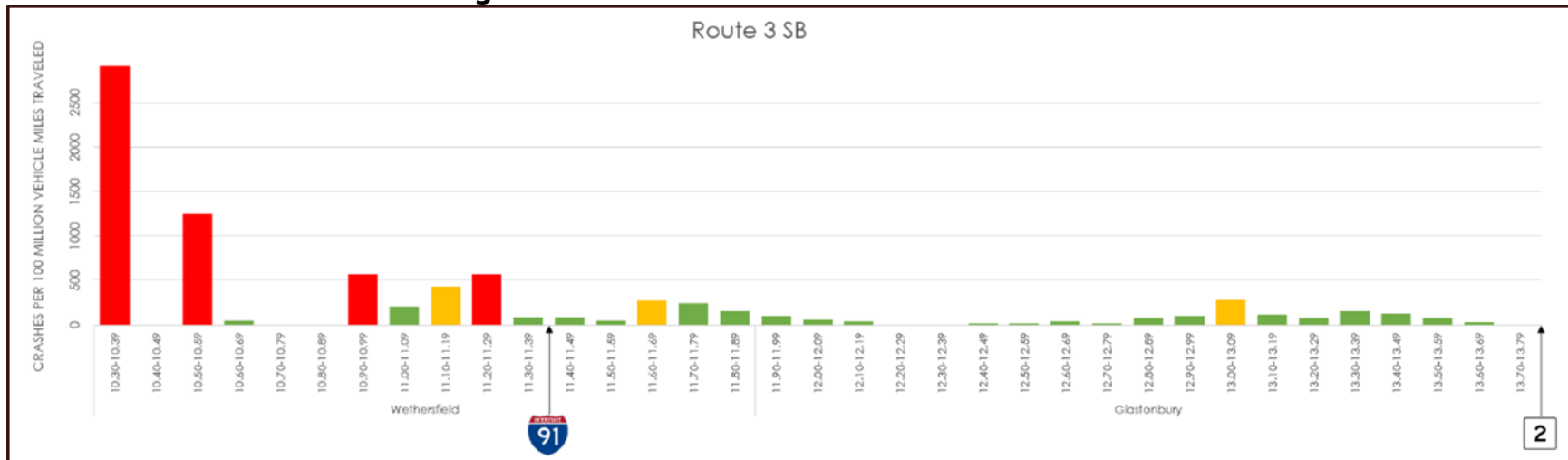
**Figure 3-19: I-291 Westbound Crash Rates**



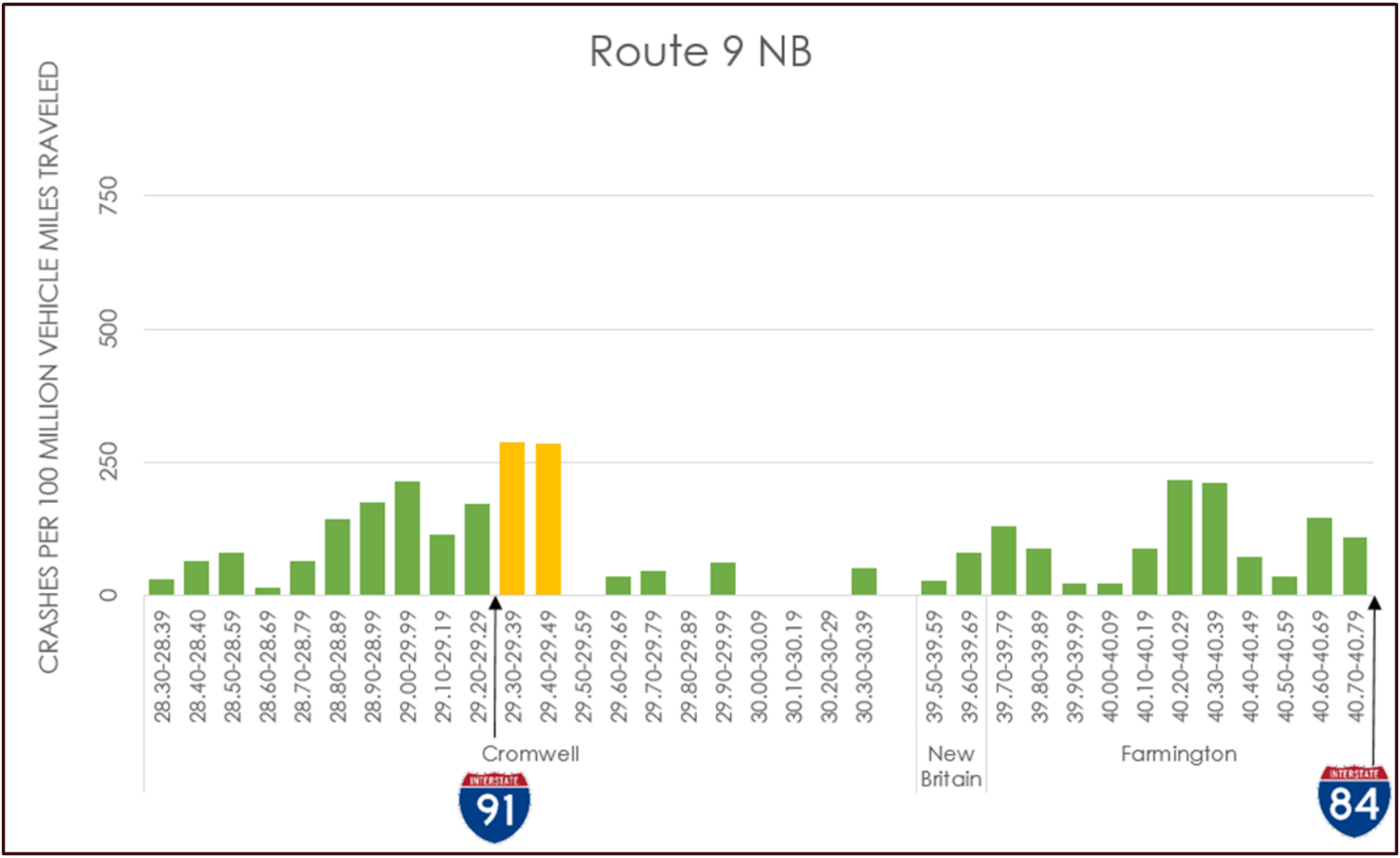
**Figure 3-21: I-384 Westbound Crash Rates**



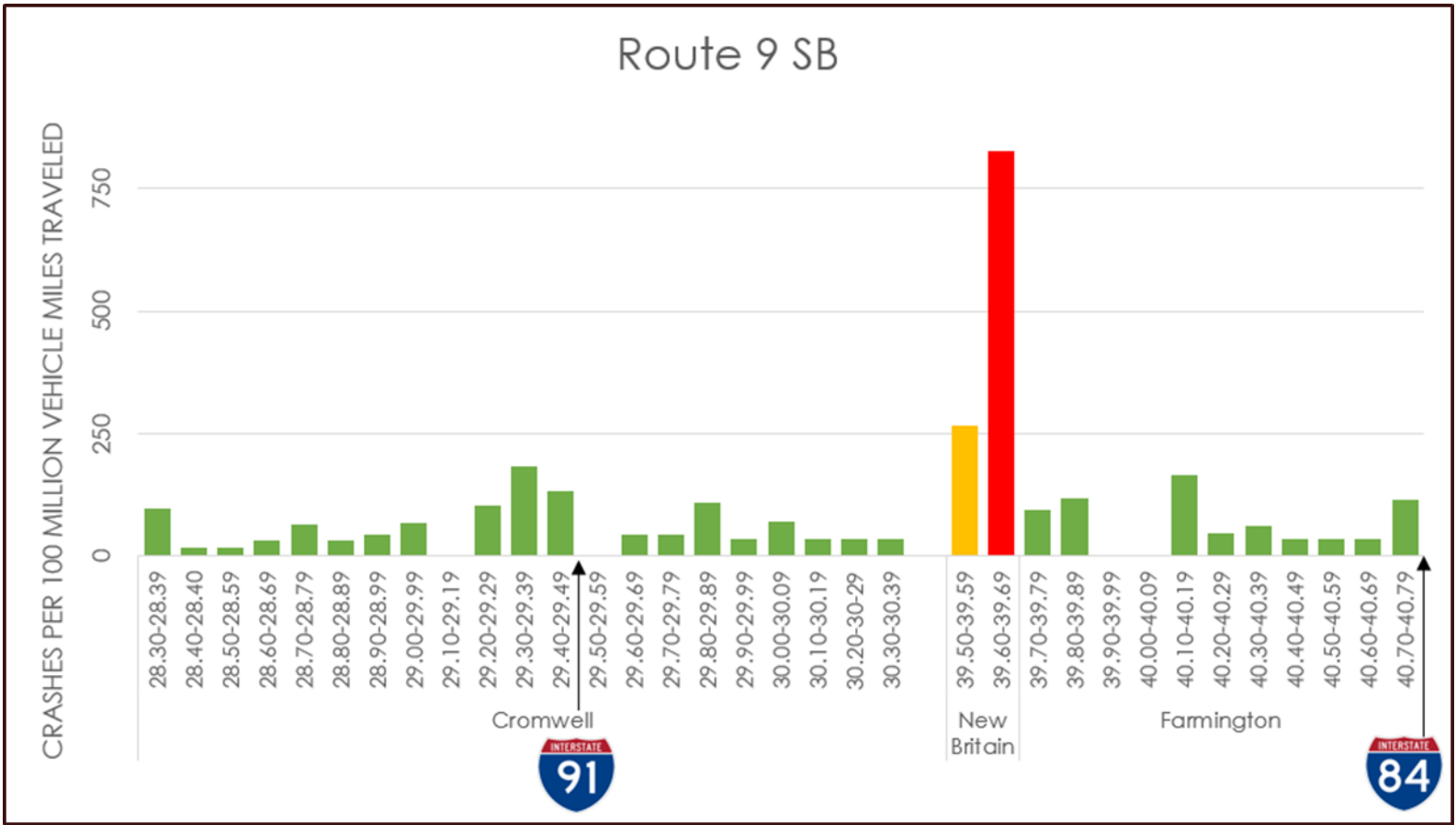
**Figure 3-22: Route 3 Northbound Crash Rates**



**Figure 3-23: Route 3 Southbound Crash Rates**



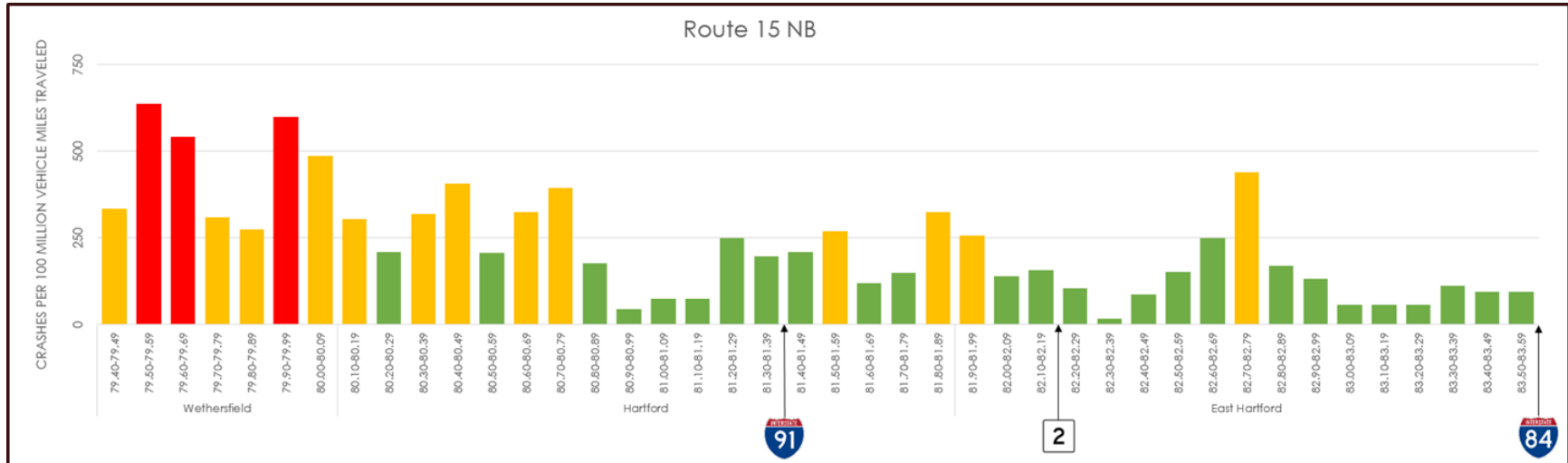
**Figure 3-24: Route 9 Northbound Crash Rates**



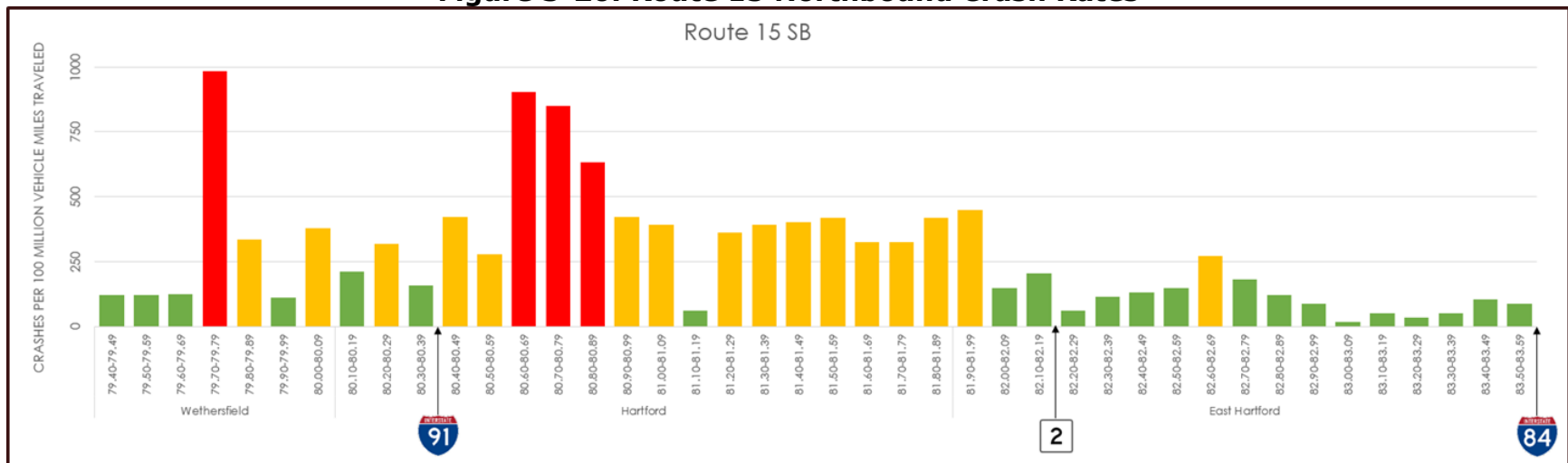
**Figure 3-25: Route 9 Southbound Crash Rates**

Crash data on Route 15 Southbound shows two locations with elevated crash rates (**Figure 3-27**). The first is at the I-91 interchange, where Route 15 is reduced from two lanes to one, with a lane dropping to Brainard Road. There is also a low-speed on-ramp from I-91 Northbound that enters in this area.

Farther south, the stop-controlled on-ramp from Route 99 is another high-crash location. Average speeds here are 50 to 60 mph and entering traffic must accelerate to this speed in a short distance.



**Figure 3-26: Route 15 Northbound Crash Rates**



**Figure 3-27: Route 15 Southbound Crash Rates**

### 3.5 Bridge Structure Assessment – Priority Corridors

Due to the extensive area encompassed by the Greater Hartford Mobility Study limits, it was not practical to look at every bridge structure within this area. As a result, it was determined to just look at the bridges on the Priority Corridors. This includes all the bridges carrying or overpassing I-84, I-91 and Route 2 and their ramp systems at major interchanges within the study limits. In total, 240 bridges were assessed and documented utilizing the latest (2018 to 2020) bridge inspection reports.

#### 3.5.1 General Description of Bridges

The majority of bridges within these priority corridors were constructed in the 1960's during the major expansion of the interstate and local highway system. They have all gone through one or more major rehabilitations during their 50 to 60 year life spans as is typical with these types of structures. At the time of construction, they were typically designed for a 50-year life span. The majority of these bridges can be classified as typical grade separation type structures, meaning they either carry the mainline highway over a local road or a local road is carried over the mainline highway on bridge structure. The exceptions are in the area of major interchanges where you can have longer multi-span bridges also referred to as viaduct structures. The crossing of I-84 over the Hartford Line rail corridor is another example of a very long multi-span structure required to separate the grades of these two shared corridor facilities.

*A viaduct is an elevated bridge structure with multiple spans typically over land.*

Typically, the highway bridges in the studied corridors have reinforced concrete bridge decks with multi steel stringer or girder superstructures simply supported on reinforced concrete piers and abutments. Almost all of the bridges have bituminous concrete overlay with membrane waterproofing, which were added during a bridge rehabilitation project. The old simply supported design of these bridges required deck joints at every substructure unit. It is important to note that these deck joints are located in the most vulnerable position on these bridges. Situated at surface level, these joints have been subjected to the impact and vibration of traffic and have been exposed not only to the effects of natural elements such as water, dirt and UV rays, but also to those of chemicals such as deicing salts and petroleum derivatives. All of the aforementioned external effects have contributed to deck joint leakages underneath these structures causing severe rust and section loss at steel beam ends. In addition to having deck joints at all substructure units, some of these bridges have other problematic details such as pin and hangers and steel pier caps, which also show severe rusting and section losses due to deck joint leakages.

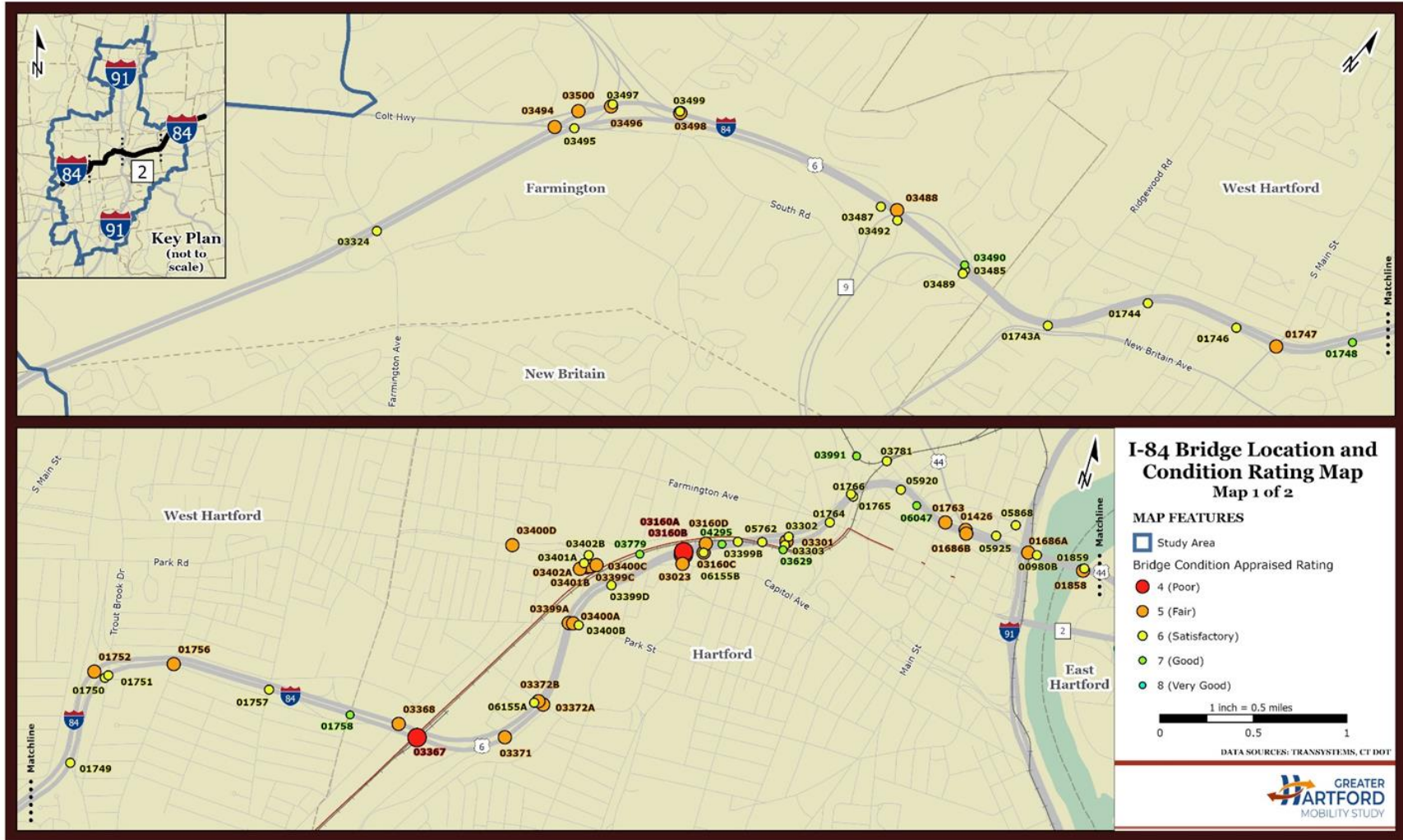
The rehabilitation work that was completed on these grade separation structures over the years have generally consisted of deck repairs and patching, substructure repairs, addition of bituminous concrete wearing surface and membrane waterproofing, bearing repair or replacement, steel repairs primarily at beam ends, pin and hanger modifications, and structural steel painting. Many of these structures have undergone rehabilitation more than once to maintain their current fair condition.

There are several sections of the studied corridors that were reconstructed in the past as part of major highway improvement projects. As such, the bridges are newer as having been replaced during these projects. Some of the major highway projects are noted as follows:

- ❖ I-84/ I-91 Interchange Improvement Project – This project widened I-84 in downtown Hartford from High Street to the east through the I-91 Interchange and also made several ramp improvements. This work was completed in the late 1980's to early 1990's. All impacted bridges were replaced to newer standards and all retaining walls were replaced in the trench section of I-84 in downtown Hartford.
- ❖ Widening and improvements to I-91 from the Hartford Interchange to Windsor Locks – This project occurred during the late 1980's to early 1990's and widened I-91 and added the HOV Lanes to I-91. Most of the bridges within this corridor were replaced during this project.

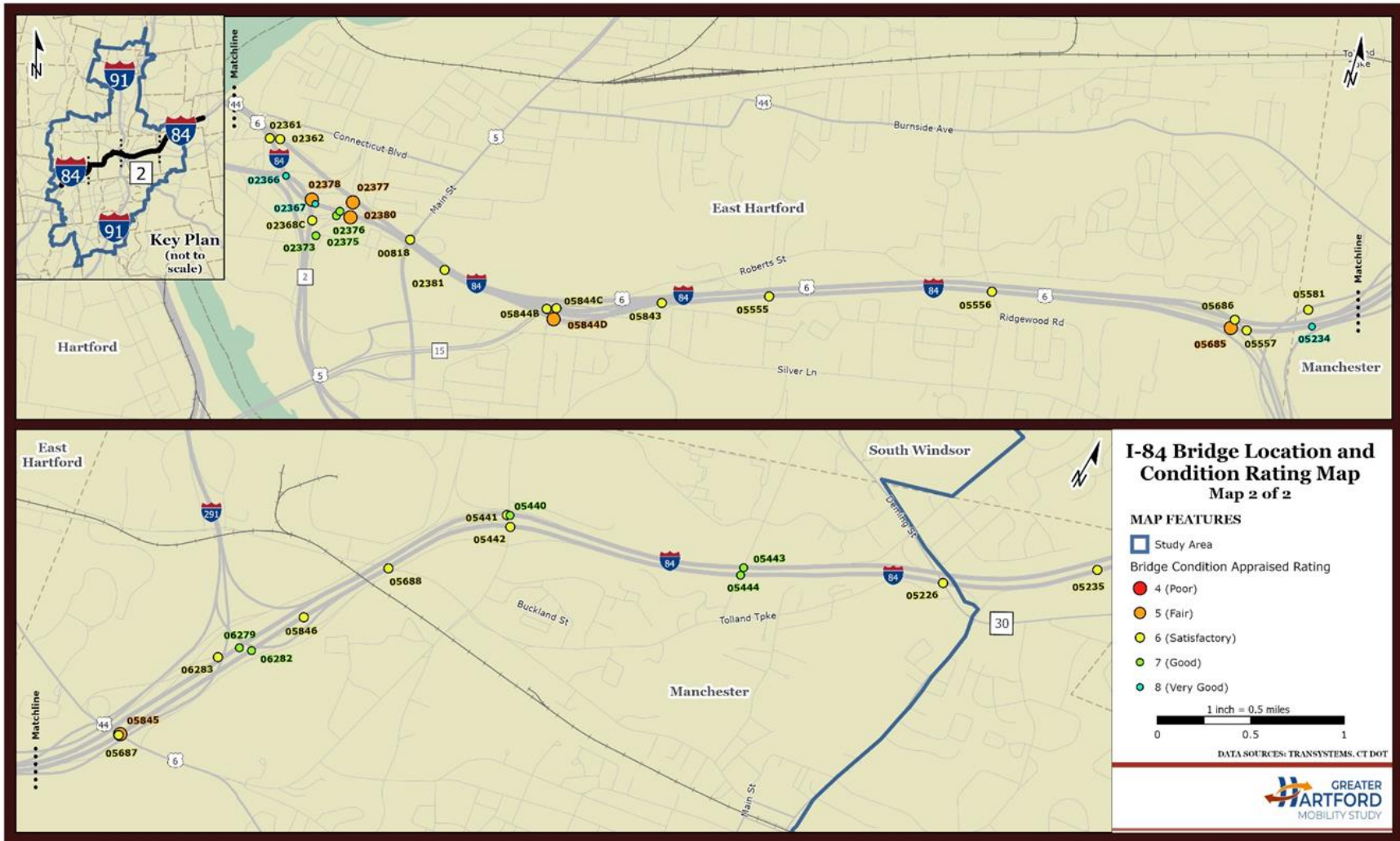
- ❖ Widening and improvements to I-84 in East Hartford and Manchester – This project was completed in the 1980's and resulted in many replaced bridges within this reach of highway. Of note is several of the replaced bridges were constructed of post-tensioned multi-span concrete boxes with integral concrete pier caps, a method not used much in Connecticut during that era.

**Figure 3-28** through **Figure 3-32** illustrate the location and identification numbers of the bridges in the study corridors. **Table 3-7** through **Table 3-9** show general information regarding the bridge location, year built and general description of each structure.

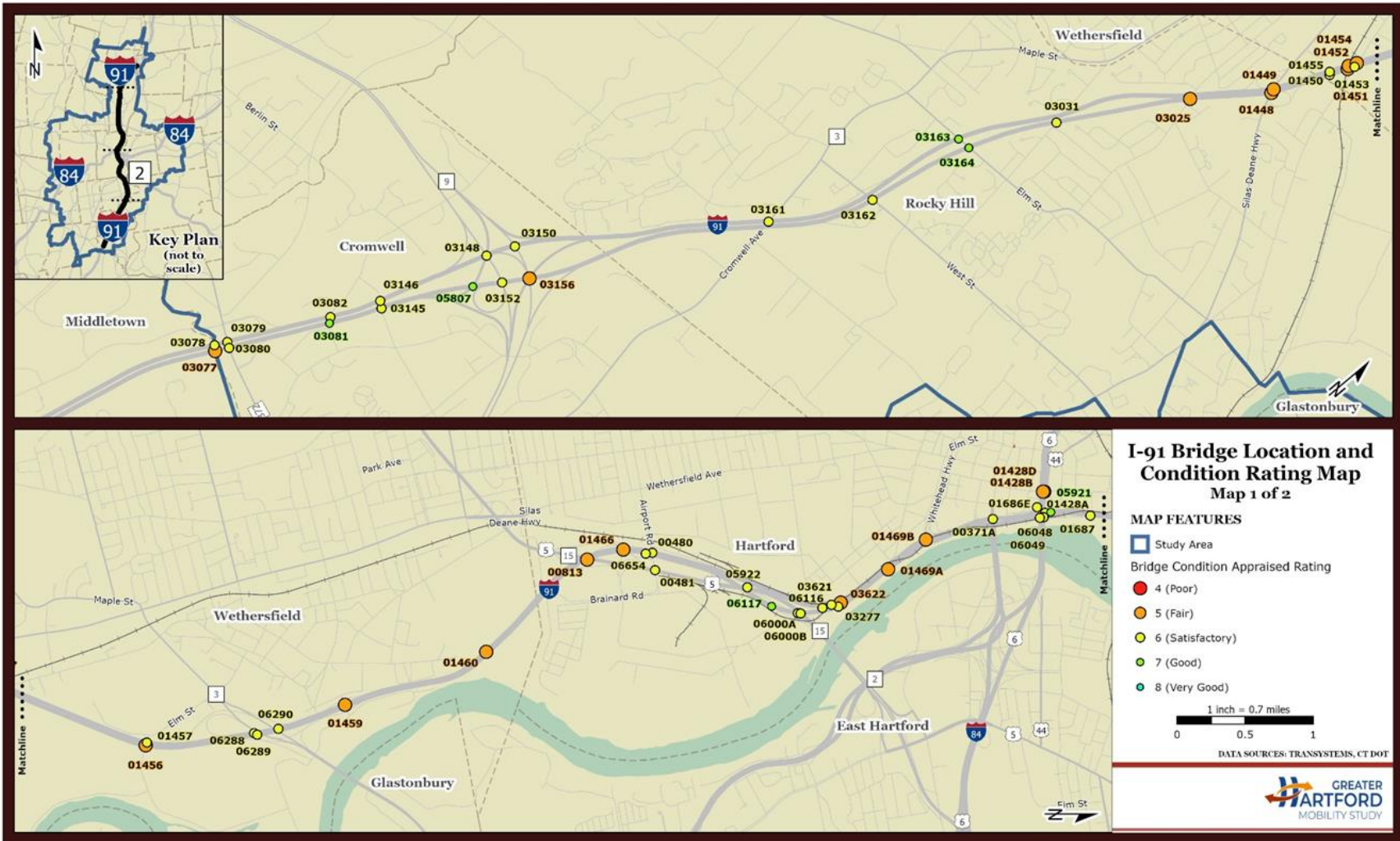


**Figure 3-28: I-84 Map 1 Priority Bridge List Bridge Location / Number Data**

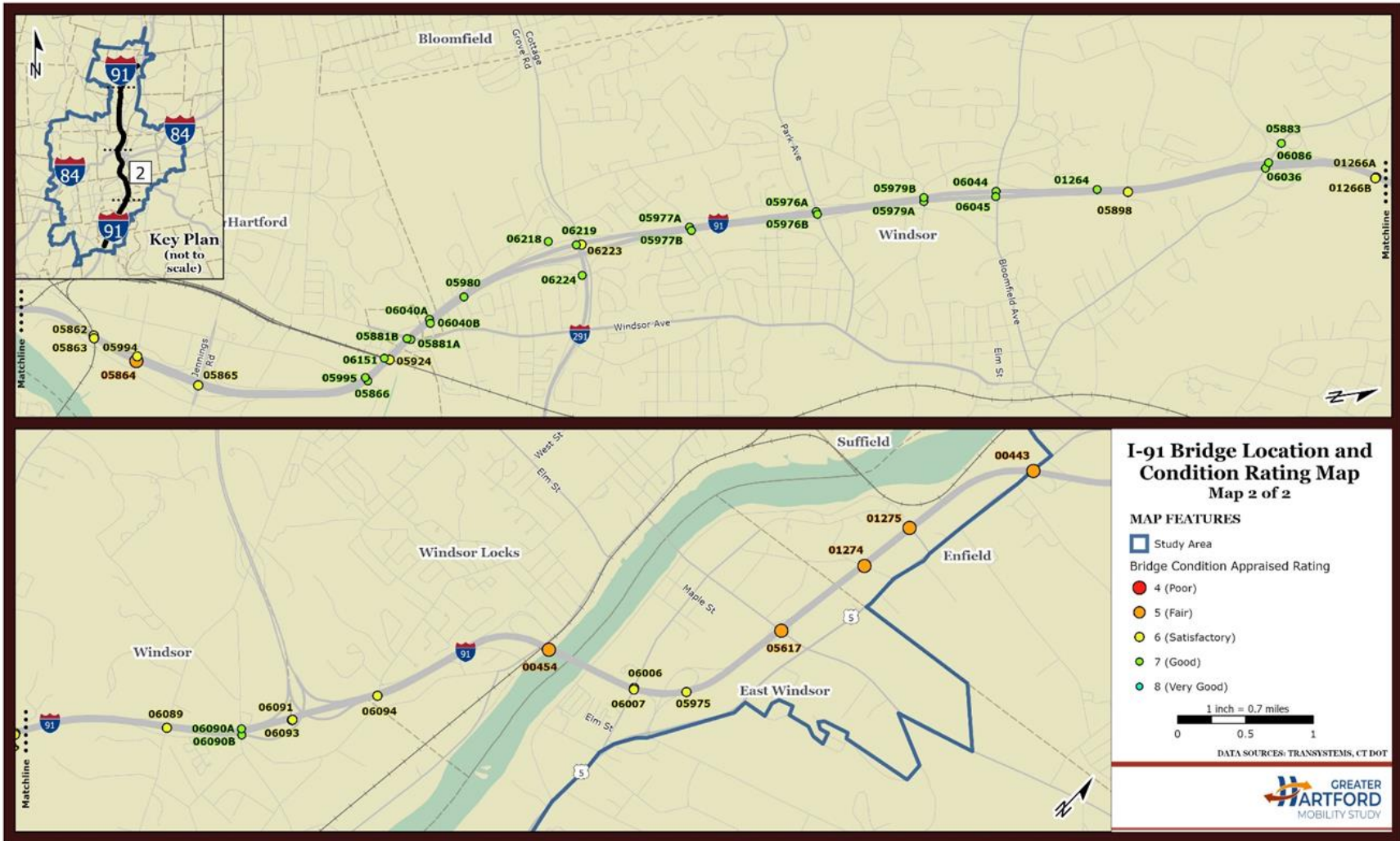




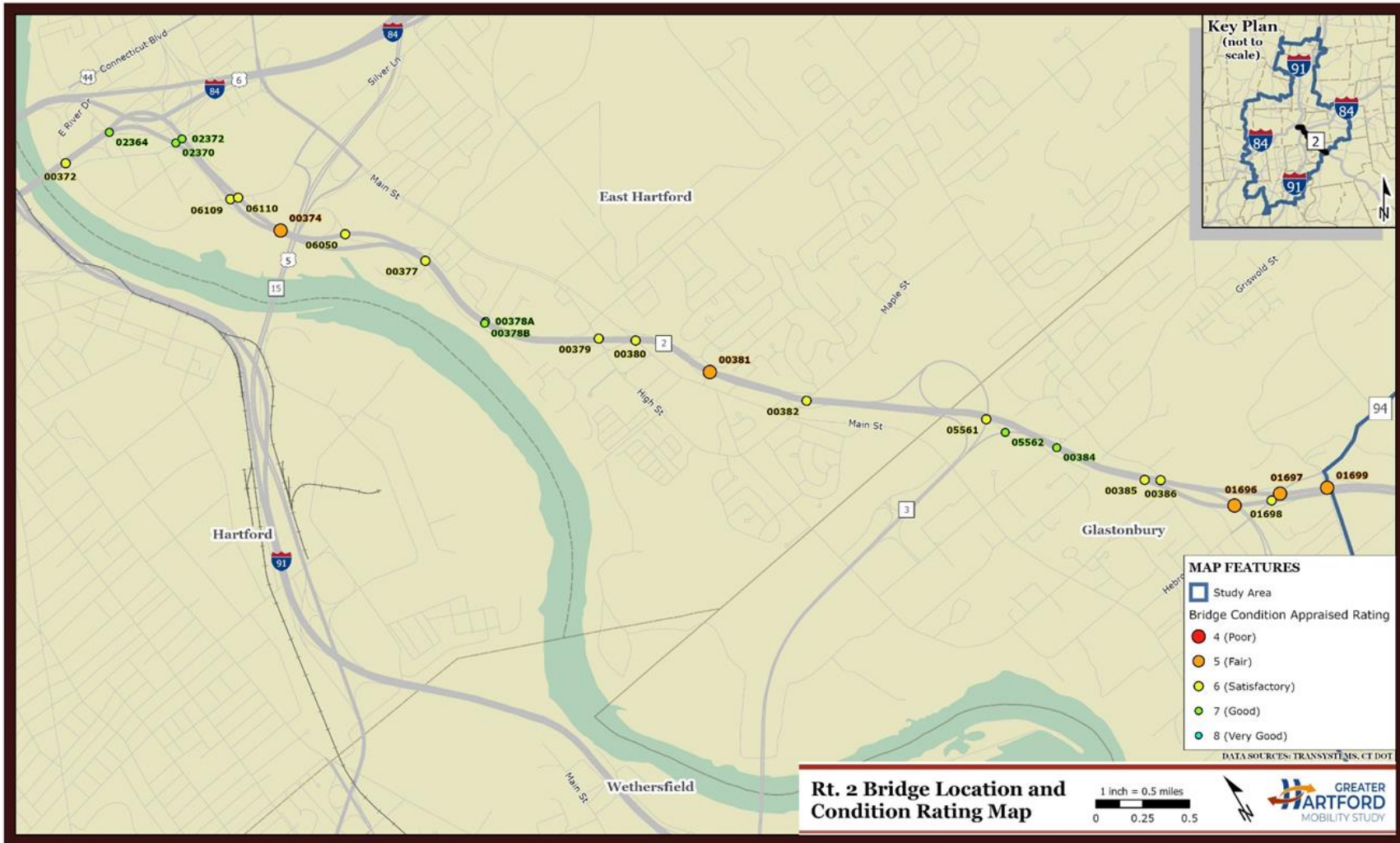
**Figure 3-29: I-84 Map 2 Priority Bridge List Bridge Location / Number Data**



**Figure 3-30: I-91 Map Priority Bridge List Bridge Location / Number Data**



**Figure 3-31: I-91 Map 2 Priority Bridge List Bridge Location / Number Data**



**Figure 3-32: Route 2 Priority Bridge List Bridge Location / Number Data**

**Table 3-7: I-84 Priority Bridge List General Bridge Data**

| Town / City   | Bridge No. | Year Built | Feature Carried / Crossed                                     | General Description  |
|---------------|------------|------------|---|--|
| <b>I-84</b>   |            |            |   |  |
| Farmington    | 03324      | 1967       | Fienemann Road over I-84                                      | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03494      | 1969       | I-84 WB over US RTE 6 EB & SR 531 WB                          | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03495      | 1969       | I-84 EB over US RTE 6 EB & SR 531 WB                          | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03500      | 1966       | I-84 TR 818 over SR 508 EB                                    | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03496      | 1969       | I-84 WB over I-84 TR 818                                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03497      | 1969       | I-84 WB over SR 508   | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03498      | 1969       | SR 531 (South Road) over I-84 & SR 508                        | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03499      | 1969       | I-84 TR 817 over I-84 Ramp 207                                | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03487      | 1969       | Vacant Route 9 Ramp over I-84                                 | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03488      | 1969       | RT 9 SB I-84 TR 820 over I-84                                 | 6 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03492      | 1970       | Vacant RTE 9 RAMP over I-84, I-84 TR 820, SR 506              | 7 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03490      | 1966       | I-84 TR 820 over Woodruff Road                                | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03485      | 1969       | I-84 EB over Woodruff Road                                    | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Farmington    | 03489      | 1966       | ROUTE 9 TR 806 over WOODRUFF ROAD                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01743A     | 1965       | I-84 EB over SR 535 (Ridgewood Road)                          | 2 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01744      | 1965       | I-84 EB over Berkshire Road                                   | 3 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01746      | 1965       | I-84 over Rockledge Brook                                     | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| West Hartford | 01747      | 1965       | Route 173 over I-84   | 2 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01748      | 1965       | Mayflower Street over I-84                                    | 2 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01749      | 1965       | I-84 EB over I-84 WB Exit 42 Off Ramp                         | 1 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01750      | 1965       | I-84 Ramps 203, 204 over Trout Brook                          | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| West Hartford | 01751      | 1965       | I-84 EB over Trout Brook & Trout Brook Drive                  | 5 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01752      | 1965       | I-84 WB over SR 501 NB & I-84 TR 821                          | 7 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01756      | 1965       | South Quaker Lane over I-84                                   | 2 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01757      | 1965       | Oakwood Avenue #2 over I-84                                   | 2 Span Steel Stringer/Multi-beam or Girder                   |
| West Hartford | 01758      | 1965       | Prospect Avenue over I-84                                     | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03368      | 1967       | I-84 WB over New Park Avenue & AMTRAK                         | 11 Span Steel Stringer/Multi-beam or Girder                  |
| Hartford      | 03367      | 1967       | I-84 EB over New Park Avenue, AMTRAK, SR 504                  | 18 Span Steel Stringer/Multi-beam or Girder                  |
| Hartford      | 03371      | 1967       | I-84 EB over Olive Street (Abandoned)                         | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 06155A     | 1964       | I-84, Amtrak, CTFastrak & Local over No. Branch of Park River | 2 Span Culvert (includes frame culvert)                      |
| Hartford      | 03372A     | 1967       | I-84 EB over Hamilton Street                                  | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03372B     | 1967       | I-84 WB over Hamilton Street                                  | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03399A     | 1969       | I-84 WB over Park Street                                      | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03400A     | 1969       | I-84 EB over Park Street                                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03400B     | 1969       | I-84 EB over Parking Lot                                      | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Hartford      | 03400D     | 1969       | I-84 TR 823 over Parking Lot                                  | 7 Span Steel Stringer/Multi-beam or Girder                   |

| Town / City   | Bridge No. | Year Built | Feature Carried / Crossed                              | General Description                                 |
|---------------|------------|------------|--|---|
| <b>I-84</b>   |            |            |  |   |
| Hartford      | 03402A     | 1969       | SR 503 WB over Amtrak & Capitol Avenue                 | 6 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03401A     | 1969       | SR 503 EB over Parking Lot                             | 5 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03401B     | 1969       | SR 503 EB over I-84 & Amtrak & Local Roads             | 16 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03402B     | 1969       | SR 503 WB over Forest Street & Parking Lot             | 10 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03399C     | 1966       | I-84 TR 824 over Capitol Ave & Amtrak                  | 14 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03399D     | 1963       | I-84 TR 824 over Capitol Ave & Amtrak                  | 6 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03400C     | 1969       | I-84 TR 823 over I-84, 503, RR, Capitol Ave, Forest    | 15 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03779      | 1962       | Laurel Street over Amtrak, CNERR & CTFastrak           | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03023      | 1964       | Sigourney Street over Capitol Ave & Amtrak             | 11 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03160A     | 1965       | I-84 EB over Amtrak; Local Roads; Parking              | 3 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03160B     | 1965       | I-84 WB over Amtrak; Local Roads; Parking              | 40 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03160C     | 1965       | I-84 Ramp 114 over Aetna Parking Lot                   | 6 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 06155B     | 1964       | I-84 Ramps & Local Roads over Park River Conduit       | 2 Span Culvert (includes frame culvert)             |
| Hartford      | 03160D     | 1965       | I-84 Ramp 115 over Aetna Parking Lot                   | 4 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 04295      | 1979       | I-84 EB On-Ramp 186 over I-84 WB Exit 48 On-Ramp       | 3 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03399B     | 1969       | I-84 WB over Parking Lot                               | 4 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 05762      | 1987       | I-84 Ramp 299 over I-84 Ramp I-91 & 06871T             | 5 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03629      | 1975       | Broad Street over Amtrak RR & Busway                   | 3 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03302      | 1966       | Broad Street over I-84 WB & I-84 Ramp 191              | 1 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03303      | 1966       | I-84 Ramp 190 over Broad Street & Amtrak RR            | 15 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 03301      | 1966       | I-84 EB over Broad Street, I-84 Ramp I-91              | 15 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 01764      | 1966       | Asylum Street over I-84                                | 1 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 01765      | 1966       | I-84 EB over Amtrak RR & Local Roads                   | 10 Span Steel Stringer/Multi-beam or Girder         |
| Hartford      | 01766      | 1964       | I-84 WB over Amtrak RR & Local Roads                   | 6 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03991      | 1912       | Edwards Street over Central New England RR             | 1 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 03781      | 1907       | Walnut Street over Amtrak & Central NE RR              | 1 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 05920      | 1988       | High Street over I-84 & Ramps                          | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 06047      | 1991       | Ann Uccello Street over I-84 & Ramps                   | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 01763      | 1964       | Trumbull Street over I-84, TR 839 & TR 841             | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 01426      | 1963       | US RTE 44 & Main Street over I-84 & Morgan Street Ramp | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 01686B     | 1961       | I-84 TR 825 over US RT 44 EB & Columbus Boulevard      | 8 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 05925      | 1990       | I-84/I-91 TR 841/858 over US RTE 44 & Market Street    | 2 Span Steel Stringer/Multi-beam or Girder          |
| Hartford      | 05868      | 1990       | W-N Turning Rdwy over I-84/I-91 Ramps, CSO RR          | 9 Span Steel Box Beam or Girders - Single or Spread |
| Hartford      | 01686A     | 1961       | I-84 over Market Street & I-91 NB                      | 14 Span Steel Stringer Viaduct                      |
| Hartford      | 00980B     | 1964       | I-84 TR 826 over Connecticut River                     | 2 Span Steel Stringer/Multi-beam or Girder          |
| East Hartford | 01858      | 1964       | I-84 EB over US Rte 44 EB                              | 1 Span Steel Stringer/Multi-beam or Girder          |
| East Hartford | 01859      | 1964       | I-84 WB over US Rte 44 EB                              | 1 Span Steel Stringer/Multi-beam or Girder          |
| East Hartford | 02361      | 1964       | I-84 EB & Ramp 196 over East River Drive               | 1 Span Steel Stringer/Multi-beam or Girder          |
| East Hartford | 02362      | 1964       | I-84 WB & TR 827 over East River Drive                 | 1 Span Steel Stringer/Multi-beam or Girder          |
| East Hartford | 02366      | 1964       | Rte 2 WB & SR 500-806 over I-84 EB & TR 828            | 1 Span Steel Stringer/Multi-beam or Girder          |

| Town / City   | Bridge No. | Year Built | Feature Carried / Crossed                           | General Description   |
|---------------|------------|------------|---|---|
| <b>I-84</b>   |            |            |   |   |
| East Hartford | 02378      | 1964       | I-84 830, SR 500-805 over I-84 EB & SR 500          | 1 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02367      | 1964       | I-84 TR 829 over I-84 EB & I-84 TR 828              | 1 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02368C     | 1994       | I-84 WB TR 827 over I-84, SR 500 and Ramps          | 10 Span Steel Box Beam or Girders - Single or Spread                  |
| East Hartford | 02373      | 1964       | SR 500 TR 801&802 over Pitkin Street                | 1 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02375      | 1964       | SR 500 TR 801 over I-84 EB and I-84 TR 833          | 7 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02376      | 1964       | I-84 TR 831 over I-84 EB                            | 3 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02377      | 1964       | SR 500 over I-84 WB and I-84 TR 10                  | 3 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02380      | 1964       | SR 500 TR 803 over SR 500 & TR 801, I-84 TR 831     | 4 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 00818      | 1963       | I-84 over Rte 5 & I-84 Ramp 116                     | 2 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 02381      | 1964       | I-84 over Hockanum River                            | 3 Span Concrete Continuous Culvert (includes r fame culverts)         |
| East Hartford | 05844B     | 1988       | I-84 EB HOV Lane over Rte 15 & Silver Lane Off Ramp | 12 Span Steel Stringer/Multi-beam or Girder                           |
| East Hartford | 05844C     | 1988       | I-84 WB HOV Lane over Rte 15                        | 15 Span Steel Stringer/Multi-beam or Girder                           |
| East Hartford | 05844D     | 1987       | I-84 EB HOV & WB Ramp over I-84, Rte 15, Ramp A     | 5 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 05843      | 1987       | SR 518 - Roberts Street over I-84 and Exit 58 Ramps | 4 Span Steel Stringer/Multi-beam or Girder                            |
| East Hartford | 05555      | 1985       | Simmons Road over I-84                              | 2 Span Steel Box Beam or Girders - Single or Spread                   |
| East Hartford | 05556      | 1985       | Forbes Street over I-84                             | 2 Span Steel Box Beam or Girders - Single or Spread                   |
| East Hartford | 05685      | 1986       | I-384 HOV over I-84 EB                              | 3 Span Prestressed Concrete Continuous Box Beam or Girders - Multiple |
| East Hartford | 05686      | 1986       | I-384 WB over I-84                                  | 3 Span Prestressed Concrete Continuous Box Beam or Girders - Multiple |
| East Hartford | 05557      | 1986       | I-384 HOV Ramps over I-84 TR 836                    | 1 Span Concrete Frame (except frame culverts)                         |
| Manchester    | 05581      | 1987       | I-84 TR 836 & Bikeway over Hockanum River & Bikeway | 3 Span Prestressed Concrete Continuous Stringer/Multi-beam or Girder  |
| Manchester    | 05234      | 2017       | I-84 Ramp 247 over Hockanum River                   | 1 Span Prestressed Concrete Stringer/Multi-beam or Girder             |
| Manchester    | 05687      | 1985       | US Rte 44 over I-84 Ramps, Rte I-384 Ramp           | 4 Span Steel Box Beam or Girders - Single or Spread                   |
| Manchester    | 05845      | 1984       | CD WB Roadway over I-84 Ramp J (Rte 44/I-84 WB)     | 3 Span Prestressed Concrete Continuous Box Beam or Girders - Multiple |
| Manchester    | 06283      | 1994       | I-84 and I-84 Ramp 305                              | 2 Span Steel Box Beam or Girders - Single or Spread                   |
| Manchester    | 06279      | 1993       | I-291 EB over I-84 TR 836, I-84 RMP 304             | 2 Span Steel Box Beam or Girders - Single or Spread                   |
| Manchester    | 06282      | 1993       | I-291 EB over I-84                                  | 2 Span Steel Box Beam or Girders - Single or Spread                   |
| Manchester    | 05846      | 1986       | I-291 EB over I-84 Ramp 306                         | 3 Span Prestressed Concrete Continuous Box Beam or Girders - Multiple |
| Manchester    | 05688      | 1984       | Tolland Turnpike over I-84 & Ramps                  | 4 Span Steel Box Beam or Girders - Multiple                           |
| Manchester    | 05441      | 1984       | I-84 WB over Buckland Street                        | 1 Span Steel Stringer/Multi-beam or Girder                            |
| Manchester    | 05442      | 1985       | I-84 EB Off Ramp over Buckland Street               | 1 Span Steel Stringer/Multi-beam or Girder                            |
| Manchester    | 05440      | 1984       | I-84 WB Off Ramp over Buckland Street               | 1 Span Steel Stringer/Multi-beam or Girder                            |
| Manchester    | 05443      | 1984       | I-84 WB over Slater Street                          | 1 Span Steel Stringer/Multi-beam or Girder                            |
| Manchester    | 05444      | 1984       | I-84 EB over Slater Street                          | 1 Span Steel Stringer/Multi-beam or Girder                            |
| Manchester    | 05226      | 1981       | Route 30 over I-84 & I-84 Ramp 247                  | 2 Span Steel Continuous Box Beam or Girders - Single or Spread        |
| Manchester    | 05235      | 1981       | I-84 Ramp 248 over Hockanum River                   | 1 Span Prestressed Concrete Stringer/Multi-beam or Girder             |

**Table 3-8: I-91 Priority Bridge List General Bridge Data**

| Town / City  | Bridge No. | Year Built | Feature Carried / Crossed                           | General Description  |
|--------------|------------|------------|---|--|
| <b>I-91</b>  |            |            |   |  |
| Middletown   | 03077      | 1965       | I-91 NB over Mattabasset River                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Middletown   | 03078      | 1962       | I-91 SB over Mattabasset River                      | 1 Span Prestressed Concrete Box Beam or Girders - Multiple   |
| Cromwell     | 03079      | 1965       | I-91 SB over Route 372                              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03080      | 1965       | I-91 NB over Route 372                              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03081      | 1965       | I-91 NB over North Road                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03082      | 1965       | I-91 SB over North Road                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03146      | 1965       | I-91 SB over Evergreen Road                         | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03145      | 1965       | I-91 NB over Evergreen Road                         | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 05807      | 1988       | I-91 NB TR 818 over I-91 NB                         | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03148      | 1965       | I-91 SB over Route 9 SB & I-91 TR 818               | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03152      | 1965       | Route 9 SB over I-91 NB TR 818                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03150      | 1965       | I-91 SB over Route 9 NB                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Cromwell     | 03156      | 1965       | Route 9 NB & I-91 TR 821 over I-91 NB & I-91 TR 823 | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03161      | 1965       | Route 3 over I-91 & Dividend Brook                  | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03162      | 1965       | SSR 411 (West Street) over I-91 & NB Ramp           | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03163      | 2019       | Route 160 over I-91 SB                              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03164      | 2019       | Route 160 over I-91 NB                              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03031      | 1964       | Gilbert Avenue over I-91                            | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 03025      | 1964       | Orchard Stret over I-91                             | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 01449      | 1964       | I-91 SB over Route 99                               | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Rocky Hill   | 01448      | 1964       | I-91 NB over Route 99                               | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01455      | 1964       | I-91 over Beaver Brook                              | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| Wethersfield | 01450      | 1964       | I-91 over Goff Brook                                | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| Wethersfield | 01451      | 1964       | I-91 NB over Providence & Worcester RR              | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01452      | 1964       | I-91 SB over Providence & Worcester RR              | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01453      | 1964       | I-91 NB over Middletown Avenue                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01454      | 1964       | I-91 SB over Middletown Avenue                      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01457      | 1964       | I-91 SB over Elm Street                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01456      | 1964       | I-91 NB over Elm Street                             | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 06288      | 1994       | Route 3 NB over I-91 TR 802                         | 1 Span Box Beam or Girders - Single or Spread                |
| Wethersfield | 06289      | 1994       | Route 3 NB over I-91                                | 1 Span Box Beam or Girders - Single or Spread                |
| Wethersfield | 06290      | 1994       | Route 3 SB over I-91 & TR 804                       | 3 Span Steel Box Beam or Girders - Single or Spread          |
| Wethersfield | 01459      | 1964       | I-91 over Great Meadow Road                         | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Wethersfield | 01460      | 1964       | I-91 over Wethersfield Cove                         | 3 Span Steel Stringer/Multi-beam or Girder                   |



| Town / City | Bridge No. | Year Built | Feature Carried / Crossed                             | General Description  |
|-------------|------------|------------|---|--|
| <b>I-91</b> |            |            |   |  |
| Hartford    | 00813      | 1964       | I-91 over US Route 5 and Route 15                     | 4 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 01466      | 1964       | I-91 over I-91 TR 827                                 | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06654      | 1964       | I-91 & SR 530 over Drainage                           | 3 Span Concrete Culvert (includes frame culverts)                  |
| Hartford    | 00480      | 1964       | I-91 over SR 530 (Airport Road)                       | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 00481      | 1964       | SR 530-Airport Road over RTE 15                       | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 05922      | 1990       | I-91 NB over US 5, RTE 15 & I-91 TR 861               | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06117      | 1991       | I-91 NB over MDC Sewer Pipe                           | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06000A     | 1991       | Route 15 NB over I-91 NB, RTE 2, CT River, RR         | 15 Span Steel Stringer/Multi-beam or Girder                        |
| Hartford    | 06000B     | 1991       | Route 15 SB over I-91 NB, RTE 2, CT River, RR         | 15 Span Steel Stringer/Multi-beam or Girder                        |
| Hartford    | 06116      | 1991       | I-91 NB over CT Southern RR                           | 1 Span Steel Box Beam or Girders - Single or Spread                |
| Hartford    | 03621      | 1958       | I-91 SB & I-91 TR 835 over Connecticut SO. Railroad   | 1 Span Concrete Frame (except frame culverts)                      |
| Hartford    | 03277      | 1958       | I-91 over CT Southern Railroad                        | 1 Span Concrete Frame (except frame culverts)                      |
| Hartford    | 03622      | 1958       | I-91 SB & TR 835 over Connecticut SO. Railroad        | 18 Span Steel Stringer/Multi-beam or Girder                        |
| Hartford    | 01469A     | 1964       | I-91 NB over Park River & CSO RR                      | 2 Span Steel Continuous Girder and Floorbeam System                |
| Hartford    | 01469B     | 1964       | I-91 SB over CSRR, SR 598WB & TR803                   | 6 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 00371A     | 1958       | RTE 2 over I-91 & Connecticut River CT SO. Railroad   | 6 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 01428D     | 1961       | I-91 NB, US Rte 44 EB, RR, CT River                   | 5 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 01428B     | 1961       | I-91 TR 839 over I-91 - 153, I-84 - 825, US RTE 44 EB | 11 Span Steel Stringer/Multi-beam or Girder                        |
| Hartford    | 01686E     | 1961       | I-91 RP 153 over Parking Area                         | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06049      | 1989       | US Route 44 EB over I-91 NB, I-91 COL, SW Roadway     | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06048      | 1989       | US Route 44 WB over I-91 NB, C-D Roadway & Ramp       | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 01428A     | 1961       | I-91 SB over Ramp D & F, I-84, US RTE 44              | 13 Span Steel Stringer/Multi-beam or Girder                        |
| Hartford    | 05921      | 1990       | I-91 TR 841 over Ramp 186                             | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 01687      | 1950       | I-91 & TR 841 over CT Southern Railroad               | 1 Span Concrete Frame (except frame culverts)                      |
| Hartford    | 05863      | 1990       | I-91 NB over CT Southern Railroad                     | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 05862      | 1989       | I-91 SB over Connecticut Southern Railroad            | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 05994      | 1991       | I-91 SB over Leibert Road                             | 1 Span Prestressed Concrete Box Beam or Girders - Single or Spread |
| Hartford    | 05864      | 1991       | I-91 NB over Leibert Road                             | 1 Span Prestressed Concrete Box Beam or Girders - Single or Spread |
| Hartford    | 05865      | 1989       | Jennings Road over I-91                               | 2 Span Steel Continuous Box Beam or Girders - Single or Spread     |
| Hartford    | 05995      | 1991       | I-91 SB over Weston Street                            | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 05866      | 1990       | I-91 NB over Weston Street                            | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06151      | 1990       | I-91 SB On Ramp over Amtrak Railroad                  | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 05924      | 1988       | I-91 NB over AMTRAK Railroad                          | 3 Span Steel Stringer/Multi-beam or Girder                         |
| Windsor     | 05881B     | 1991       | I-91 SB over Route 159                                | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Windsor     | 05881A     | 1991       | I-91 NB over Route 159                                | 1 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06040B     | 1988       | I-91 NB over Keney Park Road & Meadow Brook           | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Hartford    | 06040A     | 1991       | I-91 SB over Keney Park Road & Meadow Brook           | 2 Span Steel Stringer/Multi-beam or Girder                         |
| Windsor     | 05980      | 1990       | Bina Avenue or I-91 & HOV Lanes                       | 2 Span Steel Continuous Box Beam or Girders - Single or Spread     |

| Town / City   | Bridge No. | Year Built | Feature Carried / Crossed              | General Description  |
|---------------|------------|------------|--|--|
| <b>I-91</b>   |            |            |  |  |
| Windsor       | 06218      | 1990       | I-91 SB Ramp 204 over I-91 SB TR 855   | 1 Span Steel Box Beam or Girders - Single or Spread          |
| Windsor       | 06224      | 1992       | I-91 TR 860 over Briarwood Drive       | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06219      | 1992       | I-91 TR 854 & 855 over I-291 Ramp 001  | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06223      | 1990       | Route 218 over I-91 NB                 | 1 Span Prestressed Concrete Frame (except frame culverts)    |
| Windsor       | 05977A     | 1990       | I-91 SB over Rood Avenue               | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05977B     | 1991       | I-91 NB over Rood Avenue               | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05976B     | 1990       | I-91 NB over RTE 178 (Park Avenue)     | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05976A     | 1991       | I-91 SB over Route 178 (Park Avenue)   | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05979B     | 1991       | I-91 SB over Capen Street              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05979A     | 1990       | I-91 NB over Capen Street              | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06045      | 1990       | Route 305 over I-91 NB                 | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06044      | 1990       | Route 305 over I-91 SB                 | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 01264      | 1954       | I-91 over Mill Brook                   | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| Windsor       | 05898      | 1989       | Pigeon Hill Road over I-91             | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 05883      | 1989       | Day Hill Road WB over Route 75         | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06086      | 1991       | I-91 SB over RTE 75 (Poquonock Avenue) | 1 Span Steel Box Beam or Girders - Single or Spread          |
| Windsor       | 06036      | 1991       | I-91 NB over RTE 75 (Poquonock Avenue) | 1 Span Steel Box Beam or Girders - Single or Spread          |
| Windsor       | 01266B     | 1958       | I-91 NB over Farmington River          | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 01266A     | 1958       | I-91 SB over Farmington River          | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06089      | 1992       | Kennedy Road over I-91                 | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06090B     | 1992       | I-91 NB over Hayden Station Road       | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06090A     | 1992       | I-91 SB over Hayden Station Road       | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06091      | 1992       | Route 20 Westbound over I-91           | 5 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor       | 06093      | 1992       | I-91 NB over Route 20 Eastbound        | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor Locks | 06094      | 1992       | South Center Street over I-91          | 2 Span Steel Stringer/Multi-beam or Girder                   |
| Windsor Locks | 00454      | 1959       | I-91 over CT River, AMTRAK, RTE 159    | 8 Span Steel Stringer/Multi-beam or Girder                   |
| E Windsor     | 06006      | 1959       | I-91 SB over SR 510 (Main Street)      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| E Windsor     | 06007      | 1959       | I-91 NB over SR 510 (Main Street)      | 3 Span Steel Stringer/Multi-beam or Girder                   |
| E Windsor     | 05975      | 1989       | I-91 Ramps 101&103 over I-91           | 2 Span Steel Stringer/Multi-beam or Girder                   |
| E Windsor     | 05617      | 1959       | I-91 over Route 140                    | 3 Span Steel Stringer/Multi-beam or Girder                   |
| Enfield       | 01274      | 1959       | Pleasant Road over I-91                | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Enfield       | 01275      | 1959       | SR 510 Depot Hill over I-91            | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Enfield       | 00443      | 1959       | US RTE 5-King Street over I-91         | 4 Span Steel Stringer/Multi-beam or Girder                   |

**Table 3-9: Route 2 Priority Bridge List General Bridge Data**

| Town / City    | Bridge No. | Year Built | Feature Carried / Crossed                    | General Description  |
|----------------|------------|------------|--|--|
| <b>Route 2</b> |            |            |  |  |
| East Hartford  | 00372      | 1958       | RTE 2 over East River Drive                  | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 02364      | 1963       | RTE 2 EB over Darlin Street                  | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 02370      | 1964       | RTE 2 Eastbound over Pitkin Street           | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 02372      | 1964       | RTE 2 Westbound over Pitkin Street           | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 06109      | 1992       | RTE 2 Westbound over East River Drive        | 1 Span Prestressed Concrete Box Beam or Girders - Multiple   |
| East Hartford  | 06110      | 1992       | RTE 2 Eastbound over East River Drive        | 1 Span Prestressed Concrete Box Beam or Girders - Multiple   |
| East Hartford  | 00374      | 1962       | RTE 2 over Hockanum River                    | 5 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 06050      | 1991       | US RTE 5 TR 804 over Route 2 Westbound       | 1 Span Steel Box Beam or Girders - Single or Spread          |
| East Hartford  | 00377      | 1962       | RTE 2 over SR 516 - Willow Street Ext.       | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 00378A     | 1962       | RTE 2 WB over Ensign Street                  | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 00378B     | 1962       | RTE 2 EB over Ensign Street                  | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 00379      | 1962       | RTE 2 over SR 517 SB                         | 1 Span Prestressed Concrete Box Beam or Girders - Multiple   |
| East Hartford  | 00380      | 1962       | RTE 2 over Main Street                       | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 00381      | 1951       | RTE 2 over Sutton Avenue                     | 1 Span Steel Stringer/Multi-beam or Girder                   |
| East Hartford  | 00382      | 1951       | RTE 2 over Maple Street                      | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 05561      | 1987       | Glastonbury RTE 3 over Route 2 & Ramp 080 EB | 2 Span Steel Box Beam or Girders - Single or Spread          |
| Glastonbury    | 05562      | 1987       | RTE 3 TR 801 over RTE 2 Ramp 080             | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 00384      | 1950       | RTE 2 over Griswold Street                   | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 00385      | 1950       | RTE 2 over Salmon Brook                      | 2 Span Concrete Continuous Culvert (includes frame culverts) |
| Glastonbury    | 00386      | 1964       | RTE 2 & RT 17 SB over House Street           | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 01696      | 1964       | RTE 2 EB over RTE 17                         | 4 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 01698      | 1964       | RTE 2 WB over RTE 94                         | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 01697      | 1964       | RTE 2 EB over RTE 94                         | 1 Span Steel Stringer/Multi-beam or Girder                   |
| Glastonbury    | 01699      | 1964       | Oak Street over RTE 2                        | 4 Span Steel Stringer/Multi-beam or Girder                   |

### 3.6 Existing Structural Conditions and Overall Evaluations

In 1968 the Federal –Aid Highway Act directed the States to maintain an inventory of federal and highway bridges. According to National Bridge Inspection Standards (NBIS) today, condition ratings are used to describe an existing bridge compared with its condition if it was new. Each bridge component is assigned a condition rating based on inspection findings. These inspection ratings are based on the materials and physical condition of the deck, superstructure and the substructures. General condition ratings range from 0 (failed condition) to 9 (excellent). Bridge condition assessments are defined in **Table 3-10**, below.

In addition to the individual component ratings, an overall Structural Evaluation has been established for each bridge in NBIS. Structural Evaluation is an appraisal rating that describes an overall rating of the condition of the bridge structure. This is the summary of the separately rated conditions of the structural components of the bridge. This is the truest measure in the National Bridge Inventory (NBI) of the structural fitness of the bridge.

It should also be noted that the minimum threshold goal of the CTDOT is to maintain all bridge structures in a “State of Good Repair”, which is defined as having a minimum structural condition rating of 5 (fair) or better.

Also noted for each bridge evaluated is whether or not the bridge is functionally obsolete. This is a parameter

to assess if the bridges are up to current highway functional and safety standards. It has nothing to do with the actual structural material condition of the bridge. Reports indicate that a fairly high percentage of the bridges are functionally obsolete. This is largely due to lack of adequate shoulder width and substandard vertical clearances as compared to today’s standards.

*The term “section loss” is defined in the Bridge Inspector’s Reference Manual (BIRM) Publication No. FHWA NHI 03-001 as the loss of a (bridge) members cross-sectional area usually by corrosion or decay. A “spall” is a depression in a concrete member resulting from the separation and removal of a volume of the surface concrete. Spalls can be caused by corroding reinforcement, friction from thermal movement, and overstress. The term “scour” refers to the erosion of streambed or bank material around bridge supports due to flowing water.*

**Table 3-11** through **Table 3-13** below, shows Condition Ratings and Overall Evaluation for each bridge in the Priority Corridors within the GHMS limits.

**Table 3-10: NBIS Condition Rating Scale**

| <b>Code</b> | <b>Descriptions</b>  |
|-------------|--|
| 9           | Excellent Condition – No maintenance or rehabilitation concerns.   |
| 8           | Very Good Condition – No maintenance or rehabilitation concerns. No problems noted.  |
| 7           | Good Condition – Potential exist for minor maintenance. Some minor problems noted.   |
| 6           | Satisfactory Condition – Potential exist for major maintenance. Structural elements shown minor deterioration.   |
| 5           | Fair Condition – Potential exist for minor rehabilitation. All primary structural elements are sound but may have minor section loss*, cracking, spalling or scour.  |
| 4           | Poor Condition – Potential exist for major rehabilitation. Advance section loss, deterioration, spalling, or scour.  |
| 3           | Serious condition – Rehabilitation or repair required immediately. Loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures possible. Fatigue cracks in steel or shear cracks in concrete may be present.  |
| 2           | Critical Condition – Need for immediate repairs or rehabilitation is urgent. Advance deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken. |
| 1           | "Imminent" Failure Condition – Bridge is closed to traffic but corrective action may put back in light service. Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability.  |
| 0           | Failed Condition – Bridge is out of service and is beyond corrective action.   |

**Table 3-11: I-84 Priority Bridge List Conditions and Overall Evaluation**

| City / Town   | Bridge No. | Feature Carried / Crossed                                     | Year Inspected | # of Spans | Bridge Length (ft) | Deck Area (sq. ft.) | Deck | Condition Rating |              |         | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |
|---------------|------------|---|----------------|------------|--------------------|---------------------|------|------------------|--------------|---------|-------------------------------|--------------------|-----------------------|----------------------------------|
|               |            |   |                |            |                    |                     |      | Superstructure   | Substructure | Culvert |                               |                    |                       |                                  |
| <b>I-84</b>   |            |   |                |            |                    |                     |      |                  |              |         |                               |                    |                       |                                  |
| Farmington    | 03324      | Fienemann Road over I-84                                      | 2020           | 002        | 224                | 13776               | 6    | 6                | 6            | N       | 6                             | 74.2               | N                     |                                  |
| Farmington    | 03494      | I-84 WB over US RTE 6 EB & SR 531 WB                          | 2019           | 004        | 333                | 22477               | 6    | 5                | 6            | N       | 5                             | 77.0               | N                     |                                  |
| Farmington    | 03495      | I-84 EB over US RTE 6 EB & SR 531 WB                          | 2019           | 004        | 486                | 33777               | 5    | 6                | 6            | N       | 6                             | 84.4               | N                     | 2019                             |
| Farmington    | 03500      | I-84 TR 818 over SR 508 EB                                    | 2020           | 003        | 230                | 7245                | 6    | 5                | 7            | N       | 5                             | 81.1               | N                     | 1990                             |
| Farmington    | 03496      | I-84 WB over I-84 TR 818                                      | 2020           | 003        | 168                | 13020               | 6    | 5                | 6            | N       | 5                             | 71.7               | N                     |                                  |
| Farmington    | 03497      | I-84 WB over SR 508   | 2020           | 003        | 199                | 11701               | 6    | 6                | 6            | N       | 6                             | 86.0               | N                     |                                  |
| Farmington    | 03498      | SR 531 (South Road) over I-84 & SR 508                        | 2020           | 002        | 355                | 17218               | 6    | 6                | 5            | N       | 5                             | 83.9               | N                     |                                  |
| Farmington    | 03499      | I-84 TR 817 over I-84 Ramp 207                                | 2019           | 003        | 232                | 7308                | 6    | 6                | 6            | N       | 6                             | 95.3               | N                     |                                  |
| Farmington    | 03487      | Vacant Route 9 Ramp over I-84                                 | 2019           | 005        | 424                | 18444               | 6    | 6                | 6            | N       | 6                             | 90.0               | Y                     |                                  |
| Farmington    | 03488      | RTE 9 SB I-84 TR 820 over I-84                                | 2019           | 006        | 506                | 22011               | 6    | 6                | 5            | N       | 5                             | 84.3               | N                     |                                  |
| Farmington    | 03492      | Vacant RTE 9 Ramp over I-84, I-84 TR 820, SR 506              | 2019           | 007        | 699                | 22018               | 7    | 6                | 6            | N       | 6                             | 93.0               | Y                     |                                  |
| Farmington    | 03490      | I-84 TR 820 over Woodruff Road                                | 2020           | 003        | 120                | 5220                | 7    | 7                | 7            | N       | 7                             | 91.0               | N                     |                                  |
| Farmington    | 03485      | I-84 EB over Woodruff Road                                    | 2019           | 003        | 112                | 6227                | 6    | 6                | 6            | N       | 6                             | 81.5               | N                     |                                  |
| Farmington    | 03489      | RTE 9 TR 806 over Woodruff Road                               | 2020           | 003        | 142                | 7881                | 6    | 7                | 6            | N       | 6                             | 96.6               | N                     |                                  |
| West Hartford | 01743A     | I-84 EB over SR 535 (Ridgewood Road)                          | 2019           | 002        | 152                | 10260               | 5    | 6                | 6            | N       | 6                             | 82.5               | Y                     |                                  |
| West Hartford | 01744      | I-84 EB over Berkshire Road                                   | 2018           | 003        | 151                | 9890                | 6    | 6                | 6            | N       | 6                             | 85.9               | N                     |                                  |
| West Hartford | 01746      | I-84 over Rockledge Brook                                     | 2019           | 002        | 32                 | 8448                | N    | N                | N            | 6       | 6                             | 70.0               | N                     |                                  |
| West Hartford | 01747      | RTE 173 over I-84   | 2021           | 002        | 224                | 19645               | 6    | 5                | 6            | N       | 5                             | 81.0               | Y                     |                                  |
| West Hartford | 01748      | Mayflower Street over I-84                                    | 2019           | 002        | 260                | 13953               | 6    | 7                | 7            | N       | 7                             | 99.6               | N                     | 2017                             |
| West Hartford | 01749      | I-84 EB over I-84 WB Exit 42 Off Ramp                         | 2019           | 001        | 96                 | 6480                | 7    | 7                | 6            | N       | 6                             | 80.0               | Y                     | 1999                             |
| West Hartford | 01750      | I-84 Ramps 203, 204 over Trout Brook                          | 2020           | 002        | 51                 | 6225                | N    | N                | N            | 6       | 6                             | 96.7               | N                     |                                  |
| West Hartford | 01751      | I-84 EB over Trout Brook & Trout Brook Drive                  | 2018           | 005        | 315                | 20947               | 6    | 6                | 6            | N       | 6                             | 88.6               | N                     |                                  |
| West Hartford | 01752      | I-84 WB over SR 501 NB & I-84 TR 821                          | 2020           | 007        | 667                | 40354               | 5    | 5                | 6            | N       | 5                             | 75.5               | Y                     | 2002                             |
| West Hartford | 01756      | South Quaker Lane over I-84                                   | 2020           | 002        | 207                | 11115               | 5    | 5                | 6            | N       | 5                             | 73.1               | Y                     |                                  |
| West Hartford | 01757      | Oakwood Avenue #2 over I-84                                   | 2019           | 002        | 200                | 10740               | 7    | 7                | 6            | N       | 6                             | 94.6               | Y                     | 2013                             |
| West Hartford | 01758      | Prospect Avenue over I-84                                     | 2019           | 002        | 228                | 14250               | 7    | 7                | 7            | N       | 7                             | 75.8               | Y                     | 2015                             |
| Hartford      | 03368      | I-84 WB over New Park Avenue & AMTRAK                         | 2019           | 011        | 1043               | 57886               | 6    | 5                | 6            | N       | 5                             | 75.1               | Y                     | 1991                             |
| Hartford      | 03367      | I-84 EB over New Park Avenue, AMTRAK, SR 504                  | 2019           | 018        | 1852               | 102786              | 6    | 4                | 5            | N       | 4                             | 55.6               | N                     | 1991                             |
| Hartford      | 03371      | I-84 EB over Olive Street (Abandoned)                         | 2019           | 003        | 118                | 9381                | 6    | 5                | 6            | N       | 5                             | 79.6               | N                     |                                  |
| Hartford      | 06155A     | I-84, Amtrak, CTFastrak & Local over No. Branch of Park River | 2019           | 002        | 46                 | 191268              | N    | N                | N            | 6       | 6                             | 85.0               | N                     | 1976                             |
| Hartford      | 03372A     | I-84 EB over Hamilton Street                                  | 2019           | 003        | 121                | 9619                | 6    | 5                | 6            | N       | 5                             | 74.0               | N                     |                                  |
| Hartford      | 03372B     | I-84 WB over Hamilton Street                                  | 2019           | 003        | 121                | 9377                | 6    | 5                | 6            | N       | 5                             | 74.0               | N                     |                                  |
| Hartford      | 03399A     | I-84 WB over Park Street                                      | 2019           | 004        | 296                | 25130               | 6    | 5                | 6            | N       | 5                             | 78.9               | N                     |                                  |
| Hartford      | 03400A     | I-84 EB over Park Street                                      | 2019           | 003        | 226                | 20254               | 5    | 5                | 7            | N       | 5                             | 60.5               | N                     |                                  |
| Hartford      | 03400B     | I-84 EB over Parking Lot                                      | 2019           | 004        | 339                | 16136               | 6    | 6                | 6            | N       | 6                             | 69.5               | N                     |                                  |
| Hartford      | 03400D     | I-84 TR 823 over Parking Lot                                  | 2020           | 007        | 599                | 16473               | 4    | 5                | 5            | N       | 5                             | 79.1               | N                     |                                  |
| Hartford      | 03402A     | SR 503 WB over Amtrak & Capitol Avenue                        | 2019           | 006        | 500                | 27075               | 5    | 5                | 6            | N       | 5                             | 78.2               | Y                     |                                  |
| Hartford      | 03401A     | SR 503 EB over Parking Lot                                    | 2019           | 005        | 342                | 9405                | 5    | 6                | 6            | N       | 6                             | 94.0               | Y                     |                                  |

| City / Town   | Bridge No. | Feature Carried / Crossed                              | Year Inspected | # of Spans  | Bridge Length (ft) | Deck Area (sq. ft.) | Deck | Condition Rating |              |         | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |
|---------------|------------|--|----------------|-------------|--------------------|---------------------|------|------------------|--------------|---------|-------------------------------|--------------------|-----------------------|----------------------------------|
|               |            |  |                |             |                    |                     |      | Superstructure   | Substructure | Culvert |                               |                    |                       |                                  |
|               |            |  |                | <b>I-84</b> |                    |                     |      |                  |              |         |                               |                    |                       |                                  |
| Hartford      | 03401B     | SR 503 EB over I-84 & Amtrak & Local Roads             | 2019           | 016         | 1337               | 56281               | 5    | 5                | 5            | N       | 5                             | 74.6               | Y                     | 2011                             |
| Hartford      | 03402B     | SR 503 WB over Forest Street & Parking Lot             | 2019           | 010         | 756                | 20790               | 6    | 6                | 6            | N       | 6                             | 94.6               | Y                     | 1983                             |
| Hartford      | 03399C     | I-84 TR 824 over Capitol Ave & Amtrak                  | 2019           | 014         | 1187               | 54222               | 5    | 5                | 6            | N       | 5                             | 81.1               | Y                     |                                  |
| Hartford      | 03399D     | I-84 TR 824 over Parking Lot                           | 2019           | 006         | 458                | 12595               | 5    | 6                | 6            | N       | 6                             | 96.5               | N                     | 1983                             |
| Hartford      | 03400C     | I-84 TR 823 over I-84, 503, RR, Capitol Ave, Forest    | 2019           | 015         | 1430               | 62908               | 5    | 6                | 5            | N       | 5                             | 81.4               | Y                     |                                  |
| Hartford      | 03779      | Laurel Street over Amtrak, CNERR & CTFastrak           | 2019           | 002         | 59                 | 4611                | 7    | 8                | 7            | N       | 7                             | 73.1               | Y                     | 1994                             |
| Hartford      | 03023      | Sigourney Street over Capitol Ave & Amtrak             | 2019           | 011         | 654                | 70000               | 4    | 5                | 6            | N       | 5                             | 76.6               | N                     | 2007                             |
| Hartford      | 03160A     | I-84 EB over Amtrak; Local Roads; Parking              | 2019           | 003         | 3252               | 236132              | 6    | 4                | 4            | N       | 4                             | 27.1               | N                     | 2009                             |
| Hartford      | 03160B     | I-84 WB over Amtrak; Local Roads; Parking              | 2019           | 040         | 3177               | 209469              | 6    | 4                | 4            | N       | 4                             | 29.0               | N                     |                                  |
| Hartford      | 03160C     | I-84 Ramp 114 over Aetna Parking Lot                   | 2020           | 006         | 415                | 13860               | 6    | 6                | 5            | N       | 5                             | 81.1               | N                     |                                  |
| Hartford      | 06155B     | I-84 Ramps & Local Roads over Park River Conduit       | 2019           | 002         | 74                 | 528871              | N    | N                | N            | 6       | 6                             | 85.0               | N                     | 1976                             |
| Hartford      | 03160D     | I-84 Ramp 115 over Aetna Parking Lot                   | 2020           | 004         | 307                | 10910               | 6    | 5                | 5            | N       | 5                             | 86.0               | N                     |                                  |
| Hartford      | 04295      | I-84 EB On-Ramp 186 over I-84 WB Exit 48 On-Ramp       | 2019           | 003         | 290                | 9232                | 6    | 7                | 7            | N       | 7                             | 90.0               | Y                     |                                  |
| Hartford      | 03399B     | I-84 WB over Parking Lot                               | 2019           | 004         | 296                | 14060               | 6    | 6                | 6            | N       | 6                             | 73.2               | N                     |                                  |
| Hartford      | 05762      | I-84 Ramp 299 over I-84 Ramp I-91 & 06871T             | 2019           | 005         | 603                | 16824               | 7    | 7                | 6            | N       | 6                             | 92.4               | Y                     |                                  |
| Hartford      | 03629      | Broad Street over Amtrak RR & Busway                   | 2020           | 003         | 143                | 11297               | 7    | 7                | 7            | N       | 7                             | 92.4               | Y                     | 2013                             |
| Hartford      | 03302      | Broad Street over I-84 WB & I-84 Ramp 191              | 2020           | 001         | 128                | 10560               | 6    | 6                | 6            | N       | 6                             | 88.1               | Y                     |                                  |
| Hartford      | 03303      | I-84 Ramp 190 over Broad Street & Amtrak RR            | 2018           | 015         | 1131               | 39700               | 5    | 6                | 6            | N       | 6                             | 70.6               | Y                     | 1989                             |
| Hartford      | 03301      | I-84 EB over Broad Street, I-84 Ramp I-91              | 2018           | 015         | 974                | 46265               | 6    | 5                | 5            | N       | 5                             | 58.5               | N                     |                                  |
| Hartford      | 01764      | Asylum Street over I-84                                | 2020           | 001         | 85                 | 7692                | 7    | 6                | 6            | N       | 6                             | 82.1               | Y                     |                                  |
| Hartford      | 01765      | I-84 EB over Amtrak RR & Local Roads                   | 2020           | 010         | 1271               | 89605               | 5    | 6                | 6            | N       | 6                             | 65.6               | N                     | 1992                             |
| Hartford      | 01766      | I-84 WB over Amtrak RR & Local Roads                   | 2020           | 006         | 810                | 59670               | 5    | 6                | 7            | N       | 6                             | 77.6               | Y                     | 1992                             |
| Hartford      | 03991      | Edwards Street over Central New England Railroad       | 2019           | 001         | 66                 | 3979                | 7    | 7                | 7            | N       | 7                             | 93.6               | Y                     | 1995                             |
| Hartford      | 03781      | Walnut Street over Amtrak & Central NE RR              | 2020           | 001         | 126                | 8064                | 6    | 7                | 6            | N       | 6                             | 74.6               | Y                     | 1994                             |
| Hartford      | 05920      | High Street over I-84 & Ramps                          | 2020           | 002         | 180                | 12510               | 6    | 7                | 6            | N       | 6                             | 76.3               | Y                     |                                  |
| Hartford      | 06047      | Ann Uccello Street over I-84 & Ramps                   | 2019           | 002         | 206                | 19879               | 7    | 7                | 7            | N       | 7                             | 93.5               | N                     |                                  |
| Hartford      | 01763      | Trumbull Street over I-84, TR 839 & TR 841             | 2019           | 002         | 189                | 17483               | 6    | 5                | 6            | N       | 5                             | 58.2               | Y                     |                                  |
| Hartford      | 01426      | US RTE 44 & Main Street over I-84 & Morgan Street Ramp | 2019           | 002         | 205                | 22038               | 6    | 6                | 5            | N       | 5                             | 78.9               | Y                     | 1987                             |
| Hartford      | 01686B     | I-84 TR 825 over US RTE 44 EB & Columbus Boulevard     | 2018           | 008         | 524                | 13452               | 4    | 5                | 5            | N       | 5                             | 69.6               | N                     |                                  |
| Hartford      | 05925      | I-84/I-91 TR 841/858 over US RTE 44 & Market Street    | 2019           | 002         | 211                | 9242                | 7    | 6                | 6            | N       | 6                             | 92.0               | Y                     |                                  |
| Hartford      | 05868      | W-N Turning Rdwy over I-84/I-91 Ramps, CSO RR          | 2020           | 009         | 223                | 58402               | 7    | 7                | 6            | N       | 6                             | 91.4               | Y                     |                                  |
| Hartford      | 01686A     | I-84 over Market Street & I-91 NB                      | 2020           | 014         | 870                | 74420               | 5    | 5                | 6            | N       | 5                             | 63.4               | Y                     | 1992                             |
| Hartford      | 00980B     | I-84 TR 826 over Connecticut River                     | 2020           | 002         | 263                | 6970                | 6    | 6                | 6            | N       | 6                             | 88.4               | N                     | 2020                             |
| East Hartford | 01858      | I-84 EB over US RTE 44 EB                              | 2020           | 001         | 55                 | 3113                | 6    | 5                | 6            | N       | 5                             | 79.0               | N                     |                                  |
| East Hartford | 01859      | I-84 WB over US RTE 44 EB                              | 2020           | 001         | 59                 | 3983                | 6    | 6                | 6            | N       | 6                             | 89.9               | N                     | 2000                             |
| East Hartford | 02361      | I-84 EB & Ramp 196 over East River Drive               | 2020           | 001         | 68                 | 4454                | 7    | 6                | 7            | N       | 6                             | 85.6               | N                     |                                  |
| East Hartford | 02362      | I-84 WB & TR 827 over East River Drive                 | 2020           | 001         | 126                | 9967                | 7    | 7                | 6            | N       | 6                             | 89.8               | N                     | 1996                             |
| East Hartford | 02366      | Rte 2 WB & SR 500-806 over I-84 EB & TR 828            | 2020           | 001         | 115                | 6133                | 8    | 8                | 8            | N       | 8                             | 95.4               | Y                     | 2019                             |

| City / Town   | Bridge No. | Feature Carried / Crossed                           | Year Inspected | # of Spans  | Bridge Length (ft) | Deck Area (sq. ft.) | Deck | Condition Rating |              |         | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |
|---------------|------------|---|----------------|-------------|--------------------|---------------------|------|------------------|--------------|---------|-------------------------------|--------------------|-----------------------|----------------------------------|
|               |            |   |                |             |                    |                     |      | Superstructure   | Substructure | Culvert |                               |                    |                       |                                  |
|               |            |   |                | <b>I-84</b> |                    |                     |      |                  |              |         |                               |                    |                       |                                  |
| East Hartford | 02378      | I-84 830, SR 500-805 over I-84 EB & SR 500          | 2019           | 001         | 73                 | 4206                | 6    | 5                | 6            | N       | 5                             | 79.8               | Y                     |                                  |
| East Hartford | 02367      | I-84 TR 829 over I-84 EB & I-84 TR 828              | 2020           | 001         | 98                 | 6501                | 8    | 8                | 8            | N       | 8                             | 95.2               | N                     | 2019                             |
| East Hartford | 02368C     | I-84 WB TR 827 over I-84, SR 500 and Ramps          | 2019           | 010         | 1592               | 47362               | 7    | 6                | 7            | N       | 6                             | 79.7               | Y                     |                                  |
| East Hartford | 02373      | SR 500 TR 801&802 over Pitkin Street                | 2019           | 001         | 76                 | 4294                | 6    | 7                | 7            | N       | 7                             | 96.0               | N                     |                                  |
| East Hartford | 02375      | SR 500 TR 801 over I-84 EB and I-84 TR 833          | 2019           | 007         | 420                | 17997               | 8    | 8                | 7            | N       | 7                             | 95.5               | Y                     | 2017                             |
| East Hartford | 02376      | I-84 TR 831 over I-84 EB                            | 2019           | 003         | 164                | 5163                | 7    | 8                | 7            | N       | 7                             | 92.3               | Y                     | 2017                             |
| East Hartford | 02377      | SR 500 over I-84 WB and I-84 TR 10                  | 2019           | 003         | 146                | 10746               | 6    | 5                | 7            | N       | 5                             | 76.5               | Y                     |                                  |
| East Hartford | 02380      | SR 500 TR 803 over SR 500 & TR 801, I-84 TR 831     | 2019           | 004         | 461                | 14521               | 7    | 5                | 6            | N       | 5                             | 81.5               | Y                     | 1990                             |
| East Hartford | 00818      | I-84 over RTE 5 & I-84 Ramp 116                     | 2019           | 002         | 190                | 33193               | 5    | 6                | 6            | N       | 6                             | 82.5               | N                     | 2004                             |
| East Hartford | 02381      | I-84 over Hockanum River                            | 2020           | 003         | 64                 | 13890               | N    | N                | N            | 6       | 6                             | 70.0               | N                     |                                  |
| East Hartford | 05844B     | I-84 EB HOV Lane over Rte 15 & Silver Lane Off Ramp | 2018           | 012         | 1663               | 52947               | 7    | 6                | 6            | N       | 6                             | 91.0               | N                     |                                  |
| East Hartford | 05844C     | I-84 WB HOV Lane over Rte 15                        | 2018           | 015         | 2047               | 65094               | 7    | 6                | 6            | N       | 6                             | 96.0               | N                     |                                  |
| East Hartford | 05844D     | I-84 EB HOV & WB Ramp over I-84, Rte 15, Ramp A     | 2018           | 005         | 803                | 62540               | 6    | 5                | 6            | N       | 5                             | 78.0               | N                     |                                  |
| East Hartford | 05843      | SR 518 - Roberts Street over I-84 and Exit 58 Ramps | 2020           | 004         | 515                | 34917               | 6    | 6                | 7            | N       | 6                             | 93.5               | Y                     |                                  |
| East Hartford | 05555      | Simmons Road over I-84                              | 2020           | 002         | 291                | 20225               | 7    | 6                | 6            | N       | 6                             | 80.5               | Y                     |                                  |
| East Hartford | 05556      | Forbes Street over I-84                             | 2020           | 002         | 321                | 22310               | 6    | 6                | 7            | N       | 6                             | 93.6               | Y                     |                                  |
| East Hartford | 05685      | I-384 HOV over I-84 EB                              | 2020           | 003         | 577                | 38855               | 6    | 5                | 6            | N       | 5                             | 84.0               | N                     |                                  |
| East Hartford | 05686      | I-384 WB over I-84                                  | 2020           | 003         | 770                | 47586               | 6    | 6                | 6            | N       | 6                             | 91.9               | N                     |                                  |
| East Hartford | 05557      | I-384 HOV Ramps over I-84 TR 836                    | 2020           | 001         | 63                 | 32763               | N    | 6                | 7            | N       | 6                             | 83.0               | N                     |                                  |
| Manchester    | 05581      | I-84 TR 836 & Bikeway over Hockanum River & Bikeway | 2020           | 003         | 201                | 11397               | 7    | 6                | 7            | N       | 6                             | 90.8               | N                     |                                  |
| Manchester    | 05234      | I-84 Ramp 247 over Hockanum River                   | 2018           | 001         | 106                | 6943                | 8    | 8                | 8            | N       | 8                             | 96.8               | N                     |                                  |
| Manchester    | 05687      | US RTE 44 over I-84 Ramps, Rte I-384 Ramp           | 2019           | 004         | 819                | 57945               | 6    | 6                | 7            | N       | 6                             | 91.9               | N                     |                                  |
| Manchester    | 05845      | CD WB Roadway over I-84 Ramp J (Rte 44/I-84 WB)     | 2020           | 003         | 500                | 22900               | 6    | 5                | 7            | N       | 5                             | 83.5               | N                     |                                  |
| Manchester    | 06283      | I-84 and I-84 Ramp 305                              | 2020           | 002         | 606                | 26802               | 7    | 7                | 6            | N       | 6                             | 94.6               | N                     |                                  |
| Manchester    | 06279      | I-291 EB over I-84 TR 836, I-84 RMP 304             | 2019           | 002         | 255                | 9651                | 7    | 7                | 7            | N       | 7                             | 91.8               | N                     |                                  |
| Manchester    | 06282      | I-291 EB over I-84                                  | 2020           | 002         | 467                | 17690               | 7    | 7                | 7            | N       | 7                             | 95.7               | N                     |                                  |
| Manchester    | 05846      | I-291 EB over I-84 Ramp 306                         | 2020           | 003         | 375                | 17175               | 6    | 6                | 6            | N       | 6                             | 94.3               | N                     |                                  |
| Manchester    | 05688      | Tolland Turnpike over I-84 & Ramps                  | 2019           | 004         | 771                | 52813               | 7    | 6                | 6            | N       | 6                             | 78.0               | N                     |                                  |
| Manchester    | 05441      | I-84 WB over Buckland Street                        | 2019           | 001         | 151                | 14768               | 7    | 7                | 6            | N       | 6                             | 88.6               | N                     |                                  |
| Manchester    | 05442      | I-84 EB Off Ramp over Buckland Street               | 2019           | 001         | 150                | 13823               | 7    | 6                | 7            | N       | 6                             | 94.0               | N                     |                                  |
| Manchester    | 05440      | I-84 WB Off Ramp over Buckland Street               | 2019           | 001         | 150                | 6961                | 7    | 7                | 7            | N       | 7                             | 90.8               | N                     |                                  |
| Manchester    | 05443      | I-84 WB over Slater Street                          | 2019           | 001         | 140                | 12910               | 6    | 7                | 7            | N       | 7                             | 90.3               | N                     |                                  |
| Manchester    | 05444      | I-84 EB over Slater Street                          | 2019           | 001         | 141                | 12949               | 6    | 7                | 7            | N       | 7                             | 90.3               | N                     |                                  |
| Manchester    | 05226      | Route 30 over I-84 & I-84 Ramp 247                  | 2018           | 002         | 438                | 30003               | 7    | 6                | 6            | N       | 6                             | 64.0               | N                     |                                  |
| Manchester    | 05235      | I-84 Ramp 248 over Hockanum River                   | 2018           | 001         | 99                 | 2780                | 7    | 6                | 7            | N       | 6                             | 94.9               | N                     |                                  |



**Table 3-12: I-91 Priority Bridge List Conditions Ratings and Overall Evaluation**

| City / Town  | Bridge No. | Feature Carried / Crossed                           | Year Inspected | # of Spans | Bridge Length (ft) | Deck Area (sq. ft.) | Deck | Condition Rating |              |         | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |
|--------------|------------|---|----------------|------------|--------------------|---------------------|------|------------------|--------------|---------|-------------------------------|--------------------|-----------------------|----------------------------------|
|              |            |   |                |            |                    |                     |      | Superstructure   | Substructure | Culvert |                               |                    |                       |                                  |
| <b>I-91</b>  |            |   |                |            |                    |                     |      |                  |              |         |                               |                    |                       |                                  |
| Middletown   | 03077      | I-91 NB over Mattabasset River                      | 2020           | 003        | 222                | 12325               | 7    | 5                | 7            | N       | 5                             | 79.7               | N                     | 1998                             |
| Middletown   | 03078      | I-91 SB over Mattabasset River                      | 2020           | 003        | 220                | 12214               | 6    | 6                | 6            | N       | 6                             | 88.8               | N                     | 1998                             |
| Cromwell     | 03079      | I-91 SB over Route 372                              | 2019           | 001        | 85                 | 5567                | 6    | 6                | 6            | N       | 6                             | 85.2               | Y                     |                                  |
| Cromwell     | 03080      | I-91 NB over Route 372                              | 2019           | 001        | 84                 | 5535                | 6    | 6                | 6            | N       | 6                             | 85.2               | Y                     |                                  |
| Cromwell     | 03081      | I-91 NB over North Road                             | 2020           | 011        | 130                | 57886               | 5    | 7                | 7            | N       | 7                             | 88.0               | N                     | 1991                             |
| Cromwell     | 03082      | I-91 SB over North Road                             | 2019           | 003        | 65                 | 8117                | 5    | 6                | 6            | N       | 6                             | 89.0               | N                     | 1986                             |
| Cromwell     | 03146      | I-91 SB over Evergreen Road                         | 2020           | 003        | 127                | 7078                | 6    | 6                | 6            | N       | 6                             | 90.1               | N                     |                                  |
| Cromwell     | 03145      | I-91 NB over Evergreen Road                         | 2020           | 003        | 121                | 6716                | 5    | 6                | 6            | N       | 6                             | 89.0               | N                     |                                  |
| Cromwell     | 05807      | I-91 NB TR 818 over I-91 NB                         | 2020           | 001        | 175                | 6276                | 6    | 7                | 7            | N       | 7                             | 97.1               | N                     |                                  |
| Cromwell     | 03148      | I-91 SB over Route 9 SB & I-91 TR 818               | 2018           | 003        | 237                | 159647              | 6    | 6                | 6            | N       | 6                             | 89.8               | N                     |                                  |
| Cromwell     | 03152      | Route 9 SB over I-91 NB TR 818                      | 2018           | 003        | 158                | 8714                | 7    | 6                | 7            | N       | 6                             | 93.6               | N                     |                                  |
| Cromwell     | 03150      | I-91 SB over Route 9 NB                             | 2019           | 003        | 165                | 9172                | 6    | 6                | 7            | N       | 6                             | 89.5               | N                     | 1996                             |
| Cromwell     | 03156      | Route 9 NB & I-91 TR 821 over I-91 NB & I-91 TR 823 | 2018           | 003        | 305                | 14488               | 6    | 5                | 6            | N       | 5                             | 67.4               | N                     |                                  |
| Rocky Hill   | 03161      | Route 3 over I-91 & Dividend Brook                  | 2019           | 003        | 460                | 27907               | 6    | 6                | 7            | N       | 6                             | 79.4               | N                     | 1990                             |
| Rocky Hill   | 03162      | SSR 411 (West Street) over I-91 & NB Ramp           | 2019           | 005        | 369                | 27195               | 6    | 6                | 6            | N       | 6                             | 93.2               | N                     | 1990                             |
| Rocky Hill   | 03163      | Route 160 over I-91 SB                              | 2020           | 001        | 140                | 5645                | 7    | 8                | 7            | N       | 7                             | 97.1               | N                     |                                  |
| Rocky Hill   | 03164      | Route 160 over I-91 NB                              | 2020           | 001        | 140                | 5645                | 7    | 8                | 7            | N       | 7                             | 96.1               | N                     |                                  |
| Rocky Hill   | 03031      | Gilbert Avenue over I-91                            | 2020           | 005        | 556                | 21962               | 5    | 6                | 7            | N       | 6                             | 91.0               | N                     | 1994                             |
| Rocky Hill   | 03025      | Orchard Stret over I-91                             | 2019           | 002        | 361                | 14259               | 6    | 5                | 6            | N       | 5                             | 79.2               | Y                     | 1992                             |
| Rocky Hill   | 01449      | I-91 SB over Route 99                               | 2019           | 003        | 217                | 17078               | 6    | 5                | 7            | N       | 5                             | 74.1               | N                     | 2000                             |
| Rocky Hill   | 01448      | I-91 NB over Route 99                               | 2019           | 003        | 200                | 15758               | 6    | 5                | 6            | N       | 5                             | 75.0               | N                     | 2000                             |
| Wethersfield | 01455      | I-91 over Beaver Brook                              | 2017           | 002        | 25                 | 6875                | N    | N                | N            | 6       | 6                             | 70.0               | N                     |                                  |
| Wethersfield | 01450      | I-91 over Goff Brook                                | 2019           | 002        | 25                 | 7420                | N    | N                | N            | 6       | 6                             | 70.0               | N                     |                                  |
| Wethersfield | 01451      | I-91 NB over Providence & Worcester Railroad        | 2019           | 003        | 134                | 9247                | 6    | 5                | 5            | N       | 5                             | 74.4               | Y                     |                                  |
| Wethersfield | 01452      | I-91 SB over Providence & Worcester Railroad        | 2019           | 003        | 136                | 9382                | 6    | 5                | 5            | N       | 5                             | 74.4               | Y                     |                                  |
| Wethersfield | 01453      | i-91 NB over Middletown Avenue                      | 2019           | 003        | 202                | 13877               | 6    | 6                | 6            | N       | 6                             | 89.0               | N                     |                                  |
| Wethersfield | 01454      | I-91 SB over Middletown Avenue                      | 2019           | 003        | 192                | 13207               | 6    | 5                | 6            | N       | 5                             | 79.0               | N                     |                                  |
| Wethersfield | 01457      | I-91 SB over Elm Street                             | 2020           | 003        | 103                | 7004                | 5    | 6                | 6            | N       | 6                             | 78.8               | N                     |                                  |
| Wethersfield | 01456      | I-91 NB over Elm Street                             | 2020           | 003        | 113                | 7806                | 5    | 5                | 5            | N       | 5                             | 67.7               | Y                     |                                  |
| Wethersfield | 06288      | Route 3 NB over I-91 TR 802                         | 2018           | 001        | 170                | 7445                | 7    | 7                | 6            | N       | 6                             | 96.6               | N                     |                                  |
| Wethersfield | 06289      | Route 3 NB over I-91                                | 2019           | 002        | 423                | 30386               | 6    | 6                | 6            | N       | 6                             | 89.0               | N                     |                                  |
| Wethersfield | 06290      | Route 3 SB over I-91 & TR 804                       | 2019           | 003        | 650                | 28492               | 7    | 7                | 6            | N       | 6                             | 92.2               | N                     |                                  |
| Wethersfield | 01459      | I-91 over Great Meadow Road                         | 2019           | 003        | 106                | 13320               | 5    | 5                | 6            | N       | 5                             | 83.0               | N                     | 1995                             |
| Wethersfield | 01460      | I-91 over Wethersfield Cove                         | 2018           | 003        | 338                | 39134               | 5    | 5                | 6            | N       | 5                             | 72.0               | N                     | 1997                             |
| Hartford     | 00813      | I-91 over US RTE 5 and RTE 15                       | 2019           | 004        | 87                 | 38745               | 5    | 5                | 5            | N       | 5                             | 67.0               | Y                     |                                  |
| Hartford     | 01466      | I-91 over I-91 TR 827                               | 2020           | 003        | 174                | 20445               | 6    | 6                | 5            | N       | 5                             | 68.0               | Y                     |                                  |
| Hartford     | 06654      | I-91 & SR 530 over Drainage                         | 2020           | 003        | 23                 | 12420               | N    | N                | N            | 6       | 6                             | 70.0               | N                     |                                  |
| Hartford     | 00480      | I-91 over SR 530 (Airport Road)                     | 2020           | 001        | 109                | 13771               | 6    | 6                | 6            | N       | 6                             | 79.0               | Y                     | 1995                             |

| City / Town | Bridge No. | Feature Carried / Crossed                              | Year Inspected | # of Spans | Bridge Length (ft) | Deck Area (sq. ft.) | Condition Rating |                |              | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |      |
|-------------|------------|--|----------------|------------|--------------------|---------------------|------------------|----------------|--------------|-------------------------------|--------------------|-----------------------|----------------------------------|------|
|             |            |  |                |            |                    |                     | Deck             | Superstructure | Substructure |                               |                    |                       |                                  |      |
| <b>I-91</b> |            |  |                |            |                    |                     |                  |                |              |                               |                    |                       |                                  |      |
| Hartford    | 00481      | SR 530-Airport Road over RTE 15                        | 2019           | 003        | 182                | 13923               | 6                | 6              | 6            | N                             | 6                  | 89.3                  | Y                                |      |
| Hartford    | 05922      | I-91 NB over US 5, RTE 15 & I-91 TR 861                | 2019           | 002        | 483                | 28889               | 6                | 7              | 6            | N                             | 6                  | 91.2                  | N                                |      |
| Hartford    | 06117      | I-91 NB over MDC Sewer Pipe                            | 2020           | 002        | 220                | 19580               | 7                | 7              | 7            | N                             | 7                  | 82.0                  | N                                |      |
| Hartford    | 06000A     | Route 15 NB over I-91 NB, RTE 2, Connecticut River, RR | 2019           | 015        | 3372               | 256719              | 7                | 7              | 6            | N                             | 6                  | 91.5                  | Y                                |      |
| Hartford    | 06000B     | Route 15 SB over I-91 NB, RTE 2, Connecticut River, RR | 2019           | 015        | 3372               | 250091              | 6                | 7              | 6            | N                             | 6                  | 89.9                  | Y                                |      |
| Hartford    | 06116      | I-91 NB over CSRR                                      | 2019           | 001        | 242                | 20328               | 7                | 7              | 6            | N                             | 6                  | 89.8                  | N                                |      |
| Hartford    | 03621      | I-91 SB & I-91 TR 835 over CSRR                        | 2019           | 001        | 65                 | 5935                | N                | 6              | 6            | N                             | 6                  | 59.0                  | Y                                |      |
| Hartford    | 03277      | I-91 over CSRR   | 2019           | 001        | 78                 | 8790                | N                | 6              | 6            | N                             | 6                  | 81.0                  | Y                                |      |
| Hartford    | 03622      | I-91 SB & TR 835 over CSRR                             | 2019           | 018        | 150                | 9922                | 6                | 5              | 5            | N                             | 5                  | 48.3                  | Y                                | 1998 |
| Hartford    | 01469A     | I-91 NB over Park River & CSRR                         | 2019           | 002        | 1350               | 64125               | 5                | 5              | 5            | N                             | 5                  | 71.0                  | Y                                | 2018 |
| Hartford    | 01469B     | I-91 SB over CSRR, SR 598WB & TR803                    | 2019           | 006        | 1800               | 111575              | 4                | 5              | 5            | N                             | 5                  | 54.7                  | N                                | 2011 |
| Hartford    | 00371A     | RTE 2 over I-91 & Connecticut River, CSRR              | 2019           | 006        | 1175               | 127418              | 6                | 6              | 6            | N                             | 6                  | 87.7                  | Y                                | 1999 |
| Hartford    | 01428D     | I-91 NB, US RTE 44 EB, RR, Connecticut River           | 2018           | 005        | 408                | 12924               | 6                | 5              | 5            | N                             | 5                  | 66.7                  | Y                                | 1990 |
| Hartford    | 01428B     | I-91 TR 839 over I-91 - 153, I-84 - 825, US RTE 44 EB  | 2020           | 011        | 769                | 21147               | 7                | 5              | 7            | N                             | 5                  | 79.9                  | Y                                | 1991 |
| Hartford    | 01686E     | I-91 RP 153 over Parking Area                          | 2021           | 004        | 289                | 10806               | 6                | 6              | 6            | N                             | 6                  | 75.1                  | Y                                | 1991 |
| Hartford    | 06049      | US Route 44 EB over I-91 NB, I-91 COL, SW Roadway      | 2019           | 002        | 132                | 5082                | 6                | 6              | 7            | N                             | 6                  | 87.8                  | Y                                |      |
| Hartford    | 06048      | US Route 44 WB over I-91 NB, C-D Roadway & Ramp        | 2019           | 002        | 154                | 5364                | 7                | 6              | 6            | N                             | 6                  | 87.8                  | Y                                |      |
| Hartford    | 01428A     | I-91 SB over Ramp D & F, I-84, US RTE 44               | 2019           | 013        | 951                | 40988               | 6                | 6              | 6            | N                             | 6                  | 83.1                  | Y                                | 1991 |
| Hartford    | 05921      | I-91 TR 841 over Ramp 186                              | 2019           | 001        | 106                | 3583                | 7                | 7              | 7            | N                             | 7                  | 95.0                  | N                                |      |
| Hartford    | 01687      | I-91 & TR 841 over CSRR                                | 2019           | 001        | 40                 | 25506               | 7                | 6              | 6            | N                             | 6                  | 80.0                  | Y                                | 1990 |
| Hartford    | 05863      | I-91 NB over CSRR                                      | 2021           | 003        | 201                | 14625               | 7                | 7              | 6            | N                             | 6                  | 85.4                  | N                                |      |
| Hartford    | 05862      | I-91 SB over CSRR                                      | 2019           | 003        | 201                | 14628               | 6                | 7              | 6            | N                             | 6                  | 90.8                  | N                                |      |
| Hartford    | 05994      | I-91 SB over Leibert Road                              | 2020           | 001        | 140                | 10045               | 6                | 6              | 7            | N                             | 6                  | 85.9                  | N                                |      |
| Hartford    | 05864      | I-91 NB over Leibert Road                              | 2020           | 001        | 137                | 11465               | 6                | 5              | 6            | N                             | 5                  | 72.9                  | N                                |      |
| Hartford    | 05865      | Jennings Road over I-91                                | 2018           | 002        | 284                | 26862               | 6                | 6              | 7            | N                             | 6                  | 98.9                  | N                                |      |
| Hartford    | 05995      | I-91 SB over Weston Street                             | 2019           | 001        | 87                 | 8918                | 7                | 7              | 7            | N                             | 7                  | 86.8                  | N                                |      |
| Hartford    | 05866      | I-91 NB over Weston Street                             | 2019           | 001        | 87                 | 7801                | 7                | 7              | 7            | N                             | 7                  | 98.0                  | N                                |      |
| Hartford    | 06151      | I-91 SB On Ramp over Amtrak Railroad                   | 2019           | 003        | 150                | 4170                | 7                | 7              | 7            | N                             | 7                  | 96.3                  | N                                |      |
| Hartford    | 05924      | I-91 NB over AMTRAK Railroad                           | 2019           | 003        | 156                | 14451               | 6                | 7              | 6            | N                             | 6                  | 86.7                  | N                                |      |
| Windsor     | 05881B     | I-91 SB over RTE 159                                   | 2020           | 001        | 163                | 12977               | 7                | 7              | 7            | N                             | 7                  | 98.0                  | N                                |      |
| Windsor     | 05881A     | I-91 NB over RTE 159                                   | 2020           | 001        | 164                | 13067               | 7                | 7              | 7            | N                             | 7                  | 90.3                  | N                                |      |
| Hartford    | 06040B     | I-91 NB over Keney Park Road & Meadow Brook            | 2019           | 002        | 222                | 20275               | 7                | 7              | 7            | N                             | 7                  | 90.5                  | N                                |      |
| Hartford    | 06040A     | I-91 SB over Keney Park Road & Meadow Brook            | 2019           | 002        | 222                | 19000               | 7                | 7              | 7            | N                             | 7                  | 90.5                  | N                                |      |
| Windsor     | 05980      | Bina Avenue or I-91 & HOV Lanes                        | 2020           | 002        | 214                | 10058               | 7                | 7              | 7            | N                             | 7                  | 87.9                  | Y                                |      |
| Windsor     | 06218      | I-91 SB Ramp 204 over I-91 SB TR 855                   | 2020           | 001        | 176                | 4906                | 7                | 7              | 7            | N                             | 7                  | 96.3                  | N                                |      |
| Windsor     | 06224      | I-91 TR 860 over Briarwood Drive                       | 2020           | 001        | 113                | 3864                | 7                | 7              | 7            | N                             | 7                  | 96.9                  | N                                |      |
| Windsor     | 06219      | I-91 TR 854 & 855 over I-291 Ramp 001                  | 2020           | 001        | 127                | 10683               | 7                | 7              | 7            | N                             | 7                  | 93.4                  | N                                |      |
| Windsor     | 06223      | Route 218 over I-91 NB                                 | 2020           | 001        | 135                | 10058               | 6                | 6              | 7            | N                             | 6                  | 79.9                  | N                                |      |
| Windsor     | 05977A     | I-91 SB over Rood Avenue                               | 2019           | 001        | 107                | 8517                | 6                | 7              | 7            | N                             | 7                  | 86.3                  | N                                |      |
| Windsor     | 05977B     | I-91 NB over Rood Avenue                               | 2019           | 001        | 107                | 9780                | 6                | 7              | 7            | N                             | 7                  | 88.8                  | N                                |      |
| Windsor     | 05976B     | I-91 NB over RTE 178 (Park Avenue)                     | 2019           | 001        | 126                | 10004               | 7                | 7              | 7            | N                             | 7                  | 97.0                  | N                                |      |
| Windsor     | 05976A     | I-91 SB over RTE 178 (Park Avenue)                     | 2019           | 001        | 126                | 10004               | 7                | 7              | 7            | N                             | 7                  | 98.0                  | N                                |      |

| City / Town   | Bridge No. | Feature Carried / Crossed                    | Year Inspected | # of Spans | Bridge Length (ft) | Deck Area (sq. ft.) | Condition Rating |                |              | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |
|---------------|------------|--|----------------|------------|--------------------|---------------------|------------------|----------------|--------------|-------------------------------|--------------------|-----------------------|----------------------------------|
|               |            |  |                |            |                    |                     | Deck             | Superstructure | Substructure |                               |                    |                       |                                  |
| <b>I-91</b>   |            |  |                |            |                    |                     |                  |                |              |                               |                    |                       |                                  |
| Windsor       | 05979B     | I-91 SB over Capen Street                    | 2021           | 001        | 98                 | 9286                | 7                | 7              | 7            | N                             | 7                  | 89.9                  | N                                |
| Windsor       | 05979A     | I-91 NB over Capen Street                    | 2019           | 001        | 98                 | 8428                | 6                | 7              | 7            | N                             | 7                  | 85.0                  | N                                |
| Windsor       | 06045      | RTE 305 over I-91 NB                         | 2018           | 001        | 107                | 11074               | 7                | 7              | 7            | N                             | 7                  | 85.8                  | Y                                |
| Windsor       | 06044      | RTE 305 over I-91 SB                         | 2018           | 001        | 106                | 11013               | 7                | 7              | 7            | N                             | 7                  | 74.2                  | Y                                |
| Windsor       | 01264      | I-91 over Mill Brook                         | 2020           | 002        | 21                 | 4046                | N                | N              | N            | 7                             | 7                  | 70.0                  | N                                |
| Windsor       | 05898      | Pigeon Hill Road over I-91                   | 2018           | 002        | 212                | 8204                | 7                | 6              | 7            | N                             | 6                  | 77.0                  | Y                                |
| Windsor       | 05883      | Day Hill Road WB over RTE 75                 | 2019           | 001        | 133                | 5293                | 7                | 7              | 7            | N                             | 7                  | 94.4                  | Y                                |
| Windsor       | 06086      | I-91 SB over RTE 75 (Poquonock Avenue)       | 2020           | 001        | 186                | 14625               | 7                | 7              | 7            | N                             | 7                  | 92.0                  | N                                |
| Windsor       | 06036      | I-91 NB over Route 75 (Poquonock Avenue)     | 2020           | 001        | 186                | 17261               | 7                | 7              | 7            | N                             | 7                  | 92.0                  | N                                |
| Windsor       | 01266B     | I-91 NB over Farmington River                | 2019           | 005        | 504                | 36204               | 7                | 7              | 6            | N                             | 6                  | 91.0                  | N                                |
| Windsor       | 01266A     | I-91 SB over Farmington River                | 2019           | 005        | 504                | 36204               | 6                | 7              | 6            | N                             | 6                  | 91.0                  | N                                |
| Windsor       | 06089      | Kennedy Road over I-91                       | 2018           | 002        | 203                | 15065               | 6                | 6              | 6            | N                             | 6                  | 81.2                  | N                                |
| Windsor       | 06090B     | I-91 NB over Hayden Station Road             | 2020           | 001        | 117                | 13400               | 7                | 7              | 7            | N                             | 7                  | 98.0                  | N                                |
| Windsor       | 06090A     | I-91 SB over Hayden Station Road             | 2020           | 001        | 117                | 11209               | 7                | 7              | 7            | N                             | 7                  | 97.0                  | N                                |
| Windsor       | 06091      | Route 20 Westbound over I-91                 | 2019           | 005        | 602                | 29980               | 7                | 7              | 6            | N                             | 6                  | 92.5                  | N                                |
| Windsor       | 06093      | I-91 NB over RTE 20 Eastbound                | 2020           | 001        | 147                | 8825                | 7                | 6              | 6            | N                             | 6                  | 85.0                  | N                                |
| Windsor Locks | 06094      | South Center Street over I-91                | 2020           | 002        | 289                | 16631               | 7                | 6              | 6            | N                             | 6                  | 98.5                  | N                                |
| Windsor Locks | 00454      | I-91 over Connecticut River, AMTRAK, RTE 159 | 2019           | 008        | 1698               | 239207              | 6                | 5              | 6            | N                             | 5                  | 70.0                  | Y                                |
| East Windsor  | 06006      | I-91 SB over SR 510 (Main Street)            | 2019           | 003        | 143                | 10146               | 7                | 6              | 6            | N                             | 6                  | 89.2                  | N                                |
| East Windsor  | 06007      | I-91 NB over SR 510 (Main Street)            | 2019           | 003        | 143                | 10135               | 6                | 6              | 6            | N                             | 6                  | 90.3                  | N                                |
| East Windsor  | 05975      | I-91 RAMPS 101 & 103 over I-91               | 2019           | 002        | 246                | 13505               | 7                | 6              | 7            | N                             | 6                  | 94.8                  | N                                |
| East Windsor  | 05617      | I-91 over RTE 140                            | 2020           | 003        | 139                | 16495               | 5                | 5              | 5            | N                             | 5                  | 81.0                  | Y                                |
| Enfield       | 01274      | PLEASANT ROAD over INTERSTATE-91             | 2019           | 004        | 212                | 9065                | 6                | 5              | 6            | N                             | 5                  | 77.0                  | Y                                |
| Enfield       | 01275      | SR 510 DEPOT HILL over INTERSTATE-91         | 2019           | 004        | 186                | 9430                | 6                | 5              | 6            | N                             | 5                  | 81.5                  | Y                                |
| Enfield       | 00443      | US ROUTE 5-KING ST over INTERSTATE-91        | 2019           | 004        | 252                | 14490               | 7                | 5              | 6            | N                             | 5                  | 80.6                  | Y                                |

**Table 3-13: Route 2 Priority Bridge List Conditions Ratings and Overall Evaluation**

| City / Town    | Bridge No. | Feature Carried / Crossed                    | Year Inspected | # of Spans | Bridge Length (ft) | Deck Area (sq. ft.) | Condition Rating |                |              | Overall Structural Evaluation | Sufficiency Rating | Functionally Obsolete | Planned or Recent Rehabilitation |      |
|----------------|------------|--|----------------|------------|--------------------|---------------------|------------------|----------------|--------------|-------------------------------|--------------------|-----------------------|----------------------------------|------|
|                |            |  |                |            |                    |                     | Deck             | Superstructure | Substructure |                               |                    |                       |                                  |      |
| <b>Route 2</b> |            |  |                |            |                    |                     |                  |                |              |                               |                    |                       |                                  |      |
| East Hartford  | 00372      | RTE 2 over East River Drive                  | 2019           | 001        | 96                 | 9965                | 6                | 7              | 6            | N                             | 6                  | 83.6                  | Y                                | 1997 |
| East Hartford  | 02364      | RTE 2 EB over Darlin Street                  | 2019           | 001        | 57                 | 1807                | 5                | 7              | 7            | N                             | 7                  | 96.5                  | N                                |      |
| East Hartford  | 02370      | RTE 2 Eastbound over Pitkin Street           | 2019           | 001        | 65                 | 2874                | 7                | 7              | 7            | N                             | 7                  | 91.5                  | N                                |      |
| East Hartford  | 02372      | RTE 2 Westbound over Pitkin Street           | 2019           | 001        | 60                 | 3120                | 5                | 7              | 7            | N                             | 7                  | 90.4                  | N                                |      |
| East Hartford  | 06109      | RTE 2 Westbound over East River Drive        | 2019           | 001        | 159                | 11416               | 6                | 6              | 6            | N                             | 6                  | 94.8                  | N                                |      |
| East Hartford  | 06110      | RTE 2 Eastbound over East River Drive        | 2019           | 001        | 150                | 10770               | 6                | 6              | 6            | N                             | 6                  | 93.7                  | N                                |      |
| East Hartford  | 00374      | RTE 2 over Hockanum River                    | 2019           | 005        | 444                | 51534               | 6                | 5              | 5            | N                             | 5                  | 72.6                  | N                                | 1996 |
| East Hartford  | 06050      | US RTE 5 TR 804 over Route 2 Westbound       | 2020           | 001        | 143                | 5155                | 7                | 7              | 6            | N                             | 6                  | 97.8                  | N                                |      |
| East Hartford  | 00377      | RTE 2 over SR 516 - Willow Street Ext.       | 2020           | 001        | 69                 | 6534                | 5                | 6              | 7            | N                             | 6                  | 86.3                  | Y                                |      |
| East Hartford  | 00378A     | RTE 2 WB over Ensign Street                  | 2020           | 001        | 58                 | 2769                | 7                | 7              | 7            | N                             | 7                  | 90.7                  | Y                                | 1994 |
| East Hartford  | 00378B     | RTE 2 EB over Ensign Street                  | 2020           | 001        | 58                 | 2769                | 7                | 7              | 7            | N                             | 7                  | 93.2                  | N                                | 1993 |
| East Hartford  | 00379      | RTE 2 over SR 517 SB                         | 2020           | 001        | 78                 | 7230                | 7                | 7              | 6            | N                             | 6                  | 92.2                  | N                                | 1993 |
| East Hartford  | 00380      | RTE 2 over Main Street                       | 2019           | 001        | 99                 | 9900                | 7                | 6              | 7            | N                             | 6                  | 91.5                  | N                                | 1987 |
| East Hartford  | 00381      | RTE 2 over Sutton Avenue                     | 2019           | 001        | 57                 | 5078                | 5                | 6              | 7            | N                             | 5                  | 74.1                  | N                                |      |
| East Hartford  | 00382      | RTE 2 over Maple Street                      | 2019           | 001        | 77                 | 6969                | 5                | 6              | 6            | N                             | 6                  | 90.2                  | N                                |      |
| Glastonbury    | 05561      | Glastonbury RTE 3 over Route 2 & Ramp 080 EB | 2019           | 002        | 278                | 18292               | 7                | 7              | 6            | N                             | 6                  | 96.0                  | N                                |      |
| Glastonbury    | 05562      | RTE 3 TR 801 over Route 2 Ramp 080           | 2020           | 001        | 58                 | 1844                | 7                | 7              | 7            | N                             | 7                  | 94.9                  | N                                |      |
| Glastonbury    | 00384      | RTE 2 over Griswold Street                   | 2019           | 001        | 52                 | 4740                | 7                | 7              | 7            | N                             | 7                  | 86.1                  | N                                | 1988 |
| Glastonbury    | 00385      | RTE 2 over Salmon Brook                      | 2019           | 002        | 33                 | 9240                | N                | N              | N            | 6                             | 6                  | 72.9                  | N                                |      |
| Glastonbury    | 00386      | RTE 2 & RT 17 SB over House Street           | 2019           | 001        | 73                 | 11964               | 6                | 6              | 6            | N                             | 6                  | 89.3                  | N                                | 1986 |
| Glastonbury    | 01696      | RTE 2 EB over RTE 17                         | 2020           | 004        | 278                | 12093               | 6                | 5              | 7            | N                             | 5                  | 84.5                  | N                                |      |
| Glastonbury    | 01698      | RTE 2 WB over RTE 94                         | 2019           | 001        | 96                 | 4176                | 7                | 6              | 6            | N                             | 6                  | 91.9                  | Y                                |      |
| Glastonbury    | 01697      | RTE 2 EB over RTE 94                         | 2019           | 001        | 113                | 4915                | 7                | 5              | 6            | N                             | 5                  | 80.4                  | Y                                |      |
| Glastonbury    | 01699      | Oak Street over RTE 2                        | 2019           | 004        | 269                | 14459               | 6                | 5              | 6            | N                             | 5                  | 64.0                  | Y                                |      |

The overall results of each corridor can be summarized as follows:

**I-84 Corridor**

Total Bridges Studied – 111  
Functionally Obsolete – 42 Total (38%)

**Overall Structural Evaluation**

4 (poor) – 2% of bridges  
5 (fair) – 31% of bridges  
6 (satisfactory) – 49% of bridges  
7 (good) – 15% of bridges  
8 (very good) – 3% of bridges

**I-91 Corridor**

Total Bridges Studied – 105  
Functionally Obsolete – 39 Total (32%)

**Overall Structural Evaluation**

4 (poor) – 0% of bridges  
5 (fair) -23% of bridges  
6 (satisfactory) – 47% of bridges  
7 (good) – 30% of bridges  
8 (very good) – 0% of bridges

**Route 2 Corridor**

Total Bridges Studied – 24  
Functionally Obsolete – 8 Total (25%)

**Overall Structural Evaluation**

4 (Poor) – 0% of bridges  
5 (fair) – 21%  
6 (satisfactory) – 50%  
7 (good) – 29%  
8 (very good) – 0%

### 3.7 Existing Conditions Highway Assessment – Key Takeaways

- ❖ Although there were several locations with stopping sight distance deficiencies, the impact to mobility is likely minimal unless they can be attributed to a higher than average crash rate, which causes non-recurring delay.
- ❖ Many locations, such as Eastbound Route 2 sections, show a direct correlation between higher crash rates and geometric deficiencies.
- ❖ The section of I-84 between Interchange 41 (South Main Street) and the Bulkeley Bridge has extremely complex geometry, including several compound curves, ‘broken-back’ curves, and reverse curves with short tangents. The interchange frequency and inconsistent configurations make this section of I-84 the most challenging stretch of highway within the study area for motorists to traverse. Combining these two deficiencies with the highest vehicular volumes in the State leads to higher than average crash rates and vehicular delay.
- ❖ The deficient horizontal curve on I-91 southbound just north of the Charter Oak Bridge (U.S Route 5) is likely the cause of higher than average crash rates and should be studied for potential solutions.
- ❖ All of the original bridges remaining along the priority corridors are now 50 to 60 years old and have outlived their original design life of 50-years. Many of these structures have been rehabilitated more than once and will require additional rehabilitation to maintain a “state of good repair”, as defined by a condition rating of 5 (fair) or better.
- ❖ For the bridges studied in the priority corridors 26% of them have an overall condition rating of 5 (fair), 48% have a rating of 6 (satisfactory) and 23% have a rating of 7 (good). The higher condition rated bridges are generally the structures that were replaced during latter highway modification projects.
- ❖ 37% of the bridges are noted as functionally obsolete. They essentially don’t comply with the latest geometric and safety standards.

## 4 Bus Transit

### 4.1 Mobility

#### 4.1.1 Purpose

The purpose of this analysis is to review CTtransit route data with population and employment data to determine areas of high transit need. Maintaining connectivity between population centers and employment centers is critical to providing mobility in the region. Insight into key origins and destinations for commuters can inform planning decisions leading to a more effective transit system serving greater demand.

#### 4.1.2 Data Sources

General transit feed specification (GTFS) data was provided by CTtransit Hartford Division. This dataset includes information on the agency, routes, trips, stop times, stops, date, and day of the week (to determine service patterns).

*GTFS is a common format for public transportation schedules and combines the schedule with geographic information about the transportation network.*

Demographic data was collected from the US Census Bureau American Community Survey for population and employment data, using the 2019 5-year estimates. Employment data was downloaded from the 2018 Longitudinal Employer-Household Dynamics Origin-

Destination Employment Statistics data set. CROCOG's Comprehensive Service Analysis project's data was used to identify neighborhoods that were shown to exhibit high transit potential and/or high transit need.

#### 4.1.3 Methodology

The demographic and employment data were reviewed and assessed to determine areas of transit need and key employment hubs. The areas of need were based on four indicators associated with transit need:

- People below poverty line
- Zero car households
- Population above 65
- Population under 18

These indicators were used to calculate a Transit Dependency Index (TDI) using the following formula:

$$TDI = Population\ Density \times (\% \text{ housing units without a vehicle} + \% \text{ senior citizens} + \% \text{ children ages 18 and under} + \% \text{ individuals below poverty}).$$

The TDI was then mapped by census tract in ArcGIS to identify the top six areas for transit need to align with the six employment hubs.

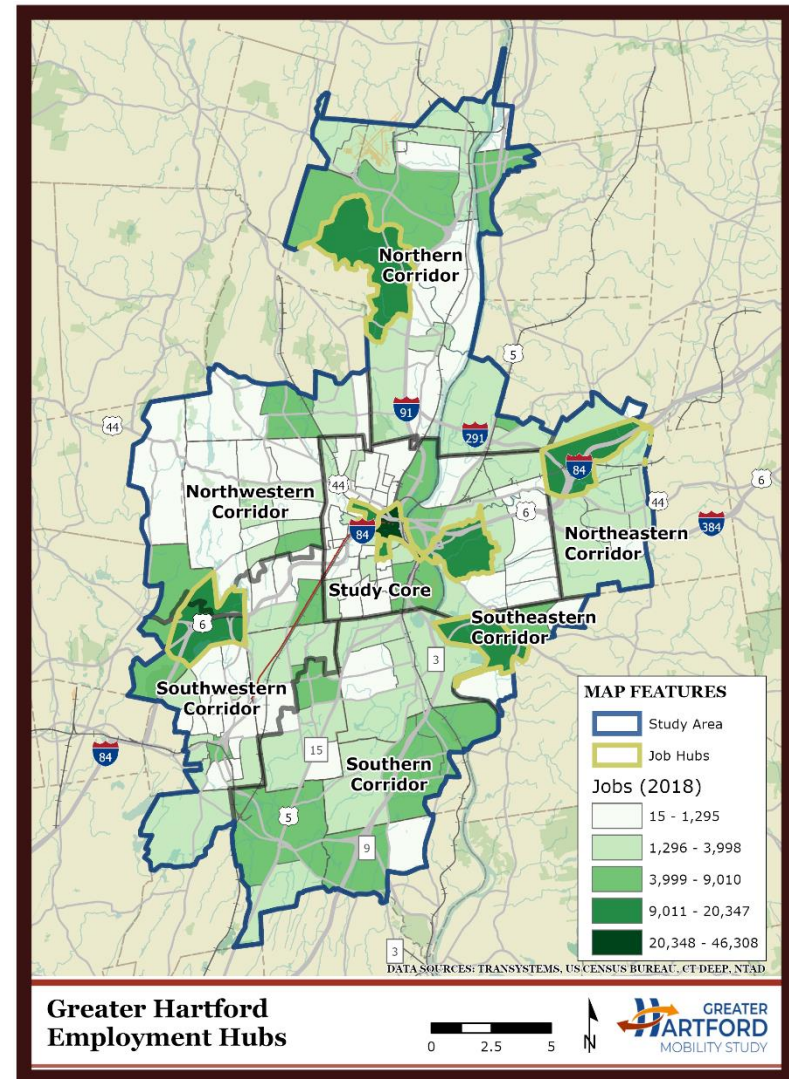
Employment data was aggregated from census block level data to census tracts. This data was also mapped using ArcGIS to identify the six key employment hubs.

The *CTtransit* Hartford Division bus GTFS data combined with population data was used to assess the number and locations of residents by ten-minute increments of transit travel time to key employment destinations in the region. Travel times were derived from GTFS data from weekdays at 8 a.m. (sampled on Monday, March 23, 2020). Using the same bus network with employment data, a review and assessment of the number and locations of jobs by ten-minute increments of travel from selected neighborhoods that were shown to exhibit high transit potential and/or high transit need in CRCOG’s Comprehensive Service Analysis project.

#### 4.1.4 Analysis

As shown in **Figure 4.1**, the employment analysis determined six employment hubs:

1. Downtown Hartford
2. East Hartford
3. Northwest Windsor
4. East Farmington
5. Northwest Manchester
6. Glastonbury



**Figure 4.1: Greater Hartford Employment Hubs**



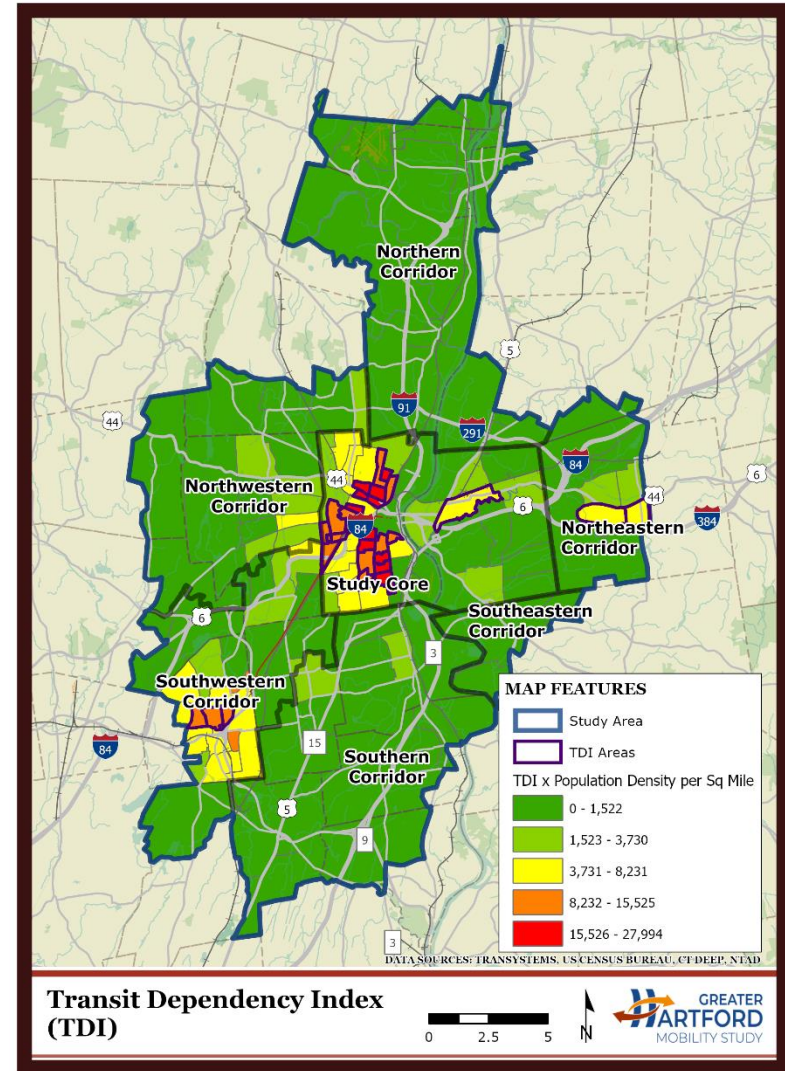
As shown in **Table 4-1**, Downtown Hartford is by far the biggest employment hub with 18% of the jobs in Greater Hartford. The second and third employment centers, Northwest Windsor and East Farmington, are much smaller at 4% each of the region’s jobs.

**Table 4-1: Greater Hartford Employment Hubs**

| Employment 2018 |                      |        |         |  |
|-----------------|----------------------|--------|---------|--|
| Hub             | Location             |        | Jobs    |  |
|                 | Districts            | Total  | Percent |  |
| 1               | Downtown Hartford    | 79,112 | 18%     |  |
| 2               | East Hartford        | 12,386 | 3%      |  |
| 3               | Northwest Windsor    | 16,809 | 4%      |  |
| 4               | East Farmington      | 16,419 | 4%      |  |
| 5               | Northwest Manchester | 10,797 | 2%      |  |
| 6               | Glastonbury          | 11,008 | 2%      |  |

Demographic analysis calculated the TDI (**Figure 4.2**), which determined six areas of transit need:

1. Hartford North
2. Hartford West
3. Hartford South
4. East Hartford
5. Central Manchester
6. Central New Britain



**Figure 4.2: Greater Hartford Transit Dependency Index and Areas of Transit Need**

As shown in **Table 4-2**, TDI area 3 has the largest population in need of transit followed by TDI area 2.

**Table 4-2: Transit Need Locations**

| Transit Dependency Index |                     |            |         |
|--------------------------|---------------------|------------|---------|
| Location                 |                     | Population |         |
| TDI                      | Districts           | Total      | Percent |
| 1                        | Hartford North      | 15,619     | 17%     |
| 2                        | Hartford West       | 19,368     | 20%     |
| 3                        | Hartford South      | 30,898     | 33%     |
| 4                        | East Hartford       | 6,556      | 7%      |
| 5                        | Central Manchester  | 9,732      | 10%     |
| 6                        | Central New Britain | 12,463     | 13%     |

Isochrone maps identified the population within 10-minute travel time increments (via bus or walking) of the six major employment hubs as shown in **Table 4-3**.

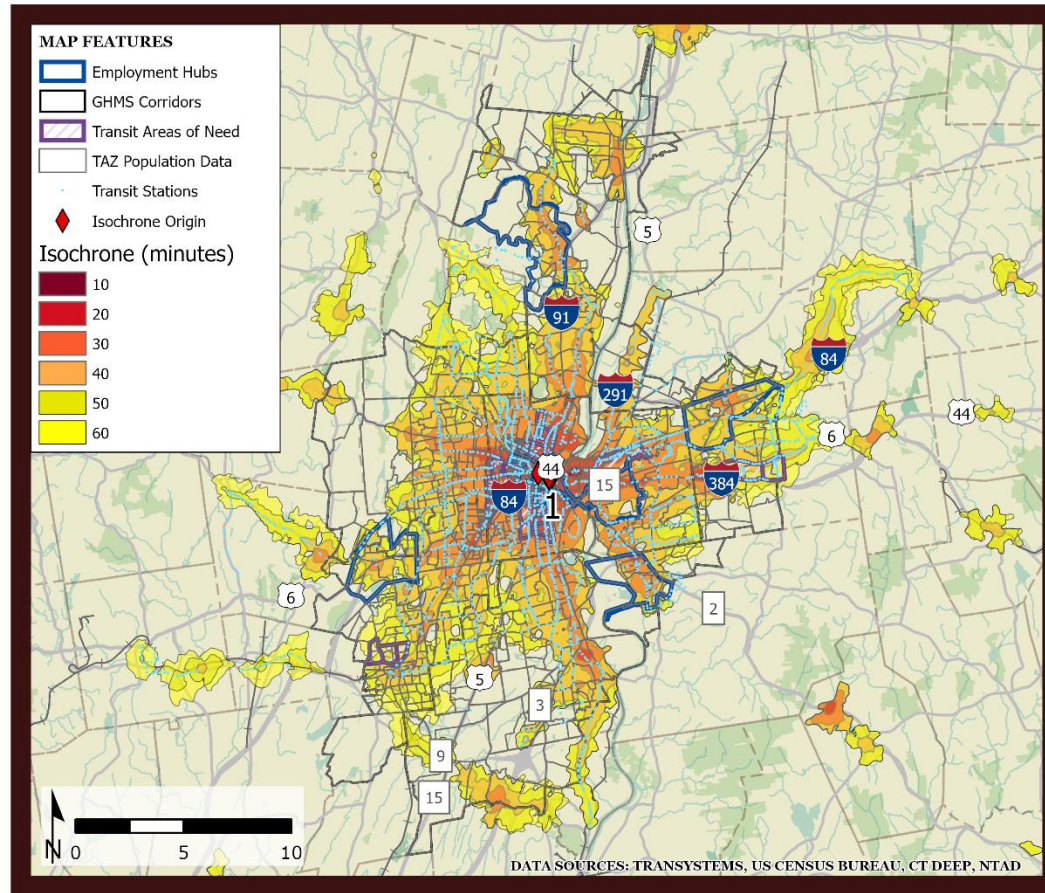
**Table 4-3: Population within 10-minute Increments Transit Travel Time of Employment Hubs**

| GHMS Isochrone Analysis: Employment HUBs to Population 2020 |                      |                       |         |         |         |         |         |
|---|----------------------|-----------------------|---------|---------|---------|---------|---------|
| Location  |                      | Travel Time (minutes) |         |         |         |         |         |
| Hub   | District             | 10                    | 20      | 30      | 40      | 50      | 60      |
| 1   | Downtown Hartford    | 3,083                 | 85,519  | 213,616 | 353,712 | 479,850 | 542,527 |
| 2   | East Hartford        | 2,815                 | 19,829  | 48,180  | 118,862 | 248,664 | 395,426 |
| 3   | Northwest Windsor    | 1,532                 | 9,236   | 37,806  | 105,736 | 116,580 | 121,330 |
| 4   | East Farmington      | 205                   | 8,351   | 48,387  | 110,407 | 116,872 | 116,917 |
| 5   | Northwest Manchester | 619                   | 16,317  | 39,512  | 75,569  | 117,477 | 196,533 |
| 6   | Glastonbury          | 1,356                 | 16,935  | 44,179  | 118,893 | 243,952 | 368,282 |
|   | All                  | 9,588                 | 136,067 | 296,698 | 432,261 | 514,411 | 555,083 |

*An isochrone map illustrates areas that can be reached from a common point within a defined range of time.*

**Figure 4.3** shows Employment Hub 1/Downtown Hartford's high potential for transit to serve areas in need with TDI areas 1, 2, 3, and 4 all within its 30-

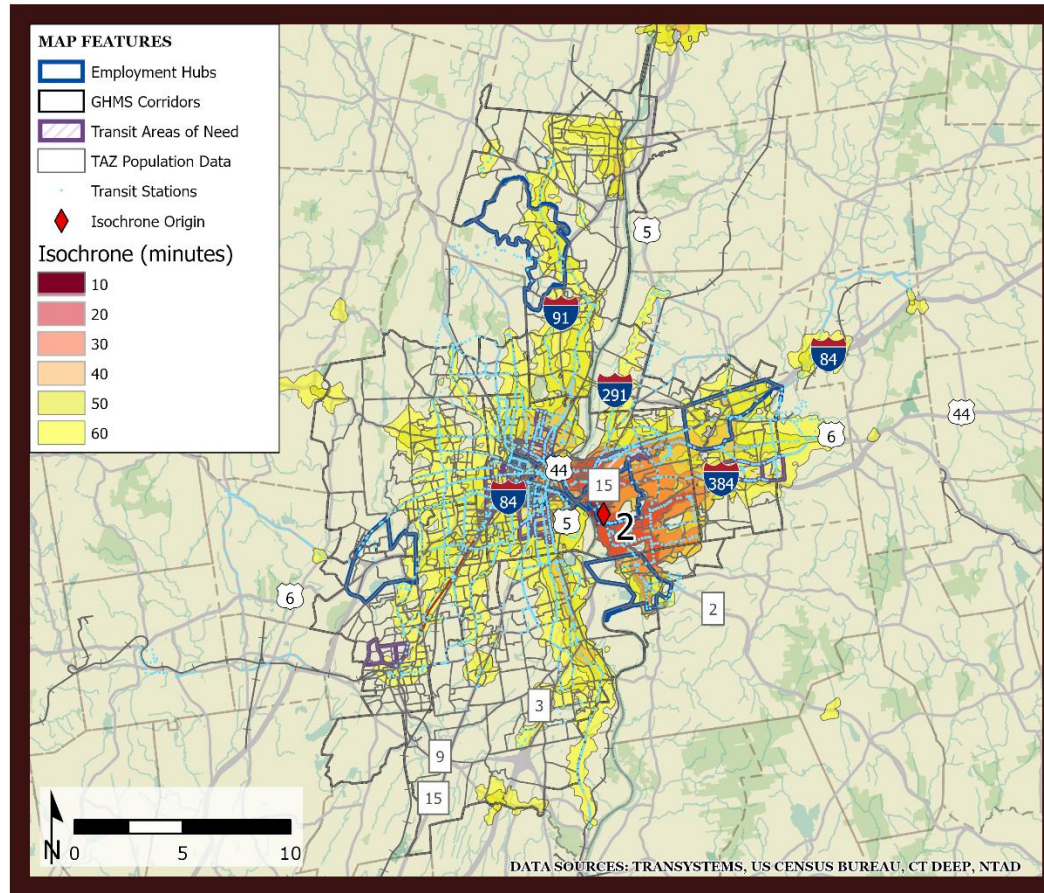
minute isochrone network. All six areas of transit need are within Downtown Hartford's 60-minute isochrone.



**Figure 4.3: Hub 1 Downtown Hartford Isochrone Map**

Employment Hub 2/East Hartford (**Figure 4.4**) shows a disconnect between transit need and employment with only TDI 4, East Hartford, covered within its 30-minute

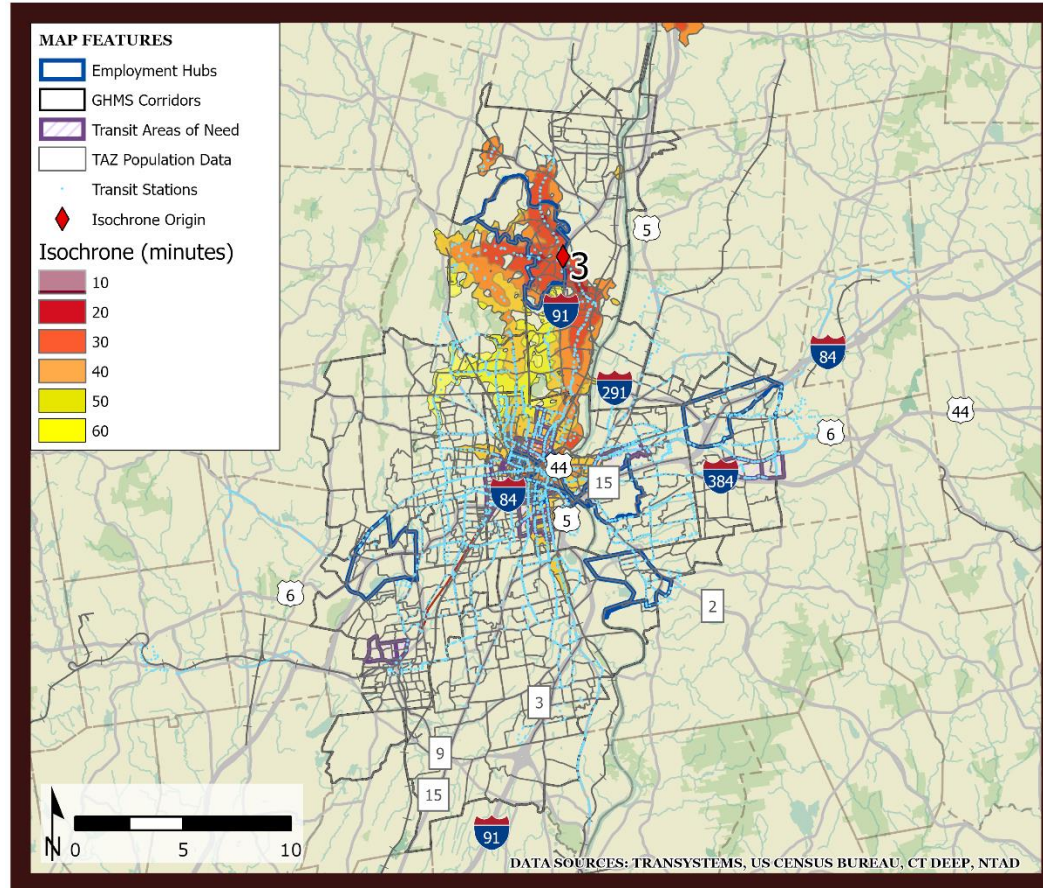
isochrone. Within its 60-minute isochrone all areas of transit need are covered except TDI 6, Central New Britain.



**Figure 4.4: Hub 2 East Hartford Isochrone Map**

Employment Hub 3/Northwest Windsor (**Figure 4.5**) is further disconnected between areas of transit need with only a portion of TDI 1, Hartford North, covered within its 30-minute isochrone. Within its 60-minute isochrone

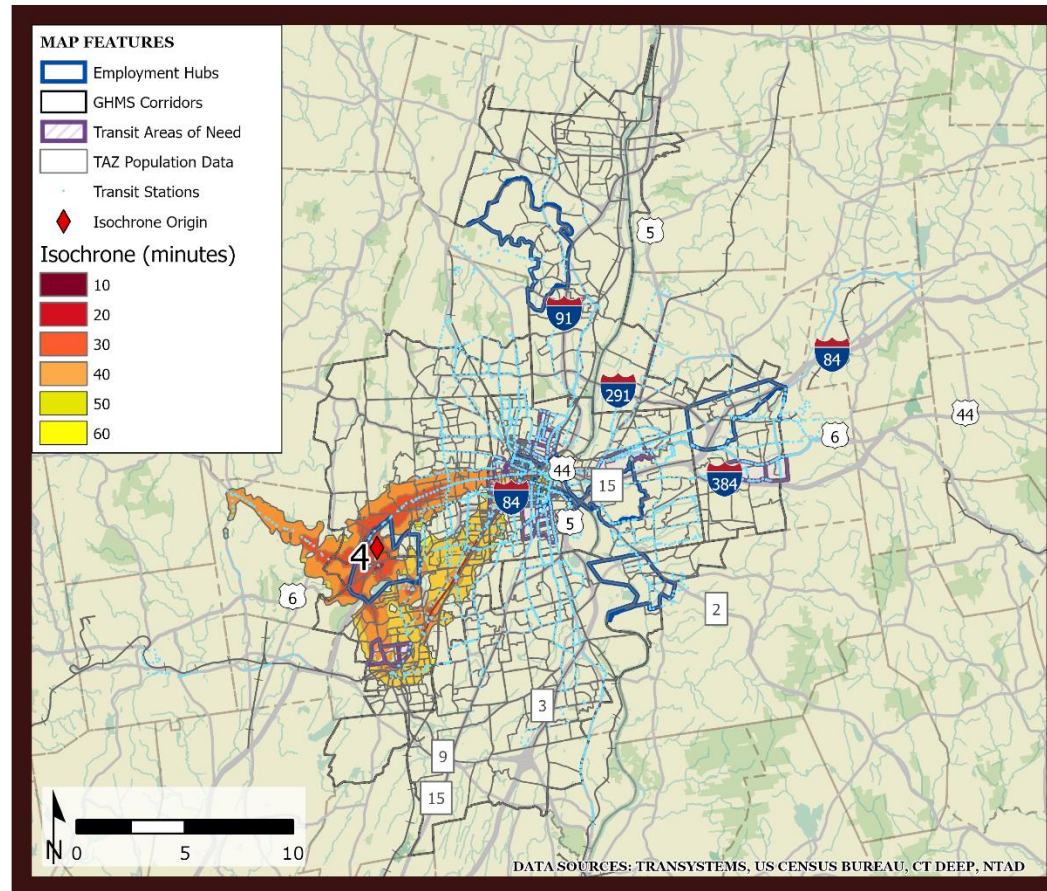
only TDI 1 is fully covered with TDI 2, 3, and 4 partially covered. TDI 5 (Manchester) and TDI 6 (New Britain) are completely outside of the 60-minute isochrone.



**Figure 4.5: Hub 3 Northwest Windsor Isochrone Map**

Employment Hub 4/East Farmington (**Figure 4.6**) is similarly isolated from areas of transit need with parts of TDI 6 (Central New Britain) and TDI 2 (West Hartford) within a 30-minute transit trip. No areas of transit need are completely covered within the Hub 4

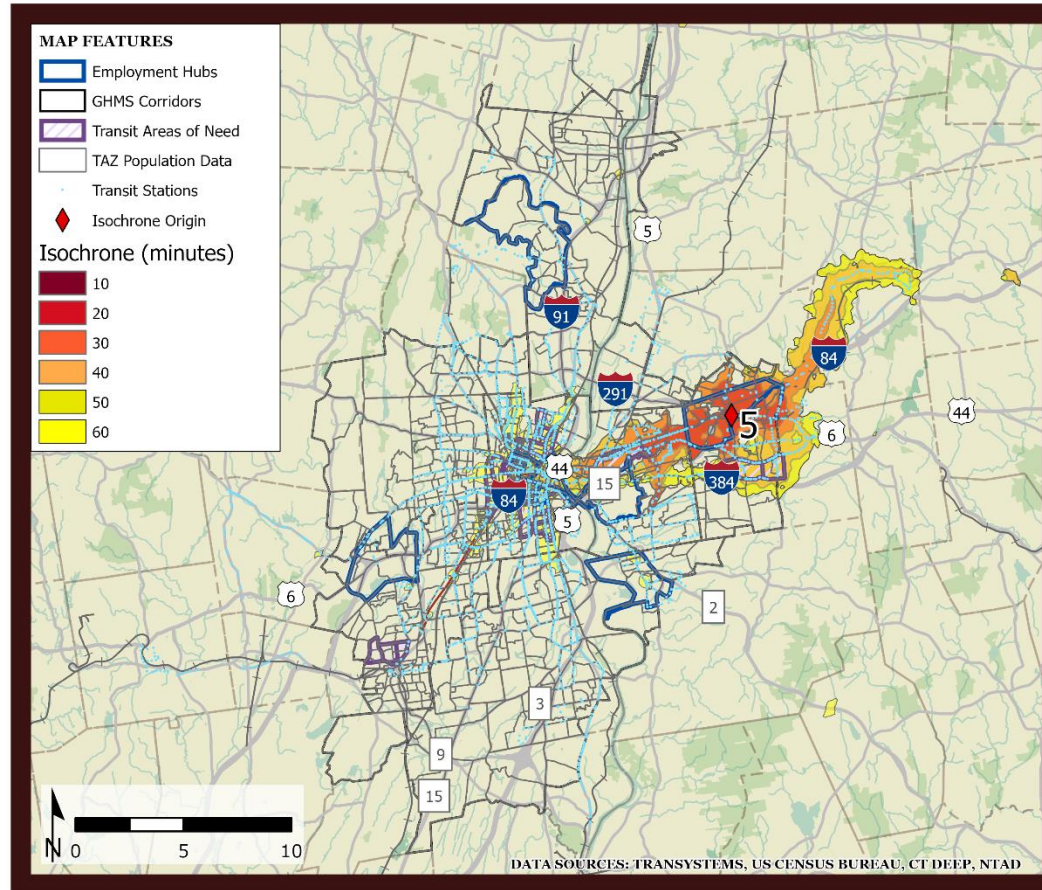
60-minute isochrone. Parts with TDI 2, 3, and 6 are covered within a one-hour transit trip. TDI 1 (Hartford North) and TDI 5 (Manchester) are completely outside of the 60-minute isochrone.



**Figure 4.6: Hub 4 East Farmington Isochrone Map**

Employment Hub 5/Northwest Manchester (**Figure 4.7**) shows most of TDI 4 (East Hartford) within a 30-minute transit trip. TDI 5 and TDI 2 are completely covered by the Hub 5 60-minute isochrone. Most of TDI

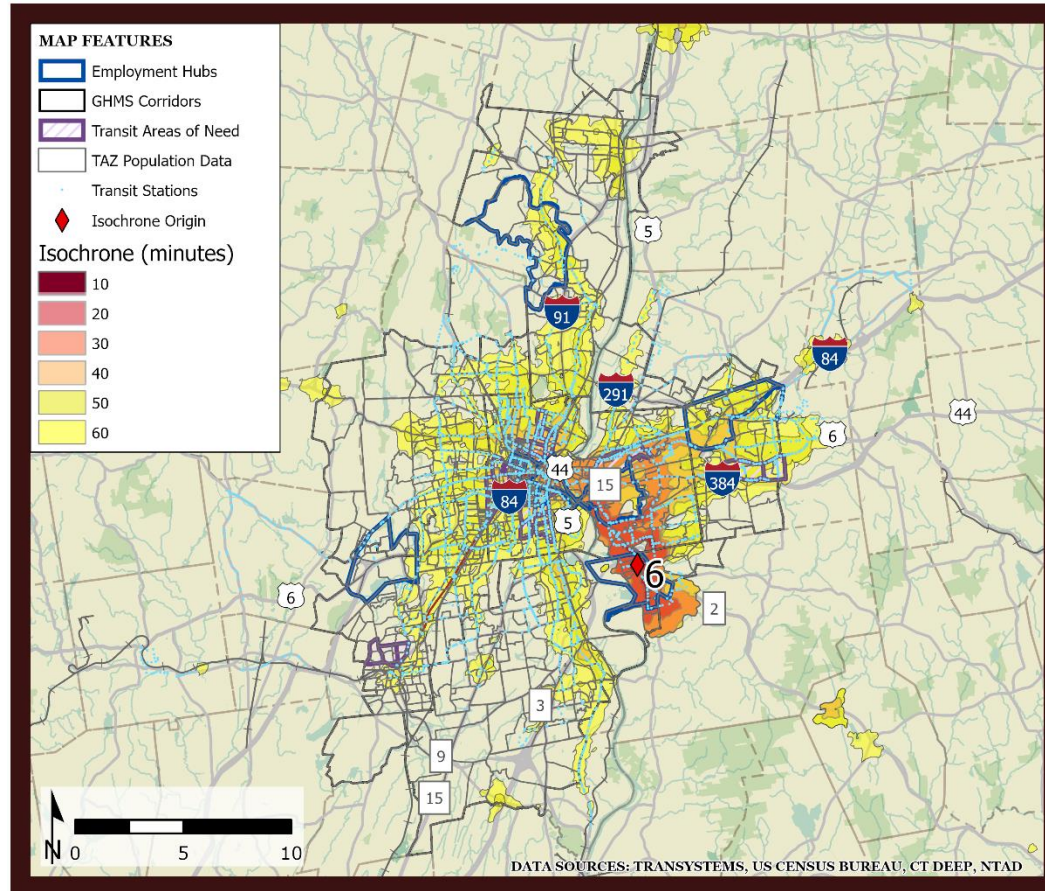
1 and TDI 3 are covered within a one-hour transit trip. TDI 6 (Central New Britain) is completely outside of the 60-minute isochrone.



**Figure 4.7: Hub 5 Northwest Manchester Isochrone Map**

The employment Hub 6/Glastonbury isochrone map (**Figure 4.8**) shows most of TDI 4 (East Hartford) and part of TDI 1 (Hartford North) within a 30-minute transit trip. TDI 2, TDI 3, and TDI 5 are completely covered by

the Hub 6 60-minute isochrone. TDI 6 (Central New Britain) is completely outside of the 60-minute isochrone.



**Figure 4.8: Hub 6 Glastonbury Isochrone Map**



A second set of isochrones maps identified employment within 10-minute travel time increments (via bus or walking) of the six TDI areas of transit need as shown in **Table 4-4**. While the areas of transit need have

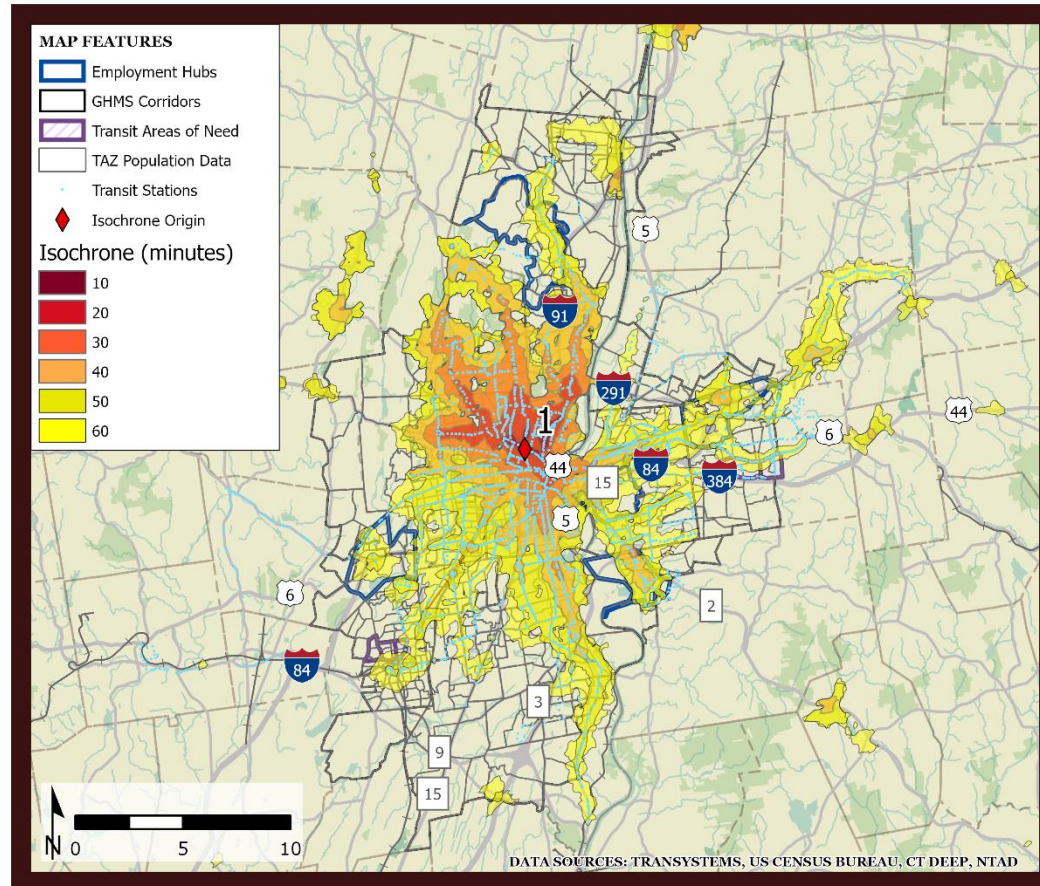
varying degrees of access to employment hubs, TDI 1 through TDI 4 serve a similar number of jobs within a 60-minute isochrone.

**Table 4-4: Employment within 10-minute Increments Transit Travel Time of Areas of Transit Need**

| GHMS Isochrone Analysis: Areas of Transit Need to Employment 2020 |                |                       |         |         |         |         |         |
|---|----------------|-----------------------|---------|---------|---------|---------|---------|
| Location  |                | Travel Time (minutes) |         |         |         |         |         |
| TDI Area  | District       | 10                    | 20      | 30      | 40      | 50      | 60      |
| 1   | Hartford North | 2,623                 | 58,257  | 115,119 | 170,184 | 229,424 | 304,184 |
| 2   | Hartford West  | 3,360                 | 65,279  | 118,334 | 166,526 | 233,130 | 303,505 |
| 3   | Hartford South | 1,531                 | 56,445  | 104,637 | 145,154 | 204,805 | 280,948 |
| 4   | East Hartford  | 1,677                 | 22,487  | 76,945  | 146,787 | 216,248 | 288,989 |
| 5   | Manchester     | 2,091                 | 10,302  | 24,937  | 44,554  | 94,010  | 116,698 |
| 6   | New Britain    | 991                   | 13,940  | 40,122  | 75,628  | 167,010 | 205,019 |
| ALL   |                | 12,274                | 150,445 | 231,678 | 285,768 | 332,286 | 384,553 |

The TDI Area 1/Hartford North isochrone map (**Figure 4.9**) shows only Hub 1/Downtown Hartford within the

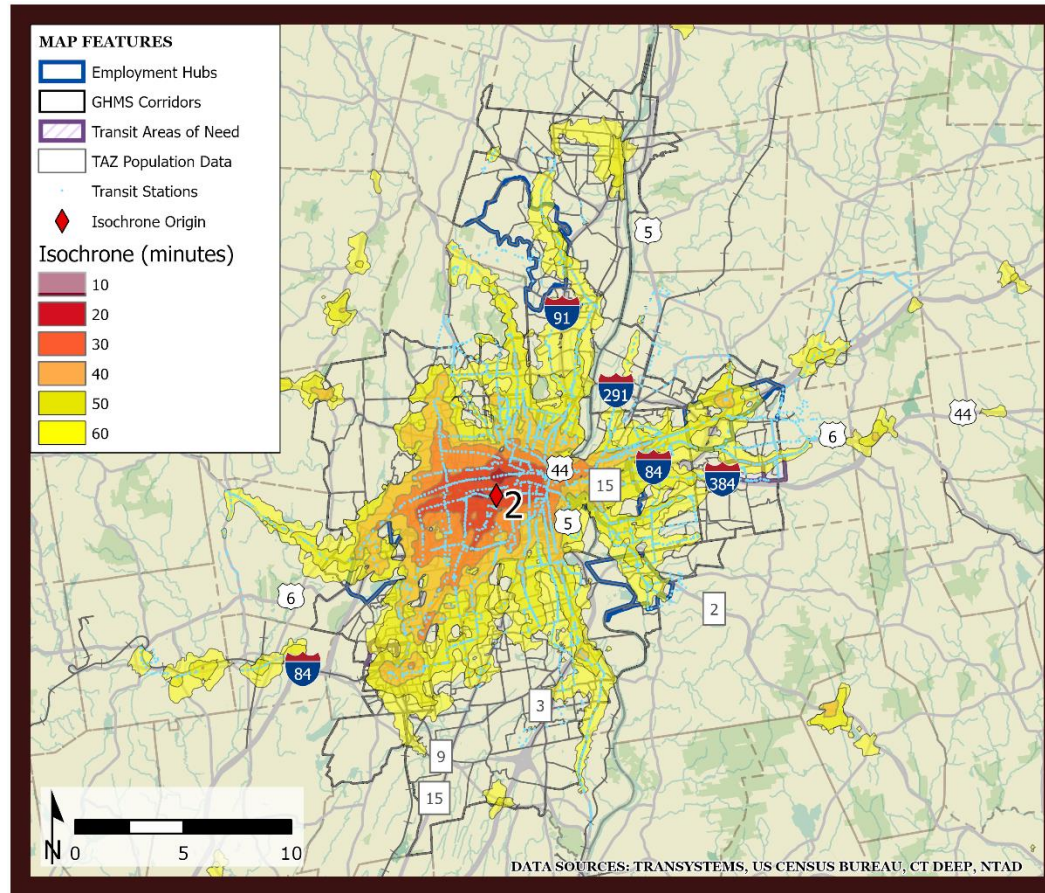
30-minute isochrone. All other employment hubs are partially within the 60-minute isochrone.



**Figure 4.9: TDI Area 1 Hartford North Isochrone Map**

The TDI Area 2/Hartford West isochrones map (**Figure 4.10**) also shows only Hub 1/Downtown Hartford within the 30-minute isochrone. All other employment hubs

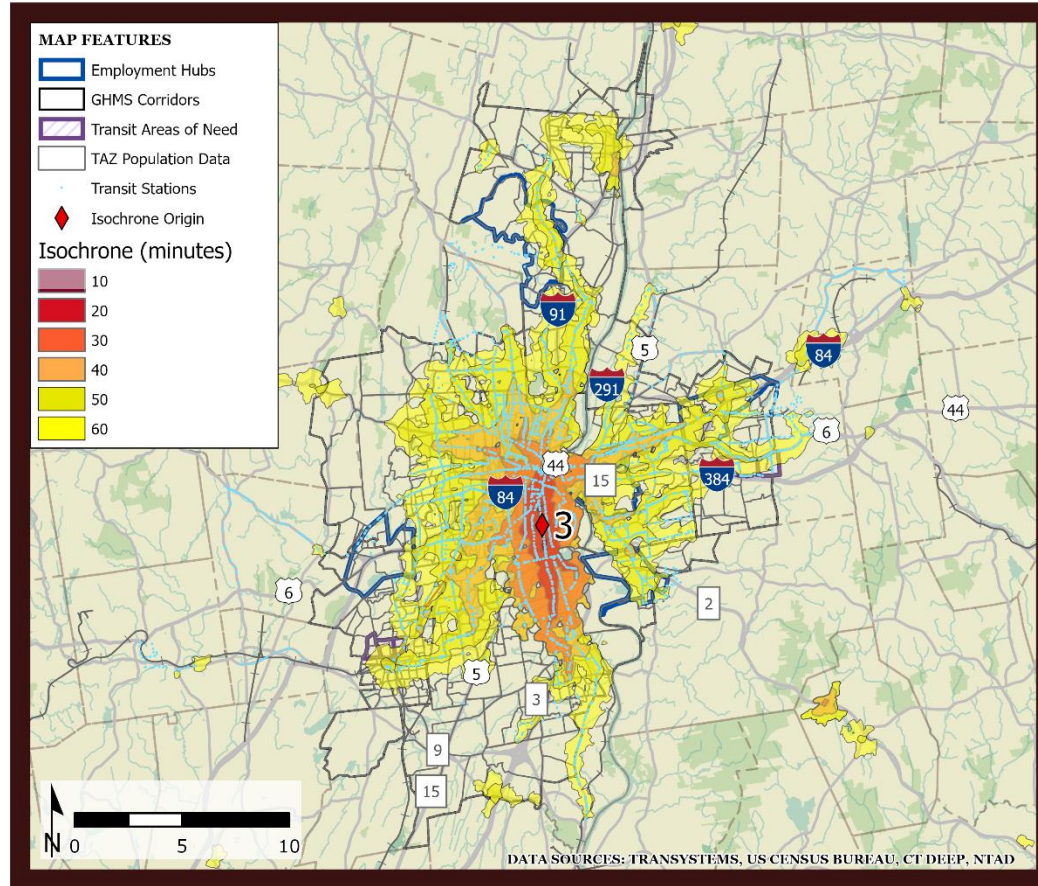
are partially within the 60-minute isochrone with most of Hub 4/East Farmington not covered by a one-hour commute.



**Figure 4.10: TDI Area 2 Hartford West Isochrone Map**

The TDI Area 3/Hartford South isochrones map (**Figure 4.11**) also shows only Hub 1/Downtown Hartford within the 30-minute isochrone. All other employment hubs

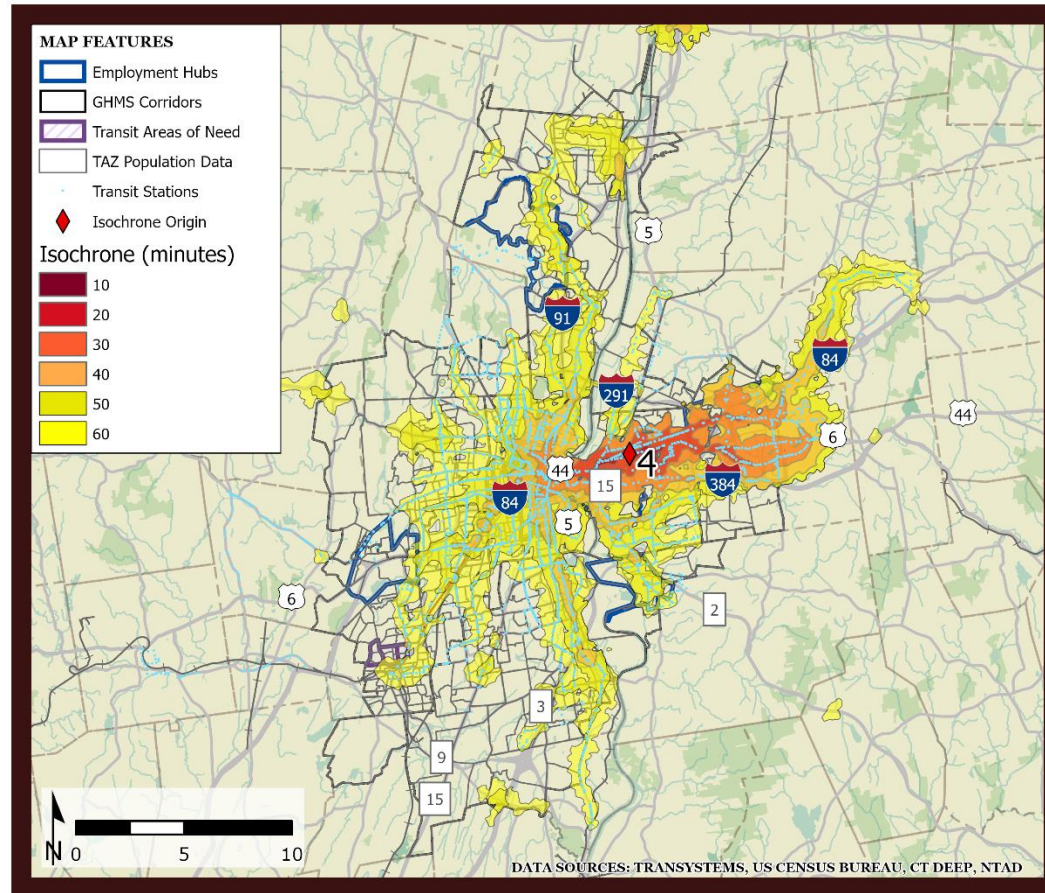
are partially within the 60-minute isochrone with most of Hub 4/East Farmington not covered by a one-hour commute.



**Figure 4.11: TDI Area 3 Hartford South Isochrone Map**

The TDI Area/East Hartford map (**Figure 4.12**) shows most of Hub 1/Downtown Hartford and Hub 5/Northwest Manchester as well as part of Hub 2/East Hartford within the 30-minute isochrone. The three

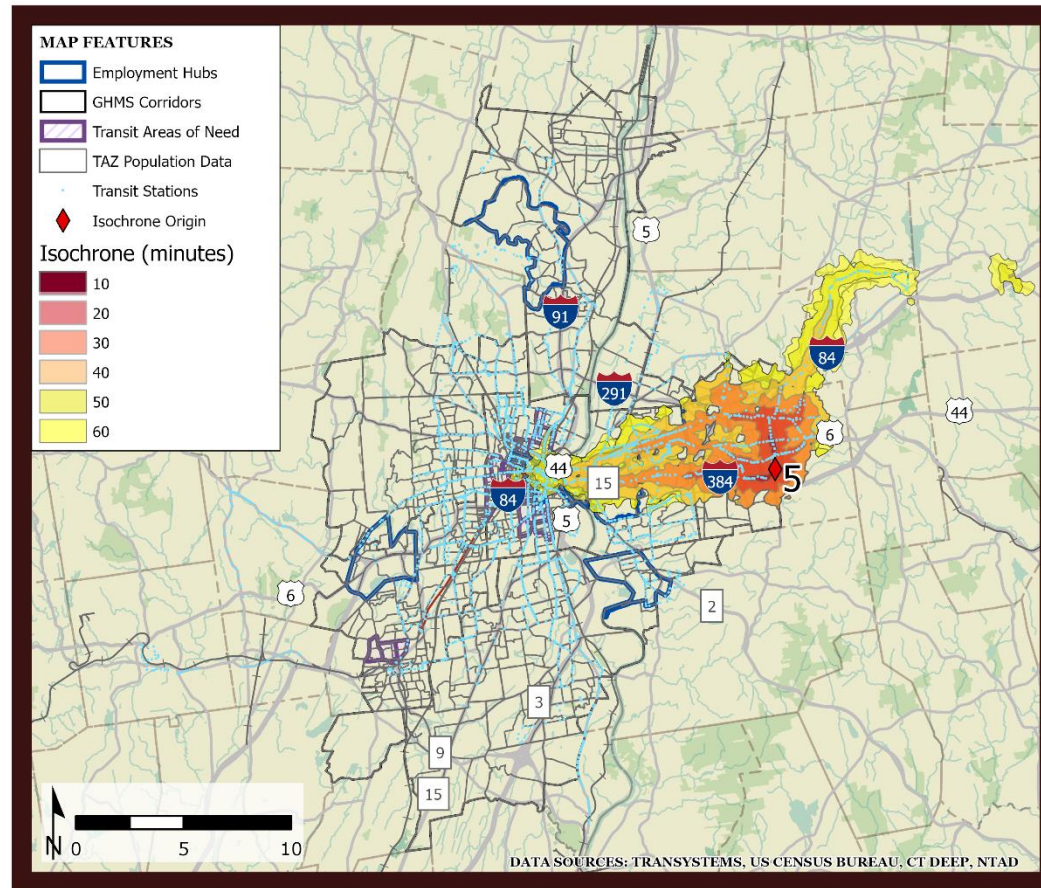
other employment hubs are partially within the 60-minute isochrone with most of Hub 4/East Farmington not covered by a one-hour commute.



**Figure 4.12: TDI Area 4 East Hartford Isochrone Map**

The TDI Area 5/Central Manchester isochrone map (**Figure 4.13**) shows most of Hub 5/Northwest Manchester as well as part of Hub 2/East Hartford within the 30-minute isochrone. Hub 1/Downtown Hartford is

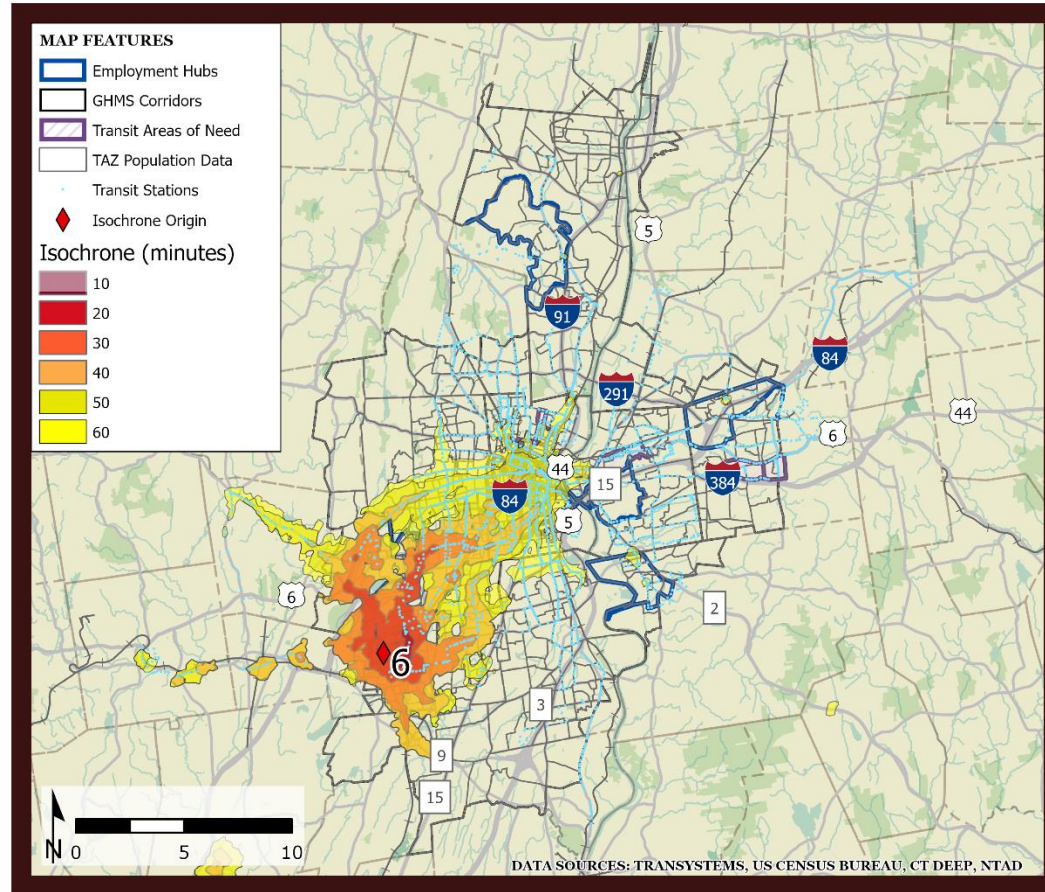
within the 60-minute isochrone. Hub 3/Northwest Windsor, Hub 4/East Farmington, and Hub 6/Glastonbury are not accessible by a one-hour transit commute.



**Figure 4.13: TDI Area 5 Central Manchester Isochrone Map**

The TDI Area 6/Central New Britain isochrone map (**Figure 4.14**) shows most of Hub 4/East Farmington within the 30-minute isochrone. Hub 1/Downtown

Hartford is within the 60-minute isochrone. The remaining three employment hubs are not accessible by a one-hour transit commute.



**Figure 4.14: TDI Area 6 Central New Britain Isochrone Map**

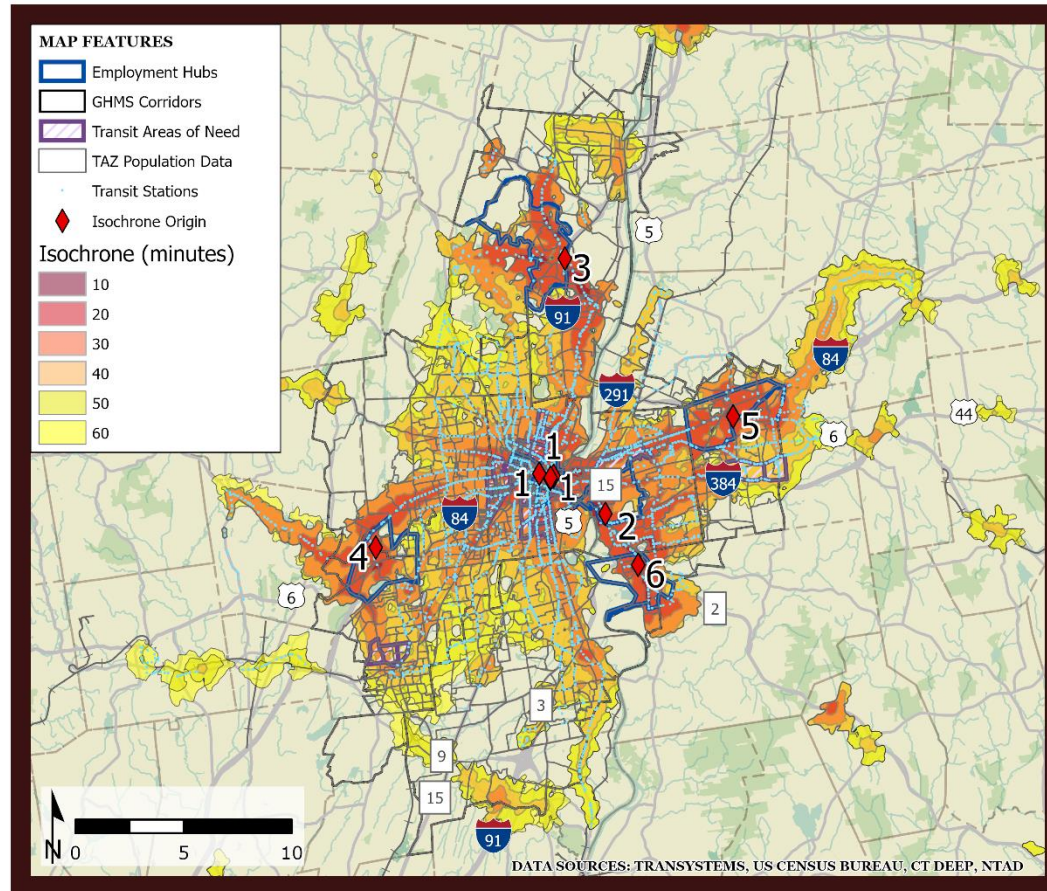
#### 4.1.5 Summary

Downtown Hartford is well connected by the existing bus network which is based primarily on radial routes. However, suburban employment areas are not as well connected (**Figure 4.15**), limiting access to these jobs by people without cars (**Figure 4.16**). Even in suburban areas that have better access like East Hartford, East Farmington and Northwest Manchester more of the population is in the 60-minute isochrone, compared to most of the population within the 30-minute isochrones in downtown. This issue is due in large part to the low-density development and lack of walkability in these peripheral communities, while much of the central population within the 10-minute and 20-minute downtown isochrones having the option to walk or take transit to jobs. It should be noted that these isochrones represent transit service during traditional weekday peak commute hours. Many commuters in low-income communities in areas of transit need work in jobs with atypical work hours, such as many service jobs, and would experience even longer transit travel times in off-peak hours.

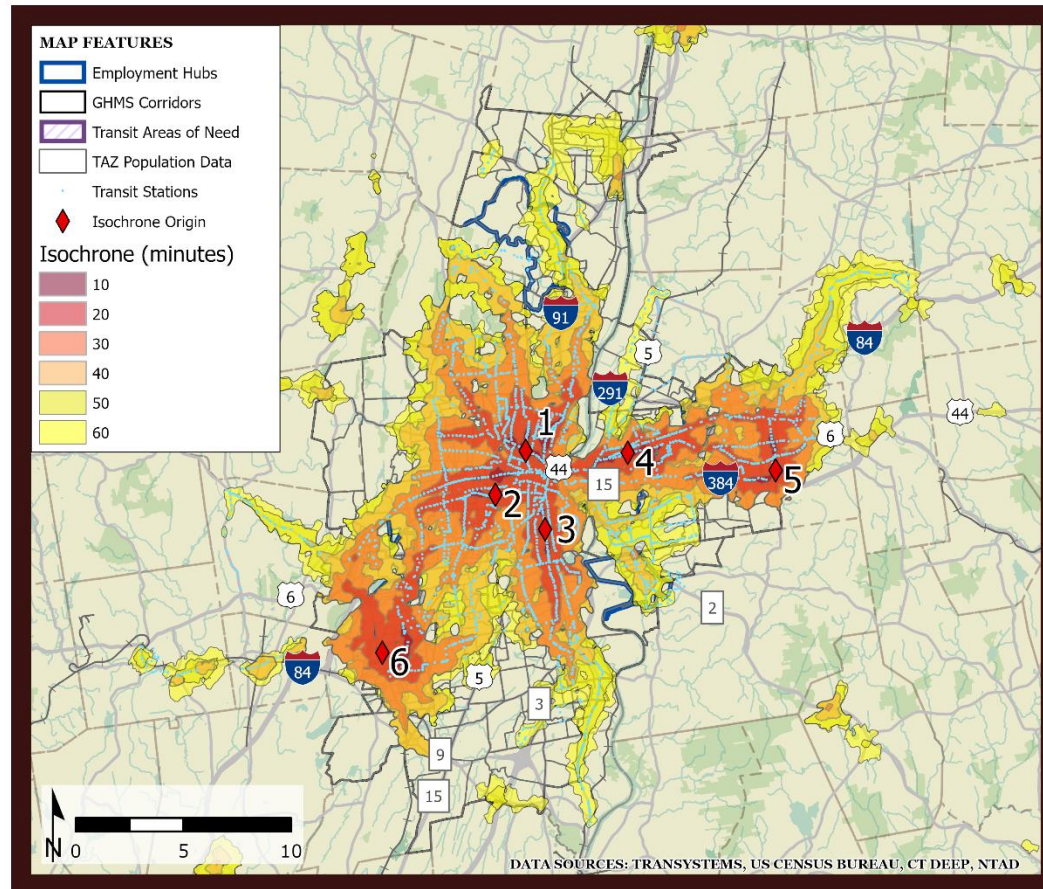
With many jobs located in downtown Hartford and four of the six residential areas of high transit need clustered around it, *CTtransit* can continue to successfully serve the needs of many residents with its current network. For suburban communities of high transit need however, the low population and employment densities may require innovative new services to be financially sustainable in the long run.

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**Figure 4.15: Greater Hartford Employment Hub Isochrones**



**Figure 4.16: Greater Hartford Areas of Transit Need Isochrones**

## 4.2 Transit Access

### 4.2.1 Purpose

The purpose of this analysis is to review the weekday frequency and span of service for each CTtransit bus route serving the Greater Hartford region. The frequency of service in particular is a key determinant in the usefulness of a bus route to transit riders. Higher frequency routes will draw more riders to transit and make it easier to use by reducing wait times and providing more travel flexibility. Higher frequency service is also useful when transfers are required, helping to minimize wait times and simplify the trip planning process.

Span of service is also important, especially for riders using public transit outside of traditional AM/PM peak hour commute windows. Many jobs require shifts that start or end early in the morning or late at night. If transit service doesn't have a long enough service span, workers in those jobs won't be able to ride the bus, which may be their only transportation option.

### 4.2.2 Data Sources

The data source used to determine frequency and span was General Transit Feed Specification (GTFS) data for the CTtransit bus system and the service schedules posted on the CTtransit website. Ridership data provided by CTtransit was also incorporated to provide context to the service data.

### 4.2.3 Methodology

Frequency was determined by running a script against the GTFS data that calculated the number of trips for a representative weekday, categorizing the trips into AM (6:00 AM — 8:59 AM), Midday (9:00 AM — 2:59 PM), PM (3:00 PM — 5:59), and Evening (6:00 PM — 8:59 PM) time periods. The number of trips was then used to calculate the average headway for each of these time periods. The span of service was calculated by determining the first time a bus departs the first station of a route in each direction and the last time a bus

*Span is the length of the day that a bus route operates.*

*Frequency is the number of trips per hour on a given route.*

*Headway is the amount of time between vehicles on a given route.*

departs the first station in each direction.

Route level ridership was calculated by summing the stop level boardings for each route for weekdays during the month of October 2019, and then dividing that sum by the number of weekdays in the month to determine the average weekday ridership.

There are two caveats to note for this analysis. First, the time period for ridership data does not align with the schedule data used, so the ridership information

provided is not for the representative day of service. Second, the GTFS data used to determine frequency only notes route direction as 0/1, while the ridership data notes route direction as east/west, north/south, or inbound/outbound. As a result, it is not possible to align the direction of travel for frequency with the direction of travel for ridership. Therefore, the route level ridership shown here is for both directions combined. The frequency shown for split routes in the tables below is for the trunk line section. As the route branches out the frequency is typically double that of the trunk portion of the route (or triple in the case of Routes 60-66).

Span was determined by the time of the first trip of the day at the first stop and the time of the last trip of the day at the first stop. Service hours shown are based on the schedules posted on the *CTtransit* website. It is possible that these operations do not reflect the latest adjustments that may have occurred due to the ongoing COVID-19 pandemic.

#### 4.2.4 Analysis

Local Routes with headways of 10 minutes or less at their peak frequency are the 60-66, 50-54, 31-33, 47, and 40-42. The 905 express route also has a peak frequency of 10 minute headways. The 101 is the only *CTfastrak* route with peak headways at or under 10 minutes, with service every 8 minutes on average during the peak hours. The AHS (Asylum Hill Shuttle) and CBS (Columbus Boulevard Shuttle) shuttle routes also have peak hour headways under 10 minutes.

Average frequency during the midday time period is a helpful gauge to understand consistently frequent service throughout the day. Several routes have midday headways of 15 minutes or less: 60-66, 50-54, 31-33, 47, 40-42, 101, and the DASH shuttle. Given this high level of service throughout the day it is not surprising these same routes also have some of the highest ridership numbers in the region. Of the local routes serving the Greater Hartford region (shown in **Table 4-5**), 26 of them have a peak headway of 30 minutes or less, while eight routes reach peak headways of 15 minutes or less. There are seven local routes whose peak average headway is 60 minutes or more.

**Table 4-5: Local Route Frequency & Boardings<sup>1,2</sup>**

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 30    | 0         | 45         | 72             | 45         | 90              | 579                   |
| 30    | 1         | 60         | 72             | 45         | 60              |                       |
| 31-33 | 0         | 10         | 10             | 10         | 30              | 2,975                 |
| 31-33 | 1         | 10         | 10             | 11         | 22              |                       |
| 32    | 0         | 36         | 72             | 45         | 60              | 372                   |
| 32    | 1         | 45         | 60             | 36         | 180             |                       |
| 34    | 0         | 60         | 360            | 60         | 0               | 296                   |
| 34    | 1         | 45         | 0              | 60         | 180             |                       |
| 36    | 0         | 36         | 60             | 60         | 180             | 542                   |
| 36    | 1         | 90         | 60             | 60         | 90              |                       |
| 37-39 | 0         | 13         | 19             | 11         | 45              | 1,699                 |
| 37-39 | 1         | 11         | 19             | 14         | 30              |                       |
| 38    | 0         | 30         | 20             | 30         | 36              | 735                   |
| 38    | 1         | 30         | 20             | 26         | 36              |                       |
| 40-42 | 0         | 10         | 10             | 10         | 18              | 2,113                 |
| 40-42 | 1         | 10         | 10             | 10         | 18              |                       |
| 41    | 0         | 22         | 30             | 22         | 45              | 451                   |
| 41    | 1         | 22         | 30             | 22         | 45              |                       |
| 43    | 0         | 22         | 33             | 22         | 180             | 395                   |
| 43    | 1         | 22         | 28             | 30         | 0               |                       |
| 44    | 0         | 36         | 60             | 30         | 0               | 316                   |

<sup>1</sup> All headway values are provided in minutes.

<sup>2</sup> Please use the following link for a map to the CTtransit's Local Route Map:

[https://www.cttransit.com/sites/default/files/maps/division/hartfordsys\\_2021.pdf](https://www.cttransit.com/sites/default/files/maps/division/hartfordsys_2021.pdf)

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 44    | 1         | 30         | 60             | 36         | 180             |                       |
| 45    | 0         | 45         | 0              | 0          | 180             | 55                    |
| 45    | 1         | 0          | 0              | 36         | 180             |                       |
| 46    | 0         | 11         | 20             | 12         | 60              | 1,219                 |
| 46    | 1         | 11         | 19             | 13         | 36              |                       |
| 47    | 0         | 10         | 10             | 10         | 36              | 2,300                 |
| 47    | 1         | 11         | 10             | 10         | 30              |                       |
| 50-54 | 0         | 9          | 10             | 9          | 30              | 3,942                 |
| 50-54 | 1         | 9          | 10             | 9          | 20              |                       |
| 53    | 0         | 22         | 60             | 20         | 180             | 704                   |
| 53    | 1         | 26         | 60             | 22         | 60              |                       |
| 55    | 0         | 45         | 60             | 36         | 180             | 696                   |
| 55    | 1         | 45         | 60             | 45         | 90              |                       |
| 56    | 0         | 30         | 60             | 30         | 180             | 555                   |
| 56    | 1         | 30         | 60             | 36         | 60              |                       |
| 58    | 0         | 30         | 60             | 45         | 180             | 469                   |
| 58    | 1         | 36         | 51             | 30         | 180             |                       |
| 59    | 0         | 30         | 60             | 36         | 180             | 336                   |
| 59    | 1         | 30         | 60             | 30         | 180             |                       |
| 60-66 | 0         | 10         | 10             | 8          | 26              | 3,593                 |
| 60-66 | 1         | 9          | 9              | 8          | 20              |                       |
| 61    | 0         | 22         | 30             | 20         | 60              | 686                   |
| 61    | 1         | 20         | 28             | 22         | 36              |                       |
| 63    | 0         | 22         | 30             | 26         | 90              | 564                   |
| 63    | 1         | 20         | 28             | 26         | 90              |                       |

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 69    | 0         | 30         | 30             | 30         | 45              | 595                   |
| 69    | 1         | 36         | 30             | 30         | 60              |                       |
| 72    | 0         | 20         | 40             | 15         | 60              | 528                   |
| 72    | 1         | 20         | 40             | 16         | 45              |                       |
| 74    | 0         | 30         | 45             | 36         | 180             | 714                   |
| 74    | 1         | 36         | 40             | 36         | 90              |                       |
| 76    | 0         | 20         | 30             | 20         | 36              | 1,144                 |
| 76    | 1         | 20         | 30             | 20         | 36              |                       |
| 82-84 | 0         | 23         | 33             | 20         | 45              | 1,752                 |
| 82-84 | 1         | 20         | 28             | 23         | 36              |                       |
| 83    | 0         | 30         | 30             | 22         | 60              | 1,684                 |
| 83    | 1         | 22         | 33             | 26         | 45              |                       |
| 85    | 0         | 90         | 60             | 90         | 180             | 118                   |
| 85    | 1         | 90         | 60             | 90         | 180             |                       |
| 86    | 0         | 36         | 120            | 30         | 180             | 243                   |
| 86    | 1         | 36         | 120            | 36         | 90              |                       |
| 87    | 0         | 36         | 60             | 45         | 180             | 244                   |
| 87    | 1         | 36         | 60             | 36         | 180             |                       |
| 88    | 0         | 18         | 30             | 16         | 60              | 1,683                 |
| 88    | 1         | 16         | 30             | 18         | 30              |                       |
| 91    | 0         | 60         | 60             | 60         | 90              | 407                   |
| 91    | 1         | 90         | 60             | 60         | 90              |                       |
| 92    | 0         | 60         | 60             | 60         | 90              | 227                   |
| 92    | 1         | 60         | 60             | 60         | 90              |                       |
| 94    | 0         | 60         | 120            | 60         | 180             | 203                   |

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 94    | 1         | 45         | 180            | 45         | 180             |                       |
| 95    | 0         | 20         | 30             | 22         | 60              | 1,128                 |
| 95    | 1         | 22         | 30             | 18         | 45              |                       |
| 96    | 0         | 36         | 120            | 45         | 180             | 292                   |
| 96    | 1         | 45         | 120            | 60         | 90              |                       |
| 542   | 0         | 0          | 60             | 0          | 60              | 32                    |
| 542   | 1         | 0          | 60             | 0          | 60              |                       |

**Table 4-6** shows the average headway and average weekday boardings for the CTfastrak routes serving the Greater Hartford region. These routes show a significant range of peak headways, from 8 minutes to 60 minutes. Two CTfastrak routes have a peak headway of 15 minutes or less, while another two have a peak headway of only 60 minutes. While the most frequent route, the 101, has the highest average weekday boardings, ridership on the other routes does not

appear to be directly correlated with frequency. This might be due to some of the frequent low ridership routes being short shuttle routes. The 140, with peak headways of 20 minutes, has lower average weekday boardings than the 144 or 153, with peak headways of 60 minutes. The three routes with highest ridership after the 101, the 128, 121, and 102, all operate at 20-30 minute peak headways and outperform the 161 with 15 minute peak headways.

**Table 4-6: CTfastrak Route Frequency & Boardings<sup>3,4</sup>**

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 101   | 0         | 8          | 12             | 8          | 16              | 5,281                 |

<sup>3</sup> All headway values are provided in minutes.

<sup>4</sup> Please use the following link for a map to the CTtransit's CTfastrak Route Map:

[https://www.cttransit.com/sites/default/files/maps/division/ctfastrak\\_system\\_AUGUST2021.pdf](https://www.cttransit.com/sites/default/files/maps/division/ctfastrak_system_AUGUST2021.pdf)



| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 101   | 1         | 8          | 12             | 8          | 14              |                       |
| 102   | 0         | 36         | 51             | 36         | 45              | 1,294                 |
| 102   | 1         | 36         | 51             | 30         | 60              |                       |
| 121   | 0         | 30         | 33             | 30         | 45              | 1,334                 |
| 121   | 1         | 30         | 30             | 30         | 36              |                       |
| 128   | 0         | 20         | 30             | 20         | 30              | 1,937                 |
| 128   | 1         | 20         | 30             | 20         | 30              |                       |
| 140   | 0         | 20         | 20             | 20         | 26              | 151                   |
| 140   | 1         | 22         | 20             | 20         | 26              |                       |
| 144   | 0         | 60         | 60             | 60         | 60              | 251                   |
| 144   | 1         | 60         | 60             | 60         | 60              |                       |
| 153   | 0         | 60         | 60             | 60         | 60              | 305                   |
| 153   | 1         | 60         | 60             | 60         | 60              |                       |
| 161   | 0         | 16         | 20             | 15         | 20              | 751                   |
| 161   | 1         | 15         | 20             | 15         | 22              |                       |

**Table 4-7** shows the average headway and average weekday boardings for the express routes serving the Greater Hartford region. The express routes are largely scheduled to serve traditional “nine to five” commuters and therefore have minimal to no service during the midday and evening periods. The 913 has the highest ridership of the express routes despite peak hour

headways ranging between 45-60 minutes. The 905 has the second highest ridership and the most frequent service for express routes, with average headways of 10 minutes during AM and PM peak periods. With a few exceptions (such as the 902, 907, and 913) higher ridership is generally correlated with more frequent service.

**Table 4-7: Express Route Frequency & Boardings<sup>5,6</sup>**

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 901   | 0         | 60         | 360            | 36         | 0               | 196                   |
| 901   | 1         | 36         | 360            | 90         | 180             |                       |
| 902   | 0         | 90         | 0              | 36         | 0               | 23                    |
| 902   | 1         | 36         | 0              | 60         | 0               |                       |
| 903   | 0         | 0          | 0              | 20         | 180             | 399                   |
| 903   | 1         | 13         | 0              | 0          | 0               |                       |
| 904   | 0         | 60         | 0              | 30         | 0               | 153                   |
| 904   | 1         | 30         | 0              | 90         | 180             |                       |
| 905   | 0         | 22         | 180            | 9          | 180             | 684                   |
| 905   | 1         | 10         | 360            | 26         | 90              |                       |
| 906   | 0         | 45         | 360            | 36         | 0               | 136                   |
| 906   | 1         | 30         | 360            | 60         | 180             |                       |
| 907   | 0         | 0          | 0              | 45         | 0               | 26                    |
| 907   | 1         | 45         | 0              | 0          | 0               |                       |
| 909   | 0         | 180        | 0              | 90         | 0               | 46                    |
| 909   | 1         | 90         | 0              | 180        | 0               |                       |
| 910   | 0         | 60         | 0              | 60         | 0               | 125                   |
| 910   | 1         | 60         | 0              | 60         | 0               |                       |
| 912   | 0         | 60         | 180            | 26         | 180             | 228                   |
| 912   | 1         | 30         | 360            | 90         | 180             |                       |
| 913   | 0         | 45         | 60             | 45         | 90              | 941                   |

<sup>5</sup> All headway values are provided in minutes.

<sup>6</sup> Please use the following link for a map to the CTtransit's CTfastrak Route Map:

[https://www.cttransit.com/sites/default/files/maps/division/expresssystem2021\\_0.pdf](https://www.cttransit.com/sites/default/files/maps/division/expresssystem2021_0.pdf)

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| 913   | 1         | 60         | 60             | 60         | 90              |                       |
| 914   | 0         | 45         | 360            | 22         | 180             | 252                   |
| 914   | 1         | 22         | 360            | 60         | 180             |                       |
| 915   | 0         | 0          | 0              | 180        | 0               | 12                    |
| 915   | 1         | 90         | 0              | 0          | 0               |                       |
| 926   | 0         | 0          | 0              | 90         | 0               | 26                    |
| 926   | 1         | 90         | 0              | 0          | 0               |                       |
| 927   | 0         | 0          | 0              | 90         | 0               | 34                    |
| 927   | 1         | 90         | 0              | 0          | 0               |                       |

**Table 4-8** shows the average headway and average weekday boardings for the shuttle routes serving the Greater Hartford region. The AHS and CBS routes have the most frequent service during the peak periods but have very minimal service during the midday and evening periods. The DASH route is less frequent during

the AM and PM peak periods but provides more consistent service frequency throughout the day. The DASH has the highest average weekday boardings, likely due in part its consistent service, though the AHS has more boardings per trip.

**Table 4-8: Shuttle Route Frequency & Boardings<sup>7</sup>**

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| AHS   | 0         | 6          | 360            | 0          | 0               | 83                    |
| AHS   | 1         | 0          | 180            | 9          | 180             |                       |

<sup>7</sup> All headway values are provided in minutes.

| Route | Direction | AM Headway | Midday Headway | PM Headway | Evening Headway | Avg Weekday Boardings |
|-------|-----------|------------|----------------|------------|-----------------|-----------------------|
| CBS   | 0         | 9          | 0              | 0          | 0               | 20                    |
| CBS   | 1         | 0          | 120            | 9          | 180             |                       |
| DASH  | 0         | 22         | 15             | 15         | 45              | 118                   |

The span of service for local routes is shown in **Table 4-9**. The overall average span of service for local routes is 15 hours and 17 minutes. Fourteen routes provide a span of service 18 hours or greater, with the 50-54, 31-33, and the 40-42 providing the greatest hours of service. Nearly all local routes provide at least 12 hours of service between the first and last trip of the day.

**Table 4-9: Local Route Span of Service**

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 30    | 0         | 4:05       | 23:40     | 19:35            |
| 30    | 1         | 4:45       | 0:10      | 19:25            |
| 31-33 | 0         | 5:05       | 0:45      | 19:40            |
| 31-33 | 1         | 4:31       | 1:04      | 20:33            |
| 32    | 0         | 6:35       | 19:15     | 12:40            |
| 32    | 1         | 5:48       | 18:04     | 12:16            |
| 34    | 0         | 5:25       | 21:25     | 16:00            |
| 34    | 1         | 6:23       | 22:37     | 16:14            |
| 36    | 0         | 6:20       | 22:45     | 16:25            |
| 36    | 1         | 5:11       | 18:38     | 13:27            |
| 37-39 | 0         | 5:00       | 23:45     | 18:45            |
| 37-39 | 1         | 4:29       | 0:13      | 19:44            |
| 38    | 0         | 5:00       | 20:20     | 15:20            |
| 38    | 1         | 5:41       | 20:03     | 14:22            |
| 40-42 | 0         | 4:15       | 0:45      | 20:30            |
| 40-42 | 1         | 4:34       | 0:00      | 19:26            |
| 41    | 0         | 5:00       | 23:45     | 18:45            |
| 41    | 1         | 4:33       | 0:30      | 19:57            |
| 43    | 0         | 6:35       | 18:20     | 11:45            |
| 43    | 1         | 5:38       | 17:56     | 12:18            |
| 44    | 0         | 6:35       | 17:55     | 11:20            |
| 44    | 1         | 6:15       | 18:15     | 12:00            |
| 45    | 0         | 6:20       | 21:25     | 15:05            |
| 45    | 1         | 16:28      | 22:07     | 5:39             |
| 46    | 0         | 5:10       | 21:25     | 16:15            |
| 46    | 1         | 5:31       | 21:45     | 16:14            |

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 47    | 0         | 6:00       | 0:45      | 18:45            |
| 47    | 1         | 5:16       | 23:57     | 18:41            |
| 50-54 | 0         | 4:20       | 23:45     | 19:25            |
| 50-54 | 1         | 4:25       | 1:07      | 20:42            |
| 53    | 0         | 5:40       | 18:10     | 12:30            |
| 53    | 1         | 5:32       | 23:00     | 17:28            |
| 55    | 0         | 6:00       | 18:15     | 12:15            |
| 55    | 1         | 5:35       | 19:13     | 13:38            |
| 56    | 0         | 5:40       | 19:15     | 13:35            |
| 56    | 1         | 6:09       | 19:44     | 13:35            |
| 58    | 0         | 5:25       | 21:25     | 16:00            |
| 58    | 1         | 6:40       | 22:12     | 15:32            |
| 59    | 0         | 6:10       | 18:20     | 12:10            |
| 59    | 1         | 6:12       | 18:45     | 12:33            |
| 60-66 | 0         | 5:50       | 0:45      | 18:55            |
| 60-66 | 1         | 5:07       | 0:10      | 19:03            |
| 61    | 0         | 5:50       | 21:25     | 15:35            |
| 61    | 1         | 5:20       | 1:00      | 19:40            |
| 63    | 0         | 6:25       | 18:45     | 12:20            |
| 63    | 1         | 5:47       | 1:07      | 19:20            |
| 69    | 0         | 5:05       | 21:25     | 16:20            |
| 69    | 1         | 5:06       | 21:52     | 16:46            |
| 72    | 0         | 6:10       | 22:45     | 16:35            |
| 72    | 1         | 6:08       | 23:09     | 17:01            |
| 74    | 0         | 5:10       | 18:25     | 13:15            |
| 74    | 1         | 5:39       | 18:45     | 13:06            |
| 76    | 0         | 5:05       | 23:45     | 18:40            |

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 76    | 1         | 5:03       | 23:15     | 18:12            |
| 82-84 | 0         | 4:53       | 22:40     | 17:47            |
| 82-84 | 1         | 4:45       | 22:16     | 17:31            |
| 83    | 0         | 5:03       | 22:40     | 17:37            |
| 83    | 1         | 5:00       | 22:39     | 17:39            |
| 85    | 0         | 7:30       | 18:15     | 10:45            |
| 85    | 1         | 7:45       | 21:10     | 13:25            |
| 86    | 0         | 6:05       | 18:15     | 12:10            |
| 86    | 1         | 5:56       | 18:41     | 12:45            |
| 87    | 0         | 5:50       | 18:10     | 12:20            |
| 87    | 1         | 6:27       | 18:05     | 11:38            |
| 88    | 0         | 5:00       | 0:46      | 19:46            |
| 88    | 1         | 4:25       | 23:13     | 18:48            |
| 91    | 0         | 5:38       | 23:09     | 17:31            |
| 91    | 1         | 5:18       | 23:06     | 17:48            |
| 92    | 0         | 6:23       | 19:39     | 13:16            |
| 92    | 1         | 7:10       | 19:32     | 12:22            |
| 94    | 0         | 5:40       | 18:00     | 12:20            |
| 94    | 1         | 6:00       | 18:23     | 12:23            |
| 95    | 0         | 5:05       | 23:45     | 18:40            |
| 95    | 1         | 5:28       | 0:15      | 18:47            |
| 96    | 0         | 5:15       | 18:10     | 12:55            |
| 96    | 1         | 5:45       | 18:41     | 12:56            |
| 542   | 0         | 5:45       | 23:50     | 18:05            |
| 542   | 1         | 5:53       | 23:58     | 18:05            |

The span of service for *CTfastrak* routes is shown in **Table 4-10**. The overall average span of service for *CTfastrak* routes is 18 hours and 35 minutes, which is the largest for all of the route types serving the Greater

Hartford region. All of the *CTfastrak* routes provide service for a minimum of 17 hours and 40 minutes, with the 101 providing the greatest span at nearly 21 hours.

**Table 4-10: CTfastrak Route Span of Service**

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 101   | 0         | 4:00       | 0:45      | 20:45            |
| 101   | 1         | 4:02       | 0:42      | 20:40            |
| 102   | 0         | 4:55       | 0:25      | 19:30            |
| 102   | 1         | 4:42       | 0:17      | 19:35            |
| 121   | 0         | 4:55       | 23:55     | 19:00            |
| 121   | 1         | 4:42       | 23:36     | 18:54            |
| 128   | 0         | 4:20       | 23:45     | 19:25            |
| 128   | 1         | 4:23       | 23:53     | 19:30            |
| 140   | 0         | 6:18       | 23:58     | 17:40            |
| 140   | 1         | 6:24       | 0:04      | 17:40            |
| 144   | 0         | 5:11       | 23:13     | 18:02            |
| 144   | 1         | 5:07       | 23:08     | 18:01            |
| 153   | 0         | 5:50       | 23:30     | 17:40            |
| 153   | 1         | 5:50       | 23:30     | 17:40            |
| 161   | 0         | 4:59       | 0:36      | 19:37            |
| 161   | 1         | 5:14       | 0:10      | 18:56            |

The span of service for Express routes is shown in **Table 4-11**. The overall average span of service for Express routes is 9 hours and 31 minutes, which is significantly shorter than for the Local and *CTfastrak* routes. This is

largely due to the fact that the Express service is geared towards traditional "9 to 5" commuters, rather than midday or evening service. Therefore, even though



some of the Express routes have a span of 10 or 11 hours they may have very little to zero midday service.

Some of the Express routes only provide service one direction at a time, such as inbound in the AM peak and outbound in the PM peak, resulting in spans of less than three hours.

**Table 4-11: Express Route Span of Service**

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 901   | 0         | 5:30       | 17:50     | 12:20            |
| 901   | 1         | 5:56       | 18:24     | 12:28            |
| 902   | 0         | 7:30       | 17:40     | 10:10            |
| 902   | 1         | 6:31       | 17:03     | 10:32            |
| 903   | 0         | 15:40      | 18:00     | 2:20             |
| 903   | 1         | 6:15       | 8:50      | 2:35             |
| 904   | 0         | 6:15       | 17:40     | 11:25            |
| 904   | 1         | 6:38       | 18:12     | 11:34            |
| 905   | 0         | 5:57       | 18:28     | 12:31            |
| 905   | 1         | 6:06       | 18:20     | 12:14            |
| 906   | 0         | 5:55       | 17:40     | 11:45            |
| 906   | 1         | 6:13       | 18:05     | 11:52            |
| 907   | 0         | 15:55      | 17:25     | 1:30             |
| 907   | 1         | 6:38       | 8:03      | 1:25             |
| 909   | 0         | 6:10       | 17:15     | 11:05            |
| 909   | 1         | 6:41       | 17:48     | 11:07            |
| 910   | 0         | 6:15       | 17:10     | 10:55            |
| 910   | 1         | 6:55       | 17:45     | 10:50            |
| 912   | 0         | 5:50       | 18:30     | 12:40            |
| 912   | 1         | 5:50       | 18:09     | 12:19            |
| 913   | 0         | 6:15       | 23:05     | 16:50            |
| 913   | 1         | 5:56       | 22:41     | 16:45            |

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| 914   | 0         | 6:00       | 18:25     | 12:25            |
| 914   | 1         | 6:06       | 18:23     | 12:17            |
| 915   | 0         | 12:18      | 18:28     | 6:10             |
| 915   | 1         | 6:20       | 7:40      | 1:20             |
| 926   | 0         | 12:10      | 16:55     | 4:45             |
| 926   | 1         | 6:15       | 7:00      | 0:45             |
| 927   | 0         | 12:10      | 16:50     | 4:40             |
| 927   | 1         | 6:10       | 6:45      | 0:35             |

The span of service for Shuttle routes is shown in **Table 4-12**. The overall average span of service for the Shuttle routes is 6 hours and 43 minutes, which is smallest of all route types serving Greater Hartford. However, there are only three Shuttle routes, two of

which only operate during the morning or afternoon and not all day. The DASH has a much longer span, at nearly 12 hours, and operates service throughout the time. DASH operations, however, are currently suspended in light of the COVID-19 pandemic.

**Table 4-12: Shuttle Route Span of Service**

| Route | Direction | First Trip | Last Trip | Hours of Service |
|-------|-----------|------------|-----------|------------------|
| AHS   | 0         | 6:40       | 9:10      | 2:30             |
| AHS   | 1         | 11:52      | 18:12     | 6:20             |
| CBS   | 0         | 6:51       | 9:06      | 2:15             |
| CBS   | 1         | 12:12      | 18:22     | 6:10             |
| DASH  | 0         | 7:00       | 18:45     | 11:45            |

#### 4.2.5 Summary

Overall, the majority of Greater Hartford routes that have high frequency service also provide service over a larger span of time. There are a few exceptions, however, particularly the Shuttle routes and a few Express routes, which provide frequent service during shorter periods of time oriented towards traditional commuting hours.

The same trend also generally holds when ridership is taken into account. Many of the frequent routes with a longer span have high ridership, but there are similar exceptions for the Shuttle and Express services, once again due to the market they are designed to serve. Looked at inversely, all of the routes with 1,000+ average boardings per day are either Local or CTfastrak routes, most of which have headways of 20 minutes or less during the AM/PM periods and 30 minutes or less during the midday period along with spans over 18 hours.

### 4.3 Travel Time Competitiveness and Transit Mode Share

#### 4.3.1 Purpose

The purpose of these analyses is to review the travel time competitiveness and the transit mode share for selected zones with a high Transit Dependency Index (TDI – as defined in Section Task 3.4.1 - Mobility), within the Greater Hartford region. Understanding how transit travel times compare to other modes, and how these differences look for different origin-destination (O-D) pairs, will help to identify where long transit

travel times may be suppressing potential transit ridership. Developing a mode share comparison will help to further understand the travel patterns already occurring in these O-D pairs and guide future mobility improvements.

#### 4.3.2 Data

Data for this analysis was drawn from the CRCOG Travel Demand Model (TDM) using the 2020 base year scenario. The TDM provides mode choice trip tables and highway and transit travel time skims that were used in the analysis discussed below.

#### 4.3.3 Methodology

Highway and transit travel time skims from the 2020 base year model were used in summarizing travel time data for the selected set of origin-destination zones that represent district pairs (see **Table 4-13** and **Figure 4.17**). At least one TDI zone was selected for each study corridor as the origin zone, while the identified employment hubs were used as the destination zones. TDI areas are those with a higher proportion of populations that are more likely to rely on transit, based on income, car ownership, and age. It should be noted that these travel times were taken from the shortest path analysis of the regional travel demand model procedures. Highway travel times include two components: in-vehicle time and terminal times. In vehicle time represents actual drive time between origin-destination endpoints. Terminal time is an average walk access/egress time from/to a zone centroid to the vehicle. Terminal time is also called out

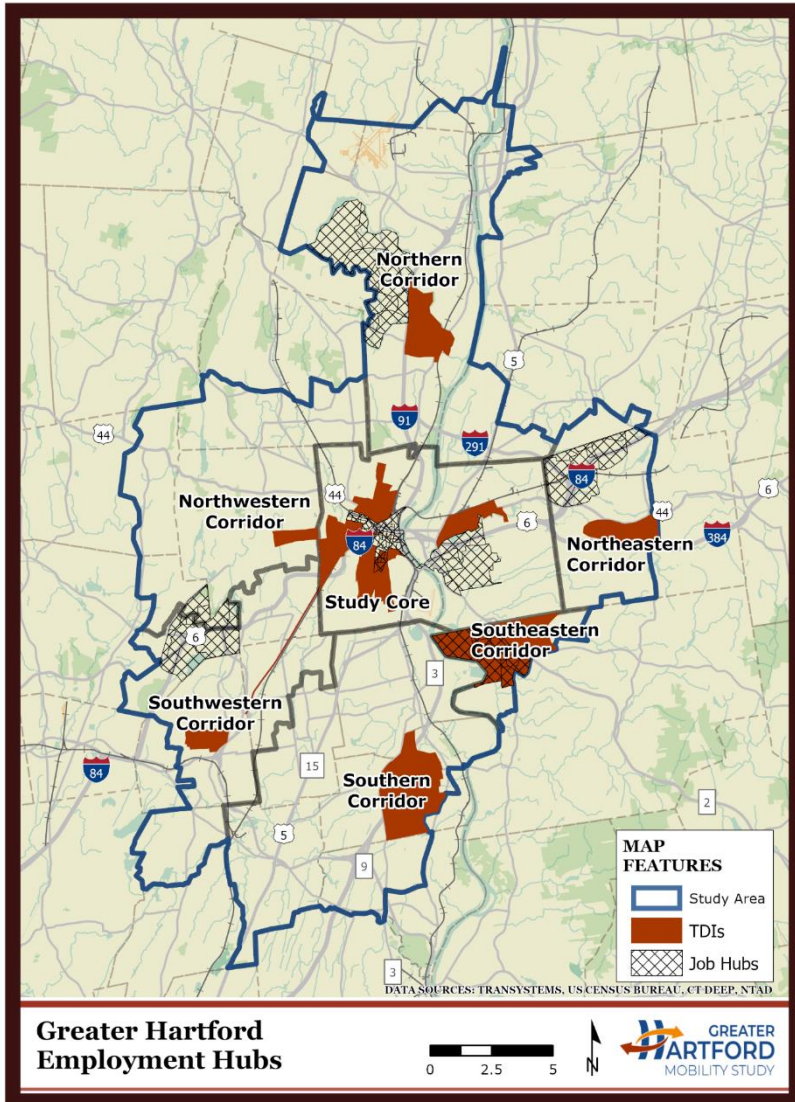
of vehicle time and is a fixed input at both ends of a trip based on the origin/destination zone characteristics. Highway travel time data also shows distances between the origins and destinations.

Transit travel times summaries also show two components: in-vehicle time and out-of-vehicle time. Out of vehicle time represents walk time at the access/egress ends plus any walk time involved during a transfer. Non-motorized (walk and bike) travel times were calculated using the highway distances with fixed speeds. Walk and bike mode speeds were assumed to be 3 mph and 10 mph respectively.

Mode choice model trip tables from the 2020 base year scenario were used in calculating mode shares for the selected set of district pairs. Mode shares were calculated for three primary modes: auto, transit and non-motorized. Auto trips include drive alone, shared 2 and shared 3+. Transit trips include local bus, express bus, BRT, and commuter rail trips. Non-motorized trips include walk and bike trips. It should be noted that the mode choice model outputs are person trips and in production-attraction format.

**Table 4-13: Distance (in miles) Between Origin Destination (O-D) Pairs**

|                               | <b>Job Hub -<br/>Core Center</b> | <b>Job Hub -<br/>Core East</b> | <b>Job Hub -<br/>North<br/>Corridor</b> | <b>Job Hub - NE<br/>Corridor</b> | <b>Job Hub - SE<br/>Corridor</b> | <b>Job Hub - SW<br/>Corridor</b> |
|-------------------------------|----------------------------------|--------------------------------|---|----------------------------------|----------------------------------|----------------------------------|
| <b>TDI-Core South</b>         | 1.5                              | 4.1                            | 11.2                                    | 9.9                              | 6.9                              | 7.6                              |
| <b>TDI-Core West</b>          | 2.3                              | 5.2                            | 11.6                                    | 11.0                             | 7.5                              | 6.4                              |
| <b>TDI-Core North</b>         | 1.1                              | 4.0                            | 9.0                                     | 9.0                              | 6.3                              | 9.2                              |
| <b>TDI-Core East</b>          | 2.5                              | 2.1                            | 10.4                                    | 4.6                              | 5.7                              | 10.9                             |
| <b>TDI-NW<br/>Corridor</b>    | 3.5                              | 6.5                            | 12.9                                    | 12.2                             | 8.8                              | 5.2                              |
| <b>TDI-North<br/>Corridor</b> | 7.6                              | 9.9                            | 2.3                                     | 8.8                              | 12.2                             | 16.0                             |
| <b>TDI-NE Corridor</b>        | 8.1                              | 7.5                            | 14.4                                    | 3.5                              | 7.6                              | 16.6                             |
| <b>TDI-SE Corridor</b>        | 5.6                              | 3.4                            | 16.6                                    | 7.0                              | 1.0                              | 16.5                             |
| <b>TDI-South<br/>Corridor</b> | 9.0                              | 9.5                            | 17.5                                    | 15.0                             | 6.2                              | 17.3                             |
| <b>TDI-SW<br/>Corridor</b>    | 11.5                             | 11.0                           | 20.8                                    | 17.7                             | 10.7                             | 5.4                              |



**Figure 4.17 Map of TDI Area and Job Hubs**

#### 4.3.4 Analysis

As noted in the methodology travel times were developed for driving, transit, walking, and biking. The travel times for each O-D pair, mode, are shown in **Table 4-14** through **Table 4-17**. Conditional formatting was applied individually to each table to help visualize the fastest (green) and slowest (red) travel times for that specific mode.

**Table 4-14: Auto Travel Time (in minutes) Between O-D Pairs**

|                           | Job Hub -<br>Core Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub - NE<br>Corridor | Job Hub - SE<br>Corridor | Job Hub -<br>SW Corridor |
|---------------------------|--------------------------|------------------------|--------------------------------|--------------------------|--------------------------|--------------------------|
| <b>TDI-Core South</b>     | 10.6                     | 12.8                   | 21.8                           | 18.1                     | 14.9                     | 20.3                     |
| <b>TDI-Core West</b>      | 10.8                     | 14.7                   | 23.7                           | 19.6                     | 17.1                     | 16.0                     |
| <b>TDI-Core North</b>     | 9.7                      | 13.6                   | 20.4                           | 17.6                     | 16.1                     | 20.8                     |
| <b>TDI-Core East</b>      | 17.0                     | 6.8                    | 25.6                           | 10.8                     | 11.2                     | 29.1                     |
| <b>TDI-NW Corridor</b>    | 13.6                     | 17.4                   | 26.4                           | 22.3                     | 19.8                     | 13.8                     |
| <b>TDI-North Corridor</b> | 17.2                     | 19.4                   | 6.7                            | 14.2                     | 21.8                     | 29.3                     |
| <b>TDI-NE Corridor</b>    | 21.9                     | 12.3                   | 26.6                           | 8.6                      | 15.4                     | 34.1                     |
| <b>TDI-SE Corridor</b>    | 20.3                     | 8.2                    | 30.7                           | 14.7                     | 4.0                      | 32.5                     |
| <b>TDI-South Corridor</b> | 19.9                     | 17.5                   | 30.0                           | 24.8                     | 12.8                     | 28.9                     |
| <b>TDI-SW Corridor</b>    | 21.7                     | 22.8                   | 34.6                           | 29.7                     | 23.1                     | 13.4                     |

**Table 4-15: Transit Travel Time (in minutes) Between O-D Pairs**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE<br>Corridor | Job Hub -<br>SE<br>Corridor | Job Hub -<br>SW<br>Corridor |
|---------------------------|-----------------------------|------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|
| <b>TDI-Core South</b>     | 14.4                        | 24.8                   | 31.0                           | 35.4                        | 36.3                        | 38.3                        |
| <b>TDI-Core West</b>      | 13.8                        | 30.5                   | 35.5                           | 41.1                        | 42.0                        | 23.1                        |
| <b>TDI-Core North</b>     | 14.3                        | 27.7                   | 34.3                           | 38.3                        | 39.2                        | 49.3                        |
| <b>TDI-Core East</b>      | 21.7                        | 11.0                   | 40.7                           | 17.2                        | 22.4                        | 51.6                        |
| <b>TDI-NW Corridor</b>    | 15.5                        | 32.2                   | 37.1                           | 42.8                        | 43.7                        | 20.1                        |
| <b>TDI-North Corridor</b> | 28.5                        | 42.0                   | 13.4                           | 52.6                        | 53.5                        | 63.5                        |
| <b>TDI-NE Corridor</b>    | 53.3                        | 38.9                   | 69.8                           | 28.1                        | 50.4                        | 73.9                        |
| <b>TDI-SE Corridor</b>    | 35.1                        | 17.4                   | 53.6                           | 34.9                        | 10.5                        | 64.9                        |
| <b>TDI-South Corridor</b> | 33.4                        | 42.2                   | 50.0                           | 52.8                        | 53.7                        | 57.3                        |
| <b>TDI-SW Corridor</b>    | 41.5                        | 53.0                   | 59.2                           | 62.3                        | 64.5                        | 50.8                        |

**Table 4-16: Walk Travel Times (in minutes) Between O-D Pairs**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE<br>Corridor | Job Hub -<br>SE<br>Corridor | Job Hub -<br>SW<br>Corridor |
|---------------------------|-----------------------------|------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|
| <b>TDI-Core South</b>     | 30.5                        | 81.9                   | 223.6                          | 197.2                       | 138.3                       | 152.3                       |
| <b>TDI-Core West</b>      | 45.4                        | 104.5                  | 232.1                          | 219.2                       | 150.2                       | 128.0                       |
| <b>TDI-Core North</b>     | 22.7                        | 80.1                   | 179.2                          | 179.6                       | 125.8                       | 184.4                       |
| <b>TDI-Core East</b>      | 49.3                        | 41.2                   | 207.3                          | 92.9                        | 114.0                       | 218.1                       |
| <b>TDI-NW Corridor</b>    | 70.8                        | 130.0                  | 257.5                          | 244.6                       | 175.7                       | 103.6                       |
| <b>TDI-North Corridor</b> | 152.4                       | 199.0                  | 45.4                           | 176.9                       | 244.7                       | 320.6                       |
| <b>TDI-NE Corridor</b>    | 162.7                       | 149.4                  | 287.3                          | 69.4                        | 151.1                       | 331.4                       |
| <b>TDI-SE Corridor</b>    | 111.6                       | 67.8                   | 332.9                          | 139.6                       | 20.3                        | 329.8                       |
| <b>TDI-South Corridor</b> | 180.8                       | 189.3                  | 350.3                          | 300.6                       | 124.1                       | 346.3                       |
| <b>TDI-SW Corridor</b>    | 229.1                       | 220.1                  | 415.8                          | 354.3                       | 213.6                       | 107.2                       |



**Table 4-17: Bike Travel Time (in minutes) Between O-D Pairs**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE<br>Corridor | Job Hub -<br>SE<br>Corridor | Job Hub -<br>SW<br>Corridor |
|---------------------------|-----------------------------|------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|
| <b>TDI-Core South</b>     | 9.2                         | 24.6                   | 67.1                           | 59.2                        | 41.5                        | 45.7                        |
| <b>TDI-Core West</b>      | 13.6                        | 31.4                   | 69.6                           | 65.7                        | 45.1                        | 38.4                        |
| <b>TDI-Core North</b>     | 6.8                         | 24.0                   | 53.8                           | 53.9                        | 37.7                        | 55.3                        |
| <b>TDI-Core East</b>      | 14.8                        | 12.4                   | 62.2                           | 27.9                        | 34.2                        | 65.4                        |
| <b>TDI-NW Corridor</b>    | 21.2                        | 39.0                   | 77.3                           | 73.4                        | 52.7                        | 31.1                        |
| <b>TDI-North Corridor</b> | 45.7                        | 59.7                   | 13.6                           | 53.1                        | 73.4                        | 96.2                        |
| <b>TDI-NE Corridor</b>    | 48.8                        | 44.8                   | 86.2                           | 20.8                        | 45.3                        | 99.4                        |
| <b>TDI-SE Corridor</b>    | 33.5                        | 20.3                   | 99.9                           | 41.9                        | 6.1                         | 99.0                        |
| <b>TDI-South Corridor</b> | 54.2                        | 56.8                   | 105.1                          | 90.2                        | 37.2                        | 103.9                       |
| <b>TDI-SW Corridor</b>    | 68.7                        | 66.0                   | 124.7                          | 106.3                       | 64.1                        | 32.2                        |

For a handful of closer O-D pairs bike travel is competitive with vehicular travel. However, for most of the trips personal automobiles are the quickest of the four modes. Nearly all walk trips are too long to be considered a reasonably viable option. A trend that carries across all modes is that trips to the Job Hub-Core Center, which is effectively downtown Hartford, are generally quicker than trips to the outlying job hubs. This is likely a result of the region's transportation infrastructure that was historically designed to get travelers into and out of downtown relatively efficiently regardless of mode.

Of particular interest when analyzing travel times at the regional level is the difference in travel time between public transit and private vehicles. Table 18 shows these differences for each of the O-D pairs analyzed, with conditional formatting that shows O-D pairs where transit is closer to auto travel time in green and longer in red. Travel time differences are negligible for the short trips in central Hartford, while longer trips start to show a larger difference in the travel times. However, as illustrated in **Table 4-19** (which shows the O-D pair distance divided by the difference in travel time), the largest travel time differences are not necessarily a result of the longest distances. Here the O-D pairs in green indicate trips where the travel time differences are relatively small compared to travel distance while O-D pairs in red where the travel time differences are relatively high compared to the distance. For example, the greatest travel time difference is 43 minutes, between the North Corridor Job Hub and Northeast

Corridor TDI area, but there are 9 other O-D pairs with a greater travel distance. The O-D pair between the SE Corridor Job Hub and South Corridor TDI area is only 6.2 miles apart but has a travel time difference of 41 minutes. Essentially, the travel time differences are not solely a function of distance, but also of the quality of transit network service and connections. These discrepancies in travel time and distance point to a transportation network outside the city core that is built largely for personal vehicle travel and lacks good transit options.

**Table 4-18: Travel Time Comparison (in minutes) Between Auto and Transit**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE<br>Corridor | Job Hub -<br>SE<br>Corridor | Job Hub -<br>SW<br>Corridor |
|---------------------------|-----------------------------|------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|
| <b>TDI-Core South</b>     | 3.9                         | 12.0                   | 9.2                            | 17.4                        | 21.4                        | 17.9                        |
| <b>TDI-Core West</b>      | 3.0                         | 15.9                   | 11.7                           | 21.5                        | 24.9                        | 7.1                         |
| <b>TDI-Core North</b>     | 4.5                         | 14.1                   | 13.9                           | 20.7                        | 23.2                        | 28.5                        |
| <b>TDI-Core East</b>      | 4.8                         | 4.1                    | 15.2                           | 6.4                         | 11.3                        | 22.5                        |
| <b>TDI-NW Corridor</b>    | 2.0                         | 14.8                   | 10.7                           | 20.5                        | 23.9                        | 6.3                         |
| <b>TDI-North Corridor</b> | 11.3                        | 22.6                   | 6.7                            | 38.4                        | 31.6                        | 34.2                        |
| <b>TDI-NE Corridor</b>    | 31.3                        | 26.6                   | 43.2                           | 19.5                        | 35.0                        | 39.8                        |
| <b>TDI-SE Corridor</b>    | 14.8                        | 9.2                    | 22.8                           | 20.2                        | 6.4                         | 32.5                        |
| <b>TDI-South Corridor</b> | 13.5                        | 24.8                   | 20.0                           | 28.0                        | 40.9                        | 28.4                        |
| <b>TDI-SW Corridor</b>    | 19.8                        | 30.2                   | 24.6                           | 32.6                        | 41.4                        | 37.4                        |

**Table 4-19: Ration of O-D Pair Distance to Auto-Transit Travel Time Difference (low number indicates large difference in travel time for a relatively shorter distance)**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE<br>Corridor | Job Hub -<br>SE<br>Corridor | Job Hub -<br>SW<br>Corridor |
|---------------------------|-----------------------------|------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|
| <b>TDI-Core South</b>     | 0.4                         | 0.3                    | 1.2                            | 0.6                         | 0.3                         | 0.4                         |
| <b>TDI-Core West</b>      | 0.8                         | 0.3                    | 1.0                            | 0.5                         | 0.3                         | 0.9                         |
| <b>TDI-Core North</b>     | 0.2                         | 0.3                    | 0.6                            | 0.4                         | 0.3                         | 0.3                         |
| <b>TDI-Core East</b>      | 0.5                         | 0.5                    | 0.7                            | 0.7                         | 0.5                         | 0.5                         |
| <b>TDI-NW Corridor</b>    | 1.8                         | 0.4                    | 1.2                            | 0.6                         | 0.4                         | 0.8                         |
| <b>TDI-North Corridor</b> | 0.7                         | 0.4                    | 0.3                            | 0.2                         | 0.4                         | 0.5                         |
| <b>TDI-NE Corridor</b>    | 0.3                         | 0.3                    | 0.3                            | 0.2                         | 0.2                         | 0.4                         |
| <b>TDI-SE Corridor</b>    | 0.4                         | 0.4                    | 0.7                            | 0.3                         | 0.2                         | 0.5                         |
| <b>TDI-South Corridor</b> | 0.7                         | 0.4                    | 0.9                            | 0.5                         | 0.2                         | 0.6                         |
| <b>TDI-SW Corridor</b>    | 0.6                         | 0.4                    | 0.8                            | 0.5                         | 0.3                         | 0.1                         |

In calculating the mode share of trips between each of the O-D pairs, the overall number of trips was determined both between each pair and for the Greater Hartford region as whole (see **Table 4-20**). As expected, the O-D pairs with the highest number of

trips are connected to central Hartford. However, there is also a substantial number of trips in some outer parts of the region, such as the Southeast Corridor and the North Corridor.

**Table 4-20: Total Trips**

|                    | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE Corridor | Job Hub -<br>SE Corridor | Job Hub -<br>SW<br>Corridor | Other            | Total            |
|--------------------|-----------------------------|------------------------|--------------------------------|--------------------------|--------------------------|-----------------------------|------------------|------------------|
| TDI-Core South     | 32,541                      | 871                    | 95                             | 199                      | 335                      | 445                         | 48,204           | 82,691           |
| TDI-Core West      | 20,395                      | 488                    | 70                             | 122                      | 192                      | 425                         | 40,808           | 62,500           |
| TDI-Core North     | 13,726                      | 448                    | 82                             | 106                      | 152                      | 137                         | 20,312           | 34,964           |
| TDI-Core East      | 1,905                       | 1,403                  | 43                             | 367                      | 175                      | 74                          | 13,797           | 17,764           |
| TDI-NW Corridor    | 1,844                       | 139                    | 29                             | 37                       | 45                       | 223                         | 12,550           | 14,867           |
| TDI-North Corridor | 580                         | 119                    | 2,028                          | 134                      | 71                       | 86                          | 12,998           | 16,016           |
| TDI-NE Corridor    | 934                         | 607                    | 82                             | 1,763                    | 247                      | 116                         | 29,289           | 33,037           |
| TDI-SE Corridor    | 1,113                       | 1,659                  | 72                             | 251                      | 11,135                   | 146                         | 20,627           | 35,002           |
| TDI-South Corridor | 592                         | 196                    | 43                             | 131                      | 305                      | 126                         | 22,637           | 24,030           |
| TDI-SW Corridor    | 456                         | 126                    | 28                             | 58                       | 80                       | 967                         | 29,792           | 31,507           |
| Other              | 171,455                     | 54,330                 | 21,123                         | 61,893                   | 33,809                   | 51,570                      | 6,018,198        | 6,412,378        |
| <b>Total</b>       | <b>245,541</b>              | <b>60,384</b>          | <b>23,695</b>                  | <b>65,062</b>            | <b>46,547</b>            | <b>54,314</b>               | <b>6,269,211</b> | <b>6,764,754</b> |

**Table 4-21** through **Table 4-23** shows the mode share for personal vehicle, transit, and non-motorized modes, respectively. Outside of some of the O-D pairs connected to downtown Hartford nearly all trips are made via personal vehicles, with many pairs at 99% or even 100%. For the region overall, nearly 89% of trips are made by personal vehicles, 11% are by non-motorized modes, and just under 1% are by transit.

Out of 60 O-D pairs, only nine pairs have a personal vehicle mode share that is below the regional mode share of 89%. Regarding transit mode share, many of the O-D pairs tied to central Hartford have a higher share of transit trips than the region overall. Many of the trips that do not connect with the region’s core have a very low rate of transit usage. The non-motorized mode share is quite high for the central, short-distance O-D pairs but drops off dramatically for pairs that have greater distance.

**Table 4-21: Percent of Trips By Personal Vehicle**

|                           | Job Hub -<br>Core Center | Job Hub -<br>Core East | Job Hub - North<br>Corridor | Job Hub - NE<br>Corridor | Job Hub -<br>SE Corridor | Job Hub -<br>SW Corridor | Other | Total |
|---------------------------|--------------------------|------------------------|-----------------------------|--------------------------|--------------------------|--------------------------|-------|-------|
| <b>TDI-Core South</b>     | 36%                      | 96%                    | 97%                         | 93%                      | 94%                      | 92%                      | 70%   | 57%   |
| <b>TDI-Core West</b>      | 42%                      | 97%                    | 98%                         | 94%                      | 95%                      | 91%                      | 68%   | 61%   |
| <b>TDI-Core North</b>     | 37%                      | 96%                    | 97%                         | 92%                      | 95%                      | 94%                      | 73%   | 59%   |
| <b>TDI-Core East</b>      | 69%                      | 87%                    | 99%                         | 94%                      | 97%                      | 97%                      | 82%   | 81%   |
| <b>TDI-NW Corridor</b>    | 77%                      | 99%                    | 100%                        | 99%                      | 99%                      | 98%                      | 79%   | 79%   |
| <b>TDI-North Corridor</b> | 93%                      | 100%                   | 82%                         | 99%                      | 99%                      | 99%                      | 88%   | 88%   |
| <b>TDI-NE Corridor</b>    | 83%                      | 99%                    | 99%                         | 93%                      | 98%                      | 98%                      | 79%   | 81%   |
| <b>TDI-SE Corridor</b>    | 92%                      | 97%                    | 100%                        | 99%                      | 66%                      | 100%                     | 90%   | 83%   |

|                           |     |      |      |      |     |      |     |     |
|---------------------------|-----|------|------|------|-----|------|-----|-----|
| <b>TDI-South Corridor</b> | 97% | 100% | 100% | 100% | 99% | 100% | 87% | 87% |
| <b>TDI-SW Corridor</b>    | 97% | 100% | 100% | 100% | 99% | 97%  | 79% | 80% |
| <b>Other</b>              | 73% | 91%  | 94%  | 89%  | 94% | 92%  | 90% | 90% |
| <b>Total</b>              | 64% | 91%  | 93%  | 90%  | 88% | 92%  | 89% | 89% |

**Table 4-22: Percent of Trips by Transit**

|                           | <b>Job Hub - Core Center</b> | <b>Job Hub - Core East</b> | <b>Job Hub - North Corridor</b> | <b>Job Hub - NE Corridor</b> | <b>Job Hub - SE Corridor</b> | <b>Job Hub - SW Corridor</b> | <b>Other</b> | <b>Total</b> |
|---------------------------|------------------------------|----------------------------|---------------------------------|------------------------------|------------------------------|------------------------------|--------------|--------------|
| <b>TDI-Core South</b>     | 9%                           | 2%                         | 3%                              | 7%                           | 5%                           | 7%                           | 6%           | 7%           |
| <b>TDI-Core West</b>      | 11%                          | 1%                         | 2%                              | 6%                           | 5%                           | 8%                           | 5%           | 7%           |
| <b>TDI-Core North</b>     | 11%                          | 1%                         | 3%                              | 8%                           | 5%                           | 6%                           | 5%           | 7%           |
| <b>TDI-Core East</b>      | 7%                           | 0%                         | 1%                              | 4%                           | 2%                           | 2%                           | 2%           | 2%           |
| <b>TDI-NW Corridor</b>    | 4%                           | 0%                         | 0%                              | 1%                           | 1%                           | 1%                           | 1%           | 2%           |
| <b>TDI-North Corridor</b> | 5%                           | 0%                         | 1%                              | 1%                           | 1%                           | 1%                           | 1%           | 1%           |
| <b>TDI-NE Corridor</b>    | 15%                          | 1%                         | 1%                              | 3%                           | 2%                           | 2%                           | 2%           | 3%           |
| <b>TDI-SE Corridor</b>    | 4%                           | 0%                         | 0%                              | 1%                           | 1%                           | 0%                           | 0%           | 1%           |
| <b>TDI-South Corridor</b> | 2%                           | 0%                         | 0%                              | 0%                           | 0%                           | 0%                           | 0%           | 0%           |
| <b>TDI-SW Corridor</b>    | 2%                           | 0%                         | 0%                              | 0%                           | 1%                           | 0%                           | 0%           | 0%           |
| <b>Other</b>              | 5%                           | 0%                         | 0%                              | 2%                           | 1%                           | 1%                           | 0%           | 0%           |
| <b>Total</b>              | 7%                           | 0%                         | 0%                              | 2%                           | 1%                           | 1%                           | 0%           | 1%           |

**Table 4-23: Percent of Trips by Non-Motorized**

|                           | Job Hub -<br>Core Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE Corridor | Job Hub -<br>SE Corridor | Job Hub -<br>SW<br>Corridor | Other | Total |
|---------------------------|--------------------------|------------------------|--------------------------------|--------------------------|--------------------------|-----------------------------|-------|-------|
| <b>TDI-Core South</b>     | 55%                      | 2%                     | 0%                             | 0%                       | 1%                       | 1%                          | 25%   | 36%   |
| <b>TDI-Core West</b>      | 47%                      | 1%                     | 0%                             | 0%                       | 0%                       | 1%                          | 26%   | 32%   |
| <b>TDI-Core North</b>     | 53%                      | 2%                     | 0%                             | 0%                       | 1%                       | 0%                          | 22%   | 33%   |
| <b>TDI-Core East</b>      | 24%                      | 13%                    | 0%                             | 2%                       | 1%                       | 0%                          | 16%   | 16%   |
| <b>TDI-NW Corridor</b>    | 19%                      | 1%                     | 0%                             | 0%                       | 0%                       | 1%                          | 20%   | 19%   |
| <b>TDI-North Corridor</b> | 2%                       | 0%                     | 17%                            | 0%                       | 0%                       | 0%                          | 11%   | 11%   |
| <b>TDI-NE Corridor</b>    | 2%                       | 1%                     | 0%                             | 4%                       | 0%                       | 0%                          | 18%   | 17%   |
| <b>TDI-SE Corridor</b>    | 4%                       | 3%                     | 0%                             | 0%                       | 33%                      | 0%                          | 9%    | 16%   |
| <b>TDI-South Corridor</b> | 1%                       | 0%                     | 0%                             | 0%                       | 1%                       | 0%                          | 13%   | 12%   |
| <b>TDI-SW Corridor</b>    | 0%                       | 0%                     | 0%                             | 0%                       | 0%                       | 3%                          | 20%   | 19%   |
| <b>Other</b>              | 22%                      | 9%                     | 6%                             | 9%                       | 5%                       | 7%                          | 10%   | 10%   |
| <b>Total</b>              | 29%                      | 9%                     | 7%                             | 9%                       | 11%                      | 7%                          | 10%   | 11%   |

#### 4.3.5 Summary

- Mode share and travel time competitiveness varies dramatically between the different O-D pairs; however, transit mode share does not appear to correlate closely with the difference in travel times. As

can be seen when the transit share and travel time difference tables are reviewed side-by-side (**Table 4-24** and **Table 4-25** below), there are several O-D pairs with minimal travel time difference but a still low transit mode share. Many of these, such as TDI Core



East to Job Hub Core East, TDI North Corridor to Job Hub North Corridor, TDI SE Corridor to Job Hub SE Corridor, are within the same corridor but outside the very center of the city. This may indicate transit service that is geared towards moving people downtown rather than serving more local trips outside of downtown. Part of the explanation is likely that some of the trips are of a short enough distance that non-motorized modes

represent a higher share of trips, but it also points to other factors beyond travel time (such as service frequency or span) that are potentially influencing the decision of whether to drive or take transit for a given trip analysis looked at data from 2019, the last quarter in particular.

**Table 4-24: Travel Time Comparison (in minutes) Between Auto and Transit**

|                           | Job Hub - Core Center | Job Hub - Core East | Job Hub - North Corridor | Job Hub - NE Corridor | Job Hub - SE Corridor | Job Hub - SW Corridor |
|---------------------------|-----------------------|---------------------|--------------------------|-----------------------|-----------------------|-----------------------|
| <b>TDI-Core South</b>     | 3.9                   | 12.0                | 9.2                      | 17.4                  | 21.4                  | 17.9                  |
| <b>TDI-Core West</b>      | 3.0                   | 15.9                | 11.7                     | 21.5                  | 24.9                  | 7.1                   |
| <b>TDI-Core North</b>     | 4.5                   | 14.1                | 13.9                     | 20.7                  | 23.2                  | 28.5                  |
| <b>TDI-Core East</b>      | 4.8                   | 4.1                 | 15.2                     | 6.4                   | 11.3                  | 22.5                  |
| <b>TDI-NW Corridor</b>    | 2.0                   | 14.8                | 10.7                     | 20.5                  | 23.9                  | 6.3                   |
| <b>TDI-North Corridor</b> | 11.3                  | 22.6                | 6.7                      | 38.4                  | 31.6                  | 34.2                  |
| <b>TDI-NE Corridor</b>    | 31.3                  | 26.6                | 43.2                     | 19.5                  | 35.0                  | 39.8                  |
| <b>TDI-SE Corridor</b>    | 14.8                  | 9.2                 | 22.8                     | 20.2                  | 6.4                   | 32.5                  |
| <b>TDI-South Corridor</b> | 13.5                  | 24.8                | 20.0                     | 28.0                  | 40.9                  | 28.4                  |
| <b>TDI-SW Corridor</b>    | 19.8                  | 30.2                | 24.6                     | 32.6                  | 41.4                  | 37.4                  |

**Table 4-25: Percent of Trips by Transit**

|                           | Job Hub -<br>Core<br>Center | Job Hub -<br>Core East | Job Hub -<br>North<br>Corridor | Job Hub -<br>NE Corridor | Job Hub -<br>SE Corridor | Job Hub -<br>SW<br>Corridor | Other | Total |
|---------------------------|-----------------------------|------------------------|--------------------------------|--------------------------|--------------------------|-----------------------------|-------|-------|
| <b>TDI-Core South</b>     | 9%                          | 2%                     | 3%                             | 7%                       | 5%                       | 7%                          | 6%    | 7%    |
| <b>TDI-Core West</b>      | 11%                         | 1%                     | 2%                             | 6%                       | 5%                       | 8%                          | 5%    | 7%    |
| <b>TDI-Core North</b>     | 11%                         | 1%                     | 3%                             | 8%                       | 5%                       | 6%                          | 5%    | 7%    |
| <b>TDI-Core East</b>      | 7%                          | 0%                     | 1%                             | 4%                       | 2%                       | 2%                          | 2%    | 2%    |
| <b>TDI-NW Corridor</b>    | 4%                          | 0%                     | 0%                             | 1%                       | 1%                       | 1%                          | 1%    | 2%    |
| <b>TDI-North Corridor</b> | 5%                          | 0%                     | 1%                             | 1%                       | 1%                       | 1%                          | 1%    | 1%    |
| <b>TDI-NE Corridor</b>    | 15%                         | 1%                     | 1%                             | 3%                       | 2%                       | 2%                          | 2%    | 3%    |
| <b>TDI-SE Corridor</b>    | 4%                          | 0%                     | 0%                             | 1%                       | 1%                       | 0%                          | 0%    | 1%    |
| <b>TDI-South Corridor</b> | 2%                          | 0%                     | 0%                             | 0%                       | 0%                       | 0%                          | 0%    | 0%    |
| <b>TDI-SW Corridor</b>    | 2%                          | 0%                     | 0%                             | 0%                       | 1%                       | 0%                          | 0%    | 0%    |
| <b>Other</b>              | 5%                          | 0%                     | 0%                             | 2%                       | 1%                       | 1%                          | 0%    | 0%    |
| <b>Total</b>              | 7%                          | 0%                     | 0%                             | 2%                       | 1%                       | 1%                          | 0%    | 1%    |

#### 4.4 Bus Reliability

##### 4.4.1 Purpose

The purpose of this analysis is to review *CTtransit* Hartford Division and *CTfastrak* on-time and other

performance statistics. Unreliable transit operation can both delay rider's arrivals at their destinations and require them to start waiting at their origin bus stop sooner than they otherwise would. This in turn

lengthens the average transit trip and makes it less competitive with other modes.

#### 4.4.2 Data

The data used was provided by CT*transit* Hartford Division and the National Transit Database (NTD). CT*transit* provided on-time performance data by route by month for September, October, and November of 2019. This data is based on timepoints passed so it measures mid-route on-time performance as well as end point performance. On-time is considered zero minutes early to 5:29 minutes late. The NTD data includes the annual number of major failures and total failures for the CT*transit* Hartford system and for peer systems CDTA, PVTA, and RIPTA. To avoid the effects of the COVID pandemic on transit operations, the

#### 4.4.3 Methodology

The on-time performance data collected was broken down by route ridership, type of route, and day of week to better understand its impact on riders. The raw data on failures received from the NTD was converted into distance between failure data to determine its impact relative to the overall size of CT*transit* Hartford's operation. Data on peer agencies was collected to provide a comparison of CT*transit*'s relative performance on this metric.

#### 4.4.4 Analysis

On-time performance varies significantly by route with Route 101 Hartford New Britain via the busway operating 81.5% on-time and Route 927 Torrington

operating at 37.7% on-time. Average on-time performance for all routes was 67.6%. See **Table 4-26**.

**Table 4-26: Overall Weekday On-time Performance**

| Route                    | Early | Late  | On-time |
|--------------------------|-------|-------|---------|
| All Routes               | 9.2%  | 23.2% | 67.6%   |
| 101 Hartford New Britain | 6.6%  | 11.9% | 81.5%   |
| 927 Torrington           | 22.6% | 39.7% | 37.7%   |

Looking at the 10 most heavily utilized routes, which together carry more than half of all riders in the 66 route Hartford Division, we see that those that operate via the busway, Routes 101 and 128, are among the most reliable in the system at 81.5% and 71.7% on time. On the other hand, the eight most heavily traveled routes that operate solely via local streets are in the bottom one half of routes in terms of on-time performance, averaging 60.1% on-time. Although this is to some extent to be expected given longer dwell times and dwell time variability on heavily traveled routes, it is still significant because it indicates that a large proportion of passengers are exposed to routes that tend to run early or late, increasing the impact on rider's lives. CRCOG is currently conducting a study to look at ways to improve speed and reliability on five major corridors in the region, a program that could have a major positive impact on transportation quality for a large number of people. See **Table 4-27**.

**Table 4-27: Ten Busiest Route On-time Performance**

| Route  | Early | Late  | On-time |
|--|-------|-------|---------|
| <b>101- Hartford<br/>New Britain</b>                   | 6.6%  | 11.9% | 81.5%   |
| <b>128<br/>Hartford/West<br/>Farms/New<br/>Britain</b> | 9.2%  | 19.1% | 71.7%   |
| <b>System Average</b>                                  | 9.2%  | 23.2% | 67.6%   |
| <b>40-42 North<br/>Main St.</b>                        | 9.5%  | 26.6% | 63.9%   |
| <b>37-39 New<br/>Britain Ave.</b>                      | 10.1% | 26.5% | 63.4%   |
| <b>60-66<br/>Farmington Ave.</b>                       | 8.7%  | 29.5% | 61.8%   |
| <b>88 Burnside Ave.</b>                                | 8.3%  | 30.1% | 61.6%   |
| <b>83 Silver Lane</b>                                  | 8.7%  | 30.6% | 60.7%   |
| <b>50-54 Blue Hills<br/>Ave.</b>                       | 11.5% | 29.9% | 58.6%   |
| <b>31-33 Park St.</b>                                  | 8.5%  | 34.3% | 57.2%   |
| <b>47 Franklin Ave.</b>                                | 12.6% | 33.4% | 54%     |

Different types of routes, *CTtransit* Local, *CTtransit* Express, *CTfastrak* BRT, and *CTfastrak* Local, have very different on-time performance levels. *CTfastrak* BRT routes are far more reliable than other types of routes achieving 83.1% on-time levels with 6.0% of buses running early and 10.9% operating late. This is followed by *CTfastrak* Local bus routes, which serve as feeders to the *CTfastrak* main line, sometimes traveling on the

busway for part of their trip and other times just serving a *CTfastrak* station. These routes operate 72.3% on-time with 8% running early and 19.7% running late. *CTtransit* Local service, which carries the largest proportion of system riders, operates 63.8% on-time with 9.6% operating early and 26.6% late. *CTtransit* Express services are the least reliable, however this is partially due to a very high number of buses running early, not a significant problem where there is little or no intermediate ridership where passengers need to wait for buses at timepoints along the route. See **Table 4-28**.

**Table 4-28: Weekday On-time Performance by Route Type**

| Route Type                      | Early | Late  | On-time |
|---------------------------------|-------|-------|---------|
| <b><i>CTtransit</i> Local</b>   | 9.6%  | 26.6% | 63.8%   |
| <b><i>CTtransit</i> Express</b> | 14.8% | 23.9% | 61.3%   |
| <b><i>CTfastrak</i> BRT</b>     | 6%    | 10.9% | 83.1%   |
| <b><i>CTfastrak</i> Local</b>   | 8%    | 19.7% | 72.3%   |

Weekend on-time performance was similar to weekday. During the three months studied Saturday on-time performance averaged 65.8% and Sunday 68.4%. The proportion of early and late buses was also similar. As on weekdays, *CTfastrak* reported the best on-time performance at 81.8% and 84.3% respectively. See **Table 4-29**.

**Table 4-29: On-time Performance by Day of Week**

| Day            | Early | Late  | On-time |
|----------------|-------|-------|---------|
| <b>Weekday</b> | 9.2%  | 23.2% | 67.6%   |

|                 |      |       |       |
|-----------------|------|-------|-------|
| <b>Saturday</b> | 9.3% | 24.8% | 65.8% |
| <b>Sunday</b>   | 8.3% | 23.4% | 68.4% |

In terms of systemwide mechanical failures, CTtransit Hartford Division had 520 major failures and 4,358 total failures in 2019. This represents 17,303 miles between major failures and 2,065 miles between any failure. Compared to peer agencies, this is comparable for major failures but below the peers in terms of all failures. See **Table 4-30**.

**Table 4-30: Distance Between Failures, CTtransit Hartford and Peers**

| <b>Agency</b>                      | <b>Distance between major failures</b> | <b>Distance between all failures</b> |
|------------------------------------|--|--------------------------------------|
| <b>CTtransit Hartford Division</b> | 17,303                                 | 2,065                                |
| <b>CDTA (Albany, NY)</b>           | 15,801                                 | 4,045                                |
| <b>RIPTA (Providence, RI)</b>      | 17,093                                 | 4,451                                |
| <b>PVTA (Springfield MA)</b>       | 4,819                                  | 3,266                                |

Compared to the other *CTtransit* Divisions this is relatively low for major failures but comparable for all failures. See **Table 4-31**.

**Table 4-31: Distance Between Failures, *CTtransit* Divisions**

| Agency                             | Distance between major failures | Distance between all failures |
|------------------------------------|---------------------------------|-------------------------------|
| <i>CTtransit</i> Hartford Division | 17,303                          | 2,065                         |
| <i>CTtransit</i> New Haven Div.    | 33,694                          | 2,250                         |
| <i>CTtransit</i> Stamford Div.     | 23,310                          | 1,903                         |

#### 4.4.5 Summary

*CTtransit* Hartford Division’s on-time performance varies by type of route. *CTfastrak* routes, with the extensive transit priority provided by the busway, perform significantly better than *CTtransit* Local routes which indicates that interaction with traffic is a major source of reliability problems. CROCOG is currently studying the potential for additional transit priority in the Hartford Region which could lead to major improvements to on-time performance especially for the busiest routes that carry the most people.

Miles between failures at *CTtransit* Hartford are similar to peer agencies and other *CTtransit* Divisions.

## 4.5 Safety Assessment

### 4.5.1 Purpose

The purpose of this analysis is to assess the overall safety of *CTtransit* Hartford Division and *CTfastrak*. Public transit is critical in providing equitable safe mobility. Monitoring safety performance over time and compared to similar transit operators can provide insight into safety performance.

### 4.5.2 Data Sources

National Transit Database (NTD) data collected by the Bureau of Transportation Statistics was used for the *CTtransit* and peer agency data analysis. The NTD data includes annual collision, fatality, injury, vehicle, ridership, and revenue mile data. The Bus Occupant Safety Data representing national averages of all transit is provided by the Bureau of Transportation Statistics. The data only includes crashes with a completed police report resulting in property damage, injury, or death. The records do not account for additional crashes that were not reported to the police.

### 4.5.3 Methodology

The assessment of safety performance metrics uses 2019 as the base year with 2014 as a 5-year historic comparison. Additional comparison was performed against national averages and peer agencies, the Capital District Transportation Authority, and Pioneer Valley Transit Authority. Relevant modes were aggregated and summarized for 2019 and 2014 for the *CTtransit* Hartford Division, Capital District Transportation Authority, and Pioneer Valley Transit

Authority from the NTD dataset. Calculations were performed to ascertain rates of fatalities, injuries, and vehicles involved in crashes per 100 million vehicle-miles for comparison purposes with national rates as well as peer agencies.

#### 4.5.4 Analysis

*CTtransit safety 2019 existing conditions* - CTtransit buses in the Hartford Division traveled approximately 10 million vehicle-miles in 2019 while experiencing 34 crashes resulting in a total of 68 injuries involving a total of 64 vehicles. There were no reported fatalities or serious injuries.

*CTtransit safety historical comparison* - Service in the CTtransit Hartford Division expanded significantly between 2014 and 2019, from approximately 6 million vehicle miles to approximately 10 million vehicle-miles in 2019, representing a 51% increase. Similarly, the region showed an increase in collision metrics in the same time period. A comparison of 2014 and 2019 CTtransit Hartford Division as shown in **Table 4-32**, shows the rates of collisions and vehicles involved in crashes increased while injury rates declined.

**Table 4-32: CTtransit Hartford Division Bus Safety Data**

|  | 2014  | 2019  | Change |
|--|-------|-------|--------|
| <b>Fatalities</b>                          | 0     | 0     |        |
| <b>Injured persons</b>                     | 52    | 68    |        |
| <b>Collisions</b>                          | 15    | 34    |        |
| <b>Vehicles involved in crashes</b>        | 25    | 64    |        |
| <b>Vehicle-miles (millions)</b>            | 6.431 | 9.679 | 51%    |
| <b>Rates per 100 million vehicle-miles</b> |       |       |        |
| Fatalities                                 | 0.00  | 0.00  | n/a    |
| Injured persons                            | 809   | 703   | -13%   |
| Collisions                                 | 233   | 351   | 51%    |
| Vehicles involved in crashes               | 389   | 661   | 70%    |

*CTtransit 2019 existing conditions safety peer comparison* - Existing 2019 data was compared between the CTtransit Hartford Division, the Capital District Transportation Authority (CDTA) in Albany, New York, and the Pioneer Valley Transit Authority (PVTA) in Springfield, Massachusetts as shown in **Table 4-33**. The data show that CTtransit Hartford Division is underperforming in safety compared to peer agencies and the national average in collisions and injuries. However, CTtransit Hartford Division did outperform the national fatality average with no deaths in 2019.

**Table 4-33: 2019 Existing Bus Safety Data Peer Comparison**

|  | CTtransit | CDTA  | PVTA  | National |
|--|-----------|-------|-------|----------|
| Fatalities                                 | 0         | 0     | 0     | 35       |
| Injured persons                            | 68        | 45    | 7     | 15,000   |
| Collisions                                 | 34        | 20    | 3     | 0        |
| Vehicles involved in crashes               | 64        | 36    | 5     | 74,000   |
| Vehicle-miles (millions)                   | 9.679     | 8.410 | 4.877 | 17,980   |
| <b>Rates per 100 million vehicle-miles</b> |           |       |       |          |
| Fatalities                                 | 0.00      | 0.00  | 0.00  | 0.19     |
| Injured persons                            | 703       | 535   | 144   | 85       |
| Collisions                                 | 351       | 238   | 62    | -        |
| Vehicles involved in crashes               | 661       | 428   | 103   | 411      |

It is important to note that CTtransit Hartford Division has seen rapid expansion at 51% growth in vehicle-miles over the five-year period from 2014-2019 while the peer agencies saw more modest growth in the 10-12% range consistent with the national average. This surge in service may have been a contributing factor in the increase in collisions. As shown in **Table 4-34**, CTtransit Hartford Division saw a smaller increase in safety related incidents than the CDTA.

**Table 4-34: Capital District Transit Authority Bus Safety Data**

|  | 2014  | 2019  | Change |
|--|-------|-------|--------|
| Fatalities                                 | 0     | 0     | n/a    |
| Injured persons                            | 38    | 45    | 18%    |
| Collisions                                 | 11    | 20    | 82%    |
| Vehicles involved in crashes               | 18    | 36    | 100%   |
| Vehicle-miles (millions)                   | 7.504 | 8.410 | 12%    |
| <b>Rates per 100 million vehicle-miles</b> |       |       |        |
| Fatalities                                 | 0.00  | 0.00  | n/a    |
| Injured persons                            | 506   | 535   | 6%     |
| Collisions                                 | 147   | 238   | 62%    |
| Vehicles involved in crashes               | 240   | 428   | 78%    |

The PVTA, however, showed significant improvement in all safety metrics over the five-year period (**Table 4-35**) while nationally bus safety improved at a more modest pace ( **Table 4-36**).

**Table 4-35: Pioneer Valley Transit Authority Bus Safety Data**

|  | 2014  | 2019  | Change |
|--|-------|-------|--------|
| Fatalities                                 | 0     | 0     | n/a    |
| Injured persons                            | 32    | 7     | -78%   |
| Collisions                                 | 7     | 3     | -57%   |
| Vehicles involved in crashes               | 14    | 5     | -64%   |
| Vehicle-miles (millions)                   | 4.451 | 4.877 | 10%    |
| <b>Rates per 100 million vehicle-miles</b> |       |       |        |
| Fatalities                                 | 0.00  | 0.00  | n/a    |
| Injured persons                            | 719   | 144   | -80%   |
| Collisions                                 | 157   | 62    | -61%   |
| Vehicles involved in crashes               | 315   | 103   | -67%   |



**Table 4-36: National Bus Safety Data**

|  | 2014   | 2019   | Change |
|--|--------|--------|--------|
| Fatalities                                 | 44     | 35     | -20%   |
| Injured persons                            | 14,000 | 15,000 | 7%     |
| Vehicles involved in crashes               | 69,000 | 74,000 | 7%     |
| Vehicle-miles (millions)                   | 15,999 | 17,980 | 12%    |
| <b>Rates per 100 million vehicle-miles</b> |        |        |        |
| Fatalities                                 | 0.28   | 0.19   | -32%   |
| Injured persons                            | 86     | 85     | -1%    |
| Vehicles involved in crashes               | 434    | 411    | -5%    |

#### 4.5.5 Summary

CTtransit Hartford Division has seen higher crashes and injuries compared to peer agencies and the national average. However, the rate of injuries has decreased while the system has expanded more quickly than the peer agencies as shown in **Table 4-37**.

**Table 4-37: 2014 vs. 2019 Percent Change Bus Safety Data Comparison**

|  | CTtransit | CDTA | PVTA | National |
|--|-----------|------|------|----------|
| <b>Fatalities</b>                          | n/a       | n/a  | n/a  | -20%     |
| <b>Injured persons</b>                     | 31%       | 18%  | -78% | 7%       |
| <b>Collisions</b>                          | 127%      | 82%  | -57% |          |
| <b>Vehicles involved in crashes</b>        | 156%      | 100% | -64% | 7%       |
| <b>Vehicle-miles (millions)</b>            | 51%       | 12%  | 10%  | 12%      |
| <b>Rates per 100 million vehicle-miles</b> |           |      |      |          |
| <b>Fatalities</b>                          | n/a       | n/a  | n/a  | -32%     |
| <b>Injured persons</b>                     | -13%      | 6%   | -80% | -1%      |
| <b>Collisions</b>                          | 51%       | 62%  | -61% | -        |
| <b>Vehicles involved in crashes</b>        | 70%       | 78%  | -67% | -5%      |

## 4.6 State of Good Repair

### 4.6.1 Purpose

The purpose of this analysis is to review the *CTtransit* bus fleet inventory to assess the average age of the fleet and the percentage of the fleet that exceeds the expected useful life. Maintaining the *CTtransit* bus fleet is crucial to ensuring that safe and reliable service can be provided to customers. Understanding the overall state of the bus fleet will also aid in capital planning by identifying when and what rate fleet vehicles will need to be replaced.

### 4.6.2 Data Sources

The primary data source for this analysis is current fleet data provided by *CTtransit*. This dataset included information on the year, make, and model of each bus, as well as the garage to which it is assigned. Supplemental data was also collected from the National Transit Database (NTD). NTD data provided historic fleet information and the data to compare to peer agencies, though the most recent year available was 2019. As a result, and due to reporting differences in the NTD data, data for the *CTtransit* fleets differ between the *CTtransit* fleet review and the peer agency review.

### 4.6.3 Methodology

The available fleet information was summarized by make and model for the Hartford and *CTfastrak* garages, as well as for the entire *CTtransit* fleet overall to provide context within the agency. The data was used to determine how many buses are nearing retirement

age and the number that are beyond retirement age. For this analysis, the retirement age was considered to be 12 years, per [Useful Life of Transit Buses and Vans Final Report \(dot.gov\)](#). The same analysis was also applied specifically to hybrid buses in the fleet. The average fleet age was calculated for the overall fleet as well as for the Hartford and *CTfastrak* garages, both for the overall fleet and by each make and model.

Additionally, a brief peer review was undertaken using NTD asset inventory time series data. The most recent year in this data set is 2019, so the Hartford data is older than the current 2021 data provided by *CTtransit* that was used in the direct analysis of the *CTtransit* fleet.

- The peer agencies included in the review:
  - Capital District Transportation Authority (CDTA) in Albany, NY
  - Pioneer Valley Transit Authority (PVTA) in Springfield, MA
  - Rhode Island Public Transit Authority (RIPTA) in Providence, RI
  - *CTtransit* New Haven

#### 4.6.4 Analysis

The current CTfastrak fleet consist of 337 buses, 292 of which are based in the Hartford garage and 45 in the CTfastrak garage. The overall CTtransit fleet consists of 637 buses. As shown in **Table 4-38**, 15% (49 buses) of the Hartford/CTfastrak fleet is above the 12 year retirement age, with 9% (30 buses) nearing retirement

(considered to be within two years of retirement age). This compares to 12% of the CTtransit fleet over the retirement age and 22% nearing retirement. **Table 4-39** shows that most of the buses nearing or above retirement age are assigned to the Hartford garage. Of the 45 CTfastrak buses, none are nearing retirement age and three are above retirement age.

**Table 4-38: Hartford/CTfastrak Buses nearing or at Retirement Age, by Make and Model**

| Make         | Model             | Grand Total | Total Below 12 yrs | % Below 12 yrs | Total Near Retirement | % Near Retirement | Total Above 12 yrs | % Above 12 yrs |
|--------------|-------------------|-------------|--------------------|----------------|-----------------------|-------------------|--------------------|----------------|
| Gillig       | 30 FT Hybrid      | 12          | 12                 | 100%           | 0                     | 0%                | 0                  | 0%             |
| MCI          | D4500             | 9           | 9                  | 100%           | 6                     | 67%               | 0                  | 0%             |
| New Flyer    | 35' Hybrid        | 3           | 3                  | 100%           | 0                     | 0%                | 0                  | 0%             |
|              | 40' LF            | 3           | 0                  | 0%             | 0                     | 0%                | 3                  | 100%           |
|              | D40LF             | 41          | 0                  | 0%             | 0                     | 0%                | 41                 | 100%           |
|              | D40LF-Commuter    | 5           | 0                  | 0%             | 0                     | 0%                | 5                  | 100%           |
|              | XD 40             | 200         | 200                | 100%           | 0                     | 0%                | 0                  | 0%             |
|              | XDE40-Hybrid      | 39          | 39                 | 100%           | 14                    | 36%               | 0                  | 0%             |
|              | No Model Listed   | 3           | 3                  | 100%           | 0                     | 0%                | 0                  | 0%             |
| Nova         | LFS60-Hybrid      | 22          | 22                 | 100%           | 10                    | 45%               | 0                  | 0%             |
| <b>Total</b> | <b>All Models</b> | <b>337</b>  | <b>288</b>         | <b>85%</b>     | <b>30</b>             | <b>9%</b>         | <b>49</b>          | <b>15%</b>     |

**Table 4-39: Buses nearing or at Retirement Age, by Garage**

| Garage           | Grand Total | Total Below 12 yrs | % Below 12 yrs | Total Near Retirement | % Near Retirement | Total Above 12 yrs | % Above 12 yrs |
|------------------|-------------|--------------------|----------------|-----------------------|-------------------|--------------------|----------------|
| <b>CTfastrak</b> | 45          | 42                 | 93%            | 0                     | 0%                | 3                  | 7%             |
| <b>Hartford</b>  | 292         | 246                | 84%            | 30                    | 10%               | 46                 | 16%            |
| <b>Total</b>     | 337         | 288                | 85%            | 30                    | 9%                | 49                 | 15%            |

No hybrid models are yet at retirement age in the CTtransit fleet, but 32% (24 buses) of hybrid buses in the Hartford/CTfastrak fleet are nearing retirement (see **Table 4-40**). All 24 buses nearing retirement are part

of the Hartford fleet. This compares to 44% (72 buses) in the overall CTtransit hybrid fleet nearing retirement age.

**Table 4-40: Hartford/CTfastrak Hybrid Buses nearing or at Retirement Age, by Make and Model**

| Make             | Model                    | Grand Total | Total Below 12 yrs | % Below 12 yrs | Total Near Retirement | % Near Retirement | Total Above 12 yrs | % Above 12 yrs |
|------------------|--------------------------|-------------|--------------------|----------------|-----------------------|-------------------|--------------------|----------------|
| <b>Gillig</b>    | 30 FT Hybrid             | 12          | 12                 | 100%           | 0                     | 0%                | 0                  | 0%             |
| <b>New Flyer</b> | 35' Hybrid               | 3           | 3                  | 100%           | 0                     | 0%                | 0                  | 0%             |
|                  | XDE40-Hybrid             | 39          | 39                 | 100%           | 14                    | 36%               | 0                  | 0%             |
| <b>Nova</b>      | LFS60-Hybrid             | 22          | 22                 | 100%           | 10                    | 45%               | 0                  | 0%             |
| <b>Total</b>     | <b>All Hybrid Models</b> | <b>76</b>   | <b>76</b>          | <b>100%</b>    | <b>24</b>             | <b>32%</b>        | <b>0</b>           | <b>0%</b>      |

As seen in **Table 4-41**, the average age of the Hartford/CTfastrak fleet is 6.1 years, while the average age of the hybrid vehicles is over two years older, at 8.2 years.

The average age of the overall CTtransit fleet is 6.8 years, while the average age of the full CTtransit fleet of hybrid buses is nearly two years older, at 8.6 years.

**Table 4-41: Average Age of Buses by Make and Model for the Hartford and CTfastrak Fleets**

| Make and Model         | Average of Vehicle Age |
|------------------------|------------------------|
| Gillig                 | 6.8                    |
| 30 FT Hybrid           | 6.8                    |
| MCI                    | 5.9                    |
| D4500                  | 7.8                    |
| New Flyer              | 5.9                    |
| 35' Hybrid             | 9.0                    |
| 40' LF                 | 14.0                   |
| D40LF                  | 15.0                   |
| D40LF-Commuter         | 14.0                   |
| XD 40                  | 3.2                    |
| XDE40-Hybrid           | 8.4                    |
| <i>No Model Listed</i> | 1.0                    |
| Nova                   | 8.4                    |
| LFS60-Hybrid           | 8.4                    |
| Overall Average        | 6.1                    |

According to data downloaded from the NTD, the Hartford/CTfastrak fleet grew substantially in recent years, from 241 buses in 2014 to 295 buses in 2019. The average age of the Hartford/CTfastrak fleet decreased from 8.8 years in 2014 to 5.9 years today. However, the average age of the fleet without the younger CTfastrak buses is 7.1 years. **Table 4-42** and **Table 4-43** shows how the Hartford/CTfastrak fleet compares to several peer transit agencies. The

Hartford/CTfastrak fleet has seen similar growth to the CTtransit New Haven Division, PVTA, and CDTA. The average age of the Hartford bus fleet decreased by 1.7 years from 2014 to 2019, while peers at PVTA, CDTA, and RIPTA saw their average fleet age increase between 0.6 years to 6.2 years. CTfastrak service began in 2015 with 12 buses and increased to 30 buses in 2019.

**Table 4-42: Fleet Comparison to Transit System Peers**

| <b>Agency</b>   | <b>Mode</b>     | <b>2014<br/>Buses</b> | <b>2019<br/>Buses</b> | <b>Absolute<br/>Change</b> | <b>%<br/>Change</b> |
|---|-----------------|-----------------------|-----------------------|----------------------------|---------------------|
| <b>CTtransit - Hartford<br/>Division</b>                        | Standard<br>Bus | 241                   | 265                   | 24                         | 10%                 |
| <b>CTtransit - Hartford<br/>CTfastrak Division</b>              | BRT Bus         |                       | 30                    | 30                         | -                   |
| <b>CTtransit New Haven<br/>Division</b>                         | Standard<br>Bus | 125                   | 137                   | 12                         | 10%                 |
| <b>Pioneer Valley<br/>Transit Authority<br/>(PVRTA)</b>         | Standard<br>Bus | 171                   | 189                   | 18                         | 11%                 |
| <b>Capital District<br/>Transportation<br/>Authority (CDTA)</b> | Commuter<br>Bus | 14                    | 16                    | 2                          | 14%                 |
| <b>Capital District<br/>Transportation<br/>Authority (CDTA)</b> | Standard<br>Bus | 222                   | 252                   | 30                         | 14%                 |
| <b>Rhode Island Public<br/>Transit Authority<br/>(RIPTA)</b>    | Standard<br>Bus | 232                   | 232                   | 0                          | 0%                  |

**Table 4-43: Average Age of Buses Compared to Transit System Peers**

| Agency   | Mode            | 2014<br>Average<br>Age | 2019<br>Average<br>Age | Absolute<br>Change | %<br>Change |
|--|-----------------|------------------------|------------------------|--------------------|-------------|
| CTtransit - Hartford<br>Division                       | Standard<br>Bus | 8.8                    | 7.1                    | -1.7               | -19%        |
| CTtransit - Hartford<br>CTfastrak Division             | BRT Bus         |                        | 5.0                    | 5.0                | -           |
| CTtransit New Haven<br>Division                        | Standard<br>Bus | 9.7                    | 3.5                    | -6.2               | -64%        |
| Pioneer Valley Transit<br>Authority (PVTA)             | Standard<br>Bus | 5.6                    | 8.8                    | 3.2                | 58%         |
| Capital District<br>Transportation<br>Authority (CDTA) | Commuter<br>Bus |                        | 0.0                    | 0.0                | -           |
| Capital District<br>Transportation<br>Authority (CDTA) | Standard<br>Bus | 7.5                    | 6.9                    | -0.6               | -8%         |
| Rhode Island Public<br>Transit Authority<br>(RIPTA)    | Standard<br>Bus | 5.1                    | 7.7                    | 2.6                | 52%         |

#### 4.6.5 Summary

Overall, the majority of CTtransit's Hartford/CTfastrak fleet is below retirement age, and both the proportion of the fleet and average vehicle age are younger than the overall CTtransit fleet. However, there are 49 buses that are due to be replaced based on FTA standards, with another 30 buses due in the next two years. Of the 30 buses nearing retirement, 24 are hybrid models,

though no hybrid models are yet above the retirement age of 12 years. The average age of the Hartford fleet as reported in 2019 was similar to the average fleet age of the peer agencies.

#### 4.7 Resiliency

Resiliency in the bus transit system is primarily related to the susceptibility of key facilities to flooding. The main physical facilities utilized by the *CTtransit* and *CTfastrak* systems are the Hartford Maintenance Facility on Leibert Road just north of downtown and the *CTfastrak* busway extending to New Britain from downtown Hartford. The bus facility is on the Connecticut River and protected by a levee, although some small amount of flooding was recently experienced during a heavy rainfall. *CTtransit* is monitoring this situation. The *CTfastrak* busway has not experienced any flooding since it was opened.



## 5 Rail Service Assessment

### 5.1 Introduction

This chapter includes existing conditions analysis of passenger and freight rail lines and operations within the study area. It highlights the role of Hartford passenger rail line in the overall Northeast Corridor rail operation and provides a context for linking study area rail service performance and opportunities with the regional rail system. The analysis includes summary of operation, station and parking facilities, level of service, and ridership data. The ridership assessment focuses on pre-COVID ridership information with discussion of pandemic impacts on ridership and passenger ridership recovery projections for post-COVID operations.

### 5.2 Passenger and Freight Operations Review

The following section details the passenger and freight rail operations within the GHMS study area. The section additionally addresses future infrastructure and service plans, and ongoing transit-oriented development (TOD) efforts in the study area. Passenger operations occur over the Hartford Line, which runs 62 miles north-south between New Haven, Connecticut, and Springfield, Massachusetts. Passenger service is operated by *CTrail* and Amtrak, with Amtrak service extending through Massachusetts and into Vermont as well as service to New York and along the Northeast Corridor to Washington, DC. Freight operation occurs over portions of the Hartford Line as well over the Suffield branch and numerous other rail lines in the region. Freight rail within the



study area is operated by Genesee & Wyoming, under the subsidiary names of Connecticut Southern Railroad, New England Central Railroad and Providence and Worcester Railway Company; a small short line Central New England Railroad (CNZR) and by Canadian National Railway and CSX. Connecticut's freight rail network is connected to national freight rail networks and the ports in New London and New Haven.

### 5.3 Passenger Rail Service

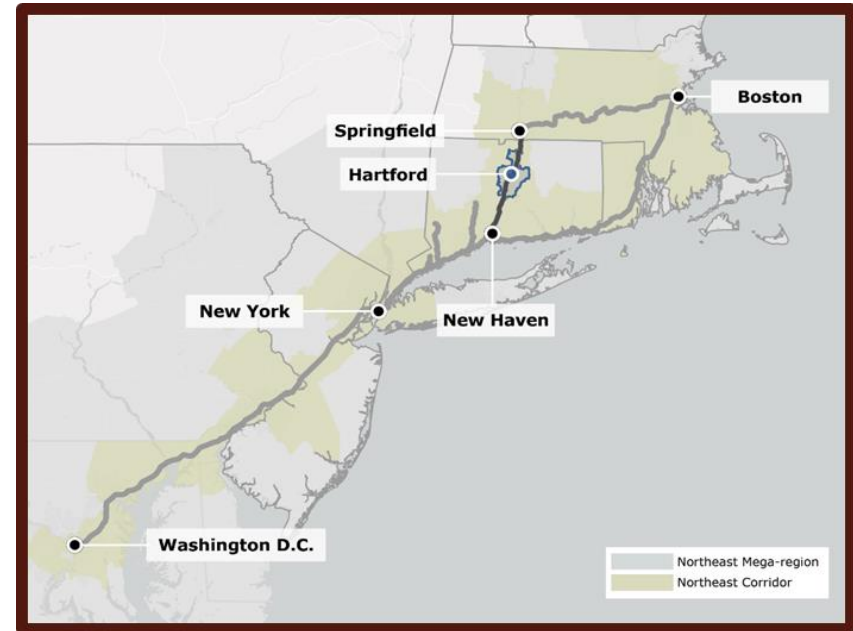
#### 5.3.1 Hartford Line Passenger Rail Service

*CTrail*-operated passenger rail service was reestablished in the corridor in the spring of 2018 following significant investments (\$769.1 million over the life of the New Haven Hartford Springfield (NHHS) program) into infrastructure and equipment. The latter half of the 20<sup>th</sup> century saw significant disinvestment and loss of intercity rail service along

the corridor in conjunction with economic recession. Prior to this, (the 1950s and 1960s) the region was well connected to the Northeast Corridor, as well as north into Massachusetts and Vermont.

Before 2018 Amtrak operated limited regional service over the line to all Hartford Line stations except New Haven / State Street. The new Hartford Line service is jointly operated by Amtrak and CTraill Service. Agreements between MassDOT and CTDOT allow for ticket reciprocity to facilitate these combined operations.

**Figure 5-1** shows the Northeast Corridor passenger rail system depicting location of the Hartford Line and GHMS study area. The Hartford Line serves nine existing rail stations. The Berlin, Hartford, Windsor, and Windsor Locks stations are all within the GHMS study area.



**Figure 5-1: Regional Rail Overview**

*5.3.1.1 Infrastructure and equipment investment (general and highlighting GHMS area stations)*

As noted earlier, significant investments in rail infrastructure and equipment were necessary to allow higher travel speeds and increase system reliability. The work included improvements to track, upgrades to bridges and grade crossings, as well as improvements to existing stations. While a majority of the work has been completed there are still additional track and station projects programmed for the near future. The following section summarizes the work completed to date.

*An **additional five stations** are proposed on the Hartford Line as part of the overall New Haven-Hartford-Springfield Rail Program. **Two of those stations (Newington and West Hartford) would be in the GHMS study area when constructed.***

**Track Improvements:** Historically the Hartford Line was double-tracked; however, in the mid-1980s Amtrak removed approximately 25 miles of one track to reduce the costs for upkeep and maintenance. In a single-track condition, Amtrak operations relied on sidings to facilitate train movements on the line. While managing train movements on a single-track system was possible prior to Hartford Line operations, the increased service density associated with the addition of Hartford Line service would limit speeds and make train movements over the line more difficult. As part of the New Haven Hartford Springfield (NHHS) rail program, CTDOT reinstalled approximately 27 miles of track (MP 7-17, MP 20-31, and MP 37-43) and installed two (2) miles of new passing sidings (MP 37-39) to replace lost double-tracking and accommodate increased service density from the Hartford Line operations. It should be noted that there are plans to complete additional double-tracking between Windsor and the Connecticut/ Massachusetts border where the alignment is still in a single-track configuration.

In addition to new double-tracking, the signal and control systems were upgraded/ replaced to facilitate the inclusion of Positive Train Control (PTC) to meet FRA regulations. A PTC system is designed to prevent train-to-train collisions, ensure that trains are not operated above allowable speeds, and improve the general safety of rail operations. The track upgrades and new signal system now allow for speeds on the line of up to 110 mph over certain sections.

**Bridges and Grade Crossings:** Beyond the track and signal improvements, work completed also

included upgrades to grade crossings and rehabilitation or replacement of some bridges and culverts. The Hartford Line has 30 at-grade crossings over its alignment. Upgrades to existing grade crossings in Wallingford, West Hartford and Windsor helped allow for increases in maximum allowable speeds (MAS) and improved at-grade crossing safety.

**Equipment:** The Hartford Line operates a combination of CTrail diesel push-pull equipment and Amtrak push-pull equipment. The CTrail locomotives are GP40 and P40 diesel locomotives. The GP40s have received top-deck overhauls and complete overhauls to the P40 fleet are currently underway. The CTrail trips operate with leased coaches from the Massachusetts Bay Transportation Authority (MBTA), which are arranged in 4-car sets.

**Drainage and Flooding:** Effective drainage is key to the safe operation of the rail line. The ponding or flow of water over tracks may damage switches, lead to erosion, or generate premature wear to ties and tracks. Drainage and flooding concerns were heavily considered within the NHHS rail program and independently by corridor communities. Despite these recent efforts periodic flooding of tracks persists in certain locations and has led to recent train delays, including August 19, 2021 when five trains were delayed due to flooding.

*Hartford Area Levee System:* Rail lines in the GHMS area, including the Hartford Line, operate within and adjacent to flood hazard areas. In the vicinity of Hartford rail lines (the Hartford Line and six freight

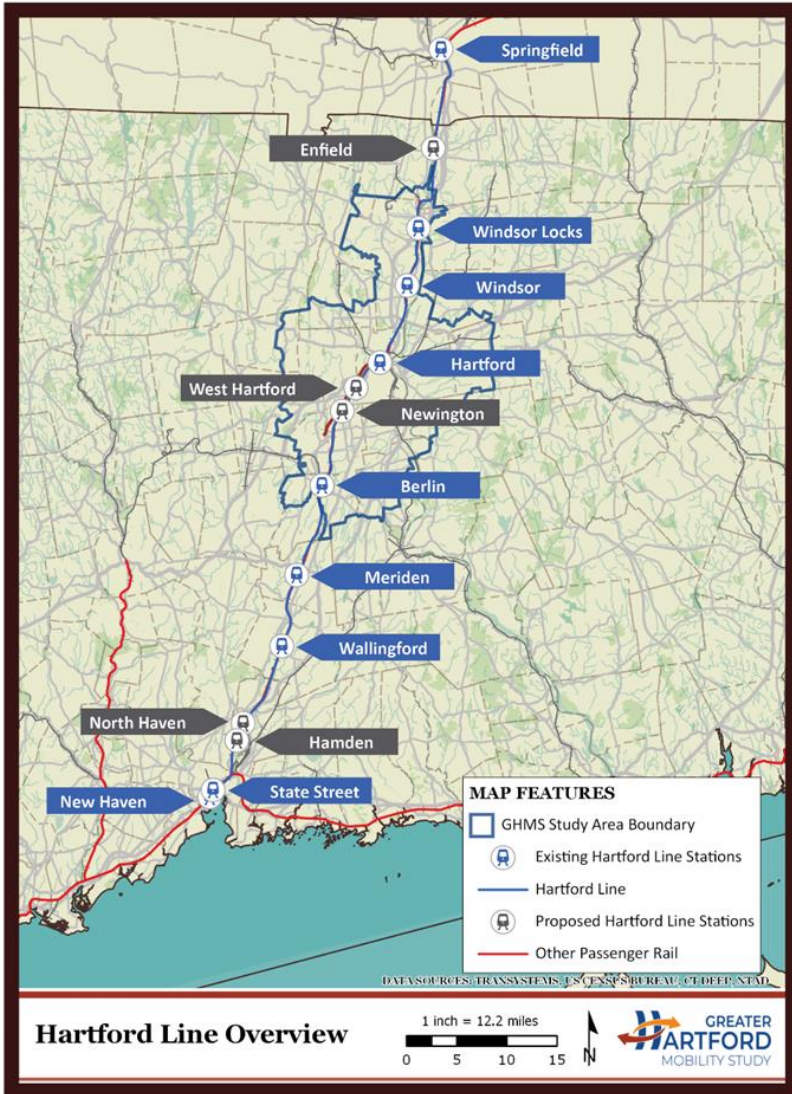
operators) and the roadway network are protected by a levee network on either side of the Connecticut River from Brainard Airport (south) to exit 34 of I-91 (north) where there is a flood control gate. The levee network was developed following catastrophic flooding in the mid-1930s, construction of the dikes began in 1938 and were completed in 1944, an additional two pumping stations and an auxiliary conduit were completed in 1981. There are five gates on the west side of the river and two on the east. Flood control gates exist where there is gap in the levee to allow either a roadway or rail line to pass through and can be closed to prevent flooding in protected areas.

**Stations and Platforms:** As previously mentioned, the Hartford Line currently serves nine stations between New Haven / Union Station and Springfield / Union Station as shown in **Figure 5-2**. This includes

two stops on the New Haven Line, seven on the Hartford Line proper, and its northern terminus in Springfield MA. Five additional stations are proposed to be constructed in Connecticut as part of the New Haven-Hartford Springfield Rail Program, as well as potential service extension further north to Greenfield, Massachusetts, at the current northern terminus of Amtrak's Valley Flyer service.

**Table 5-1** highlights improvements by station.

***Most stations along the Hartford Line have either been recently reconstructed or undergone extensive renovations to expand station amenities and improve access. The only existing stations which have not received upgrades are Windsor and Windsor Locks: however, reconstruction at both of these sites to include additional amenities and high-level platforms is programmed in the Capital Plan.***



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**Figure 5-2: Hartford Line Overview**

**Table 5-1: Summary of Station Improvements**

| <b>Station</b>                 | <b>Improvements</b>  |
|--------------------------------|--|
| <b>Springfield</b>             | Springfield Union Station was reconstructed through a combination of federal and state contributions. The interior and exterior of the building were refurbished to bring the site into a SOGR while maintaining key historic features. The renovation also included the creation of an intermodal bus hub and a new parking garage.       |
| <b>Windsor Locks</b>           | Windsor Locks Station has not yet been reconstructed or improved. Funding for station reconstruction is available and final designs are in process. The new design includes additional parking, high-level platforms, and a dedicated bus transfer zone. An illustrative plan for the station can be seen in Figure 5-14.                  |
| <b>Windsor</b>                 | The construction of a new Windsor Station is currently in progress. The design includes additional parking and high-level platforms. The station renovations are integrated with the town's TOD plan (an overview of this plan can be found in Section 5.7.3).   |
| <b>Hartford</b>                | Prior to Hartford Line operations, the platform area received upgrades to its infrastructure that include high-level platform structures which can retract to facilitate oversized freight movement. The station also received upgrades to its amenities including a new passenger information system, benches, and security improvements. |
| <b>Berlin</b>                  | The Berlin station was reconstructed as part of the NHHS rail program and opened in October 2018. The station now includes significantly increased parking availability, high-level platforms, and a pedestrian overpass.  |
| <b>Meriden</b>                 | The Meriden station was reconstructed as part of the NHHS rail program and opened in November 2017. The station includes parking for approximately 65 vehicles (below current CTDOT 200 vehicle standard), high-level platforms, and a pedestrian overpass.  |
| <b>Wallingford</b>             | The Wallingford station was reconstructed as part of the NHHS rail program and opened in November 2017. The station now includes increased parking availability, high-level platforms, and a pedestrian overpass with an elevator.   |
| <b>New Haven State Street</b>  | The State Street station received upgrades to its platforms and station facilities including a new 344-foot ADA compliant high-level platform for Track 1. The renovations to this station were completed in January 2019.   |
| <b>New Haven Union Station</b> | There are currently no major improvements planned for the station as part of ongoing work on the Hartford Line.  |

**Parking:** This section provides a broad overview of parking at all stations along the Hartford Line as well as a more in-depth assessment of parking conditions in and around Hartford Union Station. Parking operations vary along the line with the more urban and higher demand stations having a pay-to-park

model and the less urban stations providing free parking. To align with CTDOT policy, all renovated stations were upgraded to a minimum of 200 spaces, with only Windsor and Windsor Locks currently below this threshold. **Table 5-2** provides an overview of parking availability by station.

**Table 5-2: Parking Capacity and Fee Structure**

| Station                        | Capacity       | Annual Permit Fee | Monthly Parking Fee | Daily Parking Fee |
|--------------------------------|----------------|-------------------|---------------------|-------------------|
| <b>Springfield</b>             | 377            |                   | \$95.00             | N/A <sup>1</sup>  |
| <b>Windsor Locks</b>           | 30             | N/A               | N/A                 | N/A               |
| <b>Windsor</b>                 | 22             | N/A               | N/A                 | N/A               |
| <b>Hartford</b>                | 200            |                   | \$90.00             | \$15.00           |
| <b>Berlin</b>                  | 235            |                   | \$20.00             | \$2.00            |
| <b>Meriden</b>                 | 65 (surface)   |                   | \$20.00             | \$2.00            |
|                                | 225 (garage)   |                   | \$20.00             | \$2.00            |
| <b>Wallingford</b>             | 221            |                   | \$20.00             | \$2.00            |
| <b>New Haven State Street</b>  | 0 <sup>2</sup> |                   |                     |                   |
| <b>New Haven Union Station</b> | 1,135          | N/A               | \$97.00             | \$14.00           |

**Hartford Union Station Parking Availability<sup>3</sup>**

A parking assessment for the study area was performed to determine the inventory of existing parking near Hartford Union Station. As part of the parking assessment, previous parking studies of the

area were reviewed along with existing public parking within a quarter mile of Union Station.

The capacity of parking was determined based on access to public users, not including private or

<sup>1</sup> Springfield Union Station uses the Union Station Garage which does not offer daily rates, the garage offers hourly and monthly rates and a separate monthly commuter rate.

<sup>2</sup> There are no dedicated spaces for the State Street station and the location only offers a drop-off/pick-up zone. However, there are several proximal parking alternatives.

<sup>3</sup> For additional information on Hartford Union Station and its inter-modal connectivity please see chapter 9.

reserved parking areas. In addition, pricing information was obtained to provide a comprehensive assessment of parking near Union Station.

In the past 11 years, three parking studies were conducted to address parking near Union Station. These reports produced varying results across a variety of study areas. The major results of these studies are detailed below. In addition, a comprehensive city-wide parking study is currently underway in Hartford.

**The Northwest Corridor Transit Planning Project Part 2 – Union Station Planning: Final Report**, prepared by TranSystems in 2010, analyzed the parking capacity near Union Station with the purpose of comparing development alternatives in the area. The report determined there to be 1,484 parking spaces in lots/garages and 137 on-street spaces within 1/3 mile from Union Station accessible to patrons.

**The Analysis, Needs, and Deficiencies Report**, prepared by the I-84 Hartford Program Management Team in 2015, reviewed the amount of parking in a study area that included Union Station. According to the report, the Union Station/Spruce Street lot has 215 public spaces that are on average 95% utilized. It further indicated that lots on Church Street and High Street add 288 more public parking spaces. The Church Street lot recorded a low utilization (just 10%) during this survey and at the time of review the High Street lot was evening parking only and utilization wasn't calculated.

**The I-84 Multimodal Station Parking Demand Memorandum**, prepared by the I-84 Hartford Program Management Team in 2018, assessed the parking around Union Station as part of the planning for a new multimodal station. To that end, the memorandum reviewed parking needs and capacity for all modes of travel planned for the station. The memorandum reported 889 publicly accessible parking spaces within ¼ mile radius of Union Station but noted that some lots are only available to monthly or evening users.

#### *5.3.1.2 Capacity*

There are eight (8) publicly accessible parking areas within ¼ mile of Hartford Union Station, totaling 2,793 parking spaces. **Table 5-3** provides a summary of the parking capacity and pricing information for these parking areas. Of these areas, two are garages with monthly rates, while the remaining six (6) lots are available for daily or monthly use.

The closest parking area to Union Station is the Spruce Street lot adjacent to the station. As summarized in **Table 5-3**, the Spruce Street lot has a capacity of 200 parking spaces and a maximum daily rate of \$15. There are another 100 spaces across the street at the Church Street lot and an additional 80 parking spaces at the High Street lot behind the station. These lots are all within 150 yards of the station or less than a tenth of a mile.

There are approximately 232 metered spaces within a ¼ mile directly around the station. These spaces are



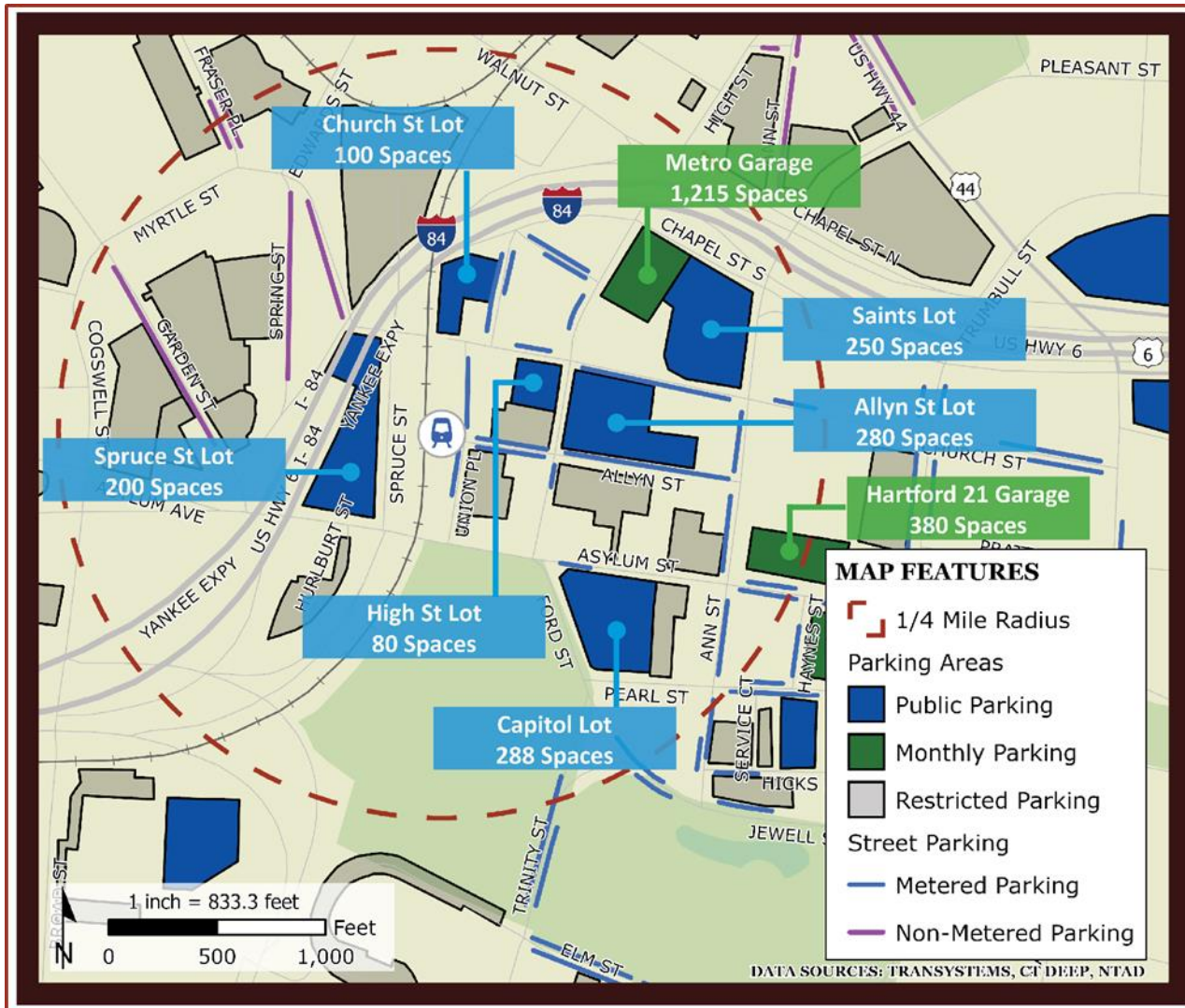
part of the Pay to Park system in downtown Hartford. The rate for on-street parking is \$0.25 per 15 minutes, with a two-hour time limit. On-street parking is free of charge after 6 PM and on weekends. While it is unlikely that metered on-street parking would be used by commuters these spaces could be used by individuals waiting for drop-off or pick-up.

The abundance of parking in the ¼ mile area, while shared with non-transit users, is more than sufficient for the current outbound usage of Hartford Union Station. Both an excess of parking or insufficient parking could negatively affect rail and transit use and

the efficiency of the rail station. The negative influence of insufficient parking is particularly true for those users who generally live outside of what is considered walking distance (¼ mile to ½ mile) from the station and who are seeking longer distance intercity travel services at Union Station. On the other hand, an excess of parking encourages users to drive, rather than consider transit for their connecting trip, because parking is easily available and private automobiles are generally considered more convenient than transit. Finding the balance between excess and inadequate parking is key to accommodating riders and encouraging transit use at Union Station.

**Table 5-3: Hartford Union Station Parking (1/4<sup>th</sup> mile)**

| Name                      | Address       | Capacity | Daily Fee | Monthly Fee | Notes        |
|---------------------------|---------------|----------|-----------|-------------|--------------|
| <b>Church St Lot</b>      | 460 Church St | 100      |           |             |              |
| <b>Spruce St Lot</b>      | 2 Spruce St   | 200      | \$15      | \$90        |              |
| <b>High St Lot</b>        | 409 Church St | 80       |           |             |              |
| <b>Allyn St Lot</b>       | 180 Allyn St  | 280      |           | \$115.92    |              |
| <b>Saints Lot</b>         | 285 Church St | 250      |           | \$116.60    |              |
| <b>Capitol Lot</b>        | 10 Ford St    | 288      |           | \$132.94    |              |
| <b>Metro Garage</b>       | 350 Church St | 1215     | -         | \$191.43    | Monthly Only |
| <b>Hartford 21 Garage</b> | 210 Asylum St | 380      | -         | \$242.92    | Monthly Only |



**Figure 5-3: Hartford Union Station Parking Availability**

*5.3.1.3 Level of service (general and highlighting GHMS area stations)*

***The existing service on the Hartford Line is a result of the significant investments to improve the operating condition of the line which now allow for speeds up to 110mph and travel between New Haven and Springfield in as little as 81 minutes.***

However, the CTrail equipment and leased MBTA coaches are not permitted to reach the line's MAS (maximum allowable speed) and may only travel at up to 80mph, while Amtrak equipment is permitted to reach the line's 110mph MAS. The level of service varies along the line, with the New Haven to Hartford portion receiving a higher level of service than those stations north of Hartford. Most CTrail trips terminate/originate in Hartford and therefore do not continue to Windsor, Windsor Locks, or Springfield. All of the Amtrak trips continue to Springfield as part of Amtrak's regional services. In total 70% of Hartford Line trips continue to terminate in Springfield.

The information provided below presents the line's pre-pandemic operations and is based on a schedule published in November 2019.<sup>4</sup> The Hartford Line

operates with 17 northbound trips servicing Hartford, with 12 of those continuing onto Springfield. There are 16 southbound trips with 11 originating in Springfield: the remaining trips originate from Hartford. This means that stations in the southern portion of the study area (Berlin and Hartford) receive a higher level of service than those in the northern portion (Windsor and Windsor Locks). Windsor and Windsor Locks each receive one additional trip in the southbound and northbound directions compared to Springfield. These trips were added to the November 2019 schedule and do not appear on previous schedules.

Headways for trips vary for both inbound and outbound trains given the service frequency noted above. Headways for outbound trains terminating in Hartford range between 40 minutes and 1 hour 26 minutes with a service gap of nearly four hours between 11:35 am and 3:26 pm.

Headways for Springfield-terminating trips are between 37 minutes and 1 hour 23 minutes. The first Springfield-terminating train does not depart New Haven until 8:15 am for a 9:47 am arrival in Springfield.

Trips between New Haven and Hartford average 52 minutes and trips between New Haven and Springfield are between 1 hour 23 minutes and 1 hour 32 minutes. The durations of equivalent southbound trips are similar. An automotive trip between New Haven

<sup>4</sup> Beginning in March of 2020 stay-at-home orders results from the COVID-19 pandemic led to significant decline in ridership leading to service modifications.

and Hartford during the peak AM period is estimated between 40 and 50 minutes depending on traffic, and an automotive trip between New Haven and Springfield during the same period is estimated at 1 hour to 1 hour 15 minutes.

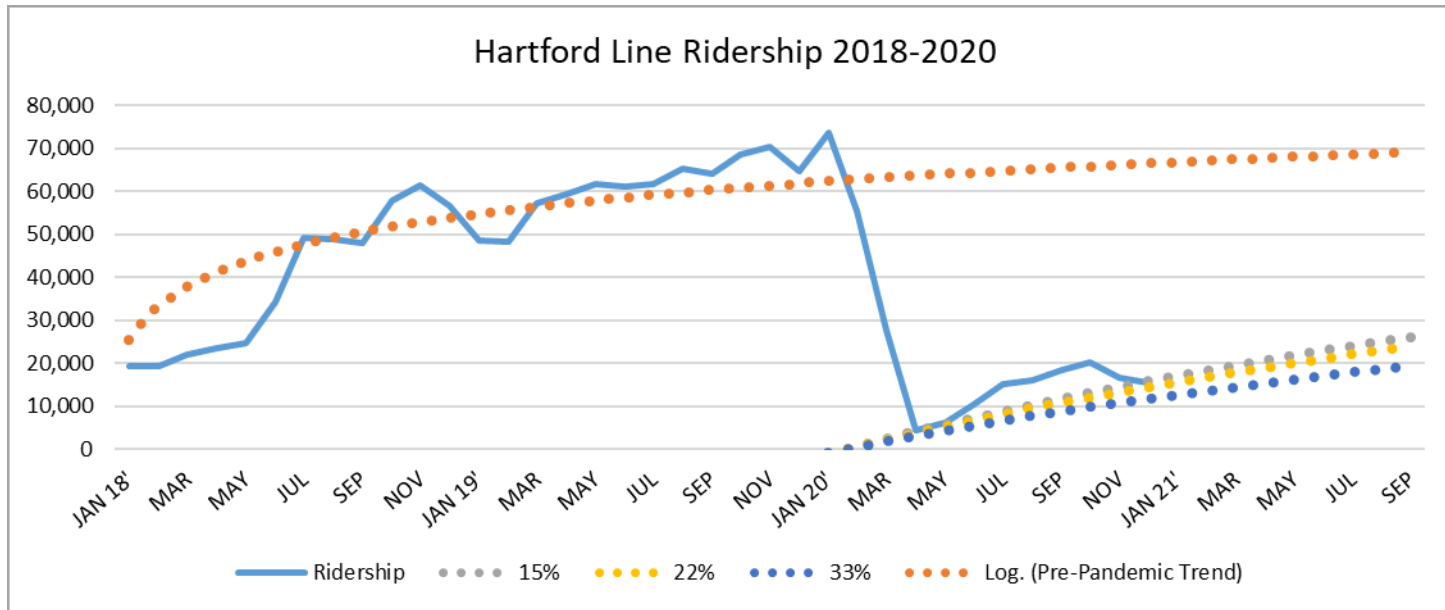
***The travel times between New Haven and Hartford are almost similar for rail and auto trip, making rail as a reliable and competitive alternative.***

#### **5.3.1.4 Ridership**

While the COVID-19 pandemic (beginning in March 2020) has significantly altered rail and transit ridership in the short-term, including on the Hartford Line, the Hartford Line had seen successive years of ridership growth since its inception. During the first year of operation, ridership exceeded pre-operation projections and served a monthly average of 50,000 riders. The following year (2019) the line averaged 60,882 riders per month and around 730,000 for the year. Moreover, January of 2020 saw the highest single-month ridership with more than 73,000 riders. Between June 2018 and January 2020 ridership grew by 114.65%.

The graph below (**Figure 5-4**) portrays Hartford Line ridership between January 2018 and December 2020. The logarithmic trend lines are the results of modeling pre-pandemic ridership, as well as the application of research from Virginia published in the summer of

2020. The Northern Virginia Transportation Authority engaged in a scenario planning exercise to explore possible futures resulting from the disruption caused by the COVID-19 pandemic. A key metric in their modeling was work-from-home trends and the role of a decreased commuter base on future transit ridership. Across their three modeled recovery scenarios, looking out to a 2025-time horizon, the projections indicated the possibility for 15%, 22%, and 37% reductions due to differing levels of continued work-from-home. These values for reduced future ridership were then used to forecast possible future ridership on the Hartford Line given the continued increase in work-from-home scenarios.



**Figure 5-4: Hartford Line Monthly Ridership (2018-2021)**

Data Source: CTDOT Office of Rail and AECOM Analysis

It is important to note that projections of this type are highly sensitive to the limited existing data and do not account for additional variables. The actual recovery of ridership will continue to evolve based on changes in infection rates and increasing vaccination levels, among other factors. Additionally, the work-from-home methodology only captures one type of rider, the daily commuter, and does not account for more regional use of the line. What should be understood about the Hartford Line is that before the onset of the COVID-19 pandemic the line was 1) doing well, 2) growing, and 3) had just seen its single highest

ridership month. The pre-pandemic trend line attempts to approximate what current (2021) ridership may have been if there had been no dip associated with the pandemic. Additionally, the three recovery trend lines attempt to provide some insight as to how ridership levels may evolve over the short term (September 2021). Additional research around these trends is ongoing as the situation rapidly evolves. The state is actively working on creating new longer-term forecasts as they work to update the State Rail Plan and continue projects under CTrail Strategies.

### 5.3.2 Hartford Line Intercity Service

Beyond the joint services operated by *CTrail* and Amtrak between New Haven and Springfield, Amtrak also operates intercity service which connects the New York City market to Vermont, as well as eastern (Boston) and western (Pittsfield) Massachusetts. A majority of the Amtrak trips made over the line as part of Hartford Line service (northbound) are part of Amtrak's regional service. The corridor is part of a larger regional rail network, which affords connections throughout the Northeast and across the country over Amtrak's national service network.

#### 5.3.2.1 Level of Service

Before operation of the Hartford Line, Amtrak services allowed for limited connections along the corridor through their *Vermont* and *Valley Flyer* services. While not designed as a commuter system it was possible to commute via Amtrak's regional service. All of the original Hartford Line Stations (excluding State Street) were serviced daily by Amtrak trips along the corridor.

The map below (**Figure 5-5**) depicts Amtrak's regional rail network. Services that interface with the Hartford Line include *Acela* (Northeast Corridor), and *Lake Shore Limited*. Services that operate over the Hartford Line include Amtrak Hartford Line (trips included in the Hartford Line schedule), *Northeast Regional*, the *Valley Flyer*, and the *Vermont*. These services provide connections throughout the Northeast and to Amtrak's national rail network.

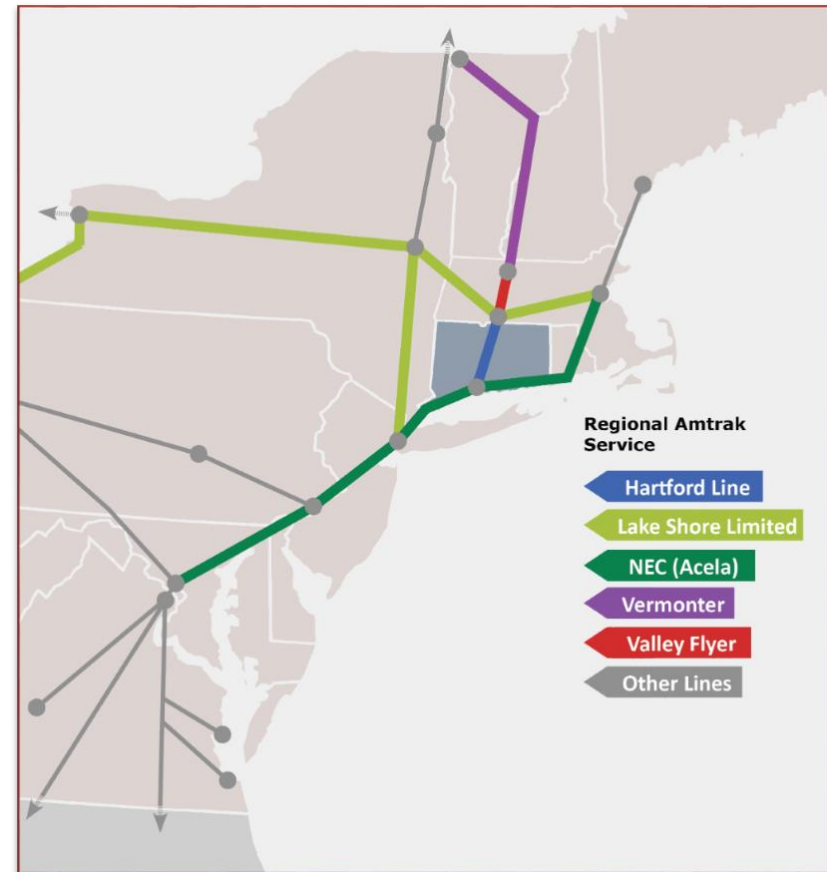
**Acela (NEC):** The *Acela* is the primary Amtrak connection along the Northeast Corridor (NEC) and provides limited-stop service between Washington DC and Boston Massachusetts. The service includes a stop at Union Station in New Haven which facilitates connections to other Amtrak services and the Hartford Line.

**Lake Shore Limited:** The *Lake Shore Limited* provides daily service between Chicago Illinois and Boston Massachusetts and is currently the only rail connection between Springfield and Boston. One eastbound and one westbound trip are operated daily. Travel time between Chicago IL and Boston MA is 19 hours, while travel time on the service between Springfield MA and Boston MA is 2 hours 30 minutes.

**Valley Flyer:** The *Valley Flyer* operates as a regional connection along the Knowledge Corridor between New Haven, CT, and Greenfield, MA with trips seven-days per week. Travel time between New Haven and Greenfield is 2 hours 48 minutes.

**Vermont:** The *Vermont* is an intercity city service that operates daily between Washington DC and St. Albans Vermont. Travel time between the two termini is 13 hours 45 minutes.

**Hartford Line (Amtrak trips):** The Hartford Line service consists of CTrail-operated trains and Amtrak-operated trains with ticket reciprocity between the two providers over the line. Amtrak operates 8 northbound trips and 8 southbound trips, and unlike the CTrail trips, all of the Amtrak-operated trips continue to Springfield as opposed to terminating in Hartford or Windsor Locks. The Amtrak trips operated over the Hartford Line are part of Amtrak’s Northeast Regional Service. Northeast Regional service provides intercity service across the northeast, traveling as far south as Virginia Beach and as far north as Boston MA.



**Figure 5-5: Amtrak Regional Rail Network**

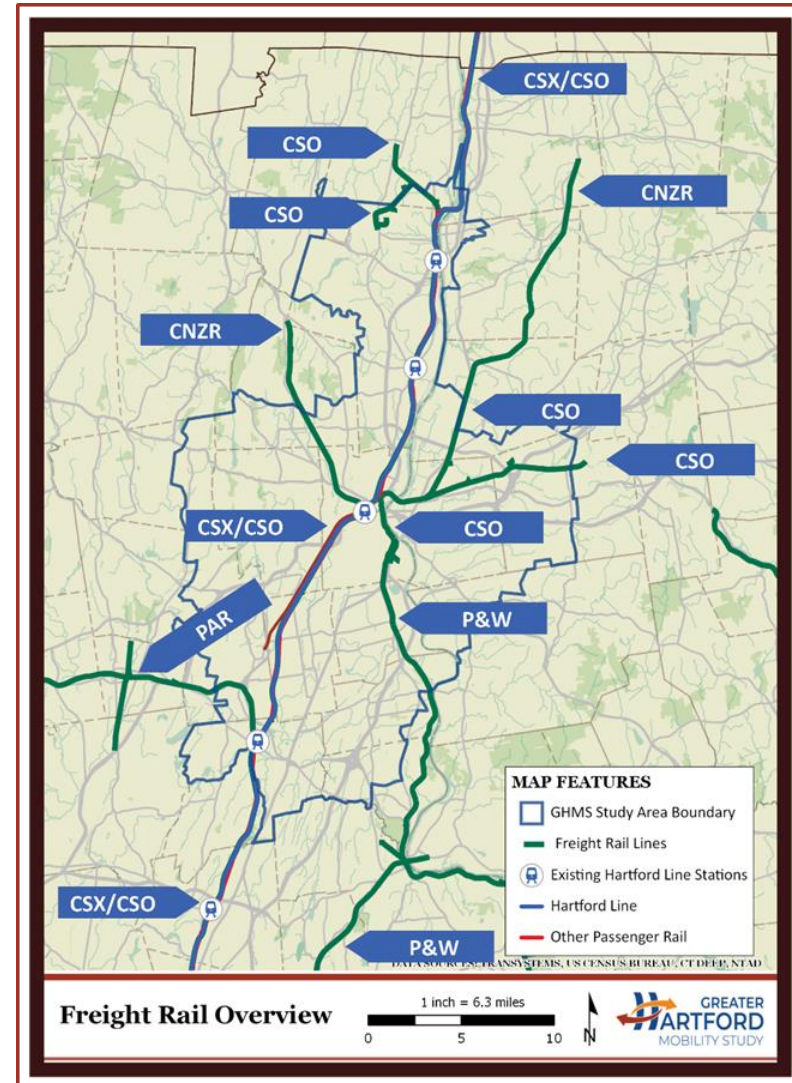
### 5.4 Freight Rail Operation

Freight rail is operated throughout the state and includes operations over passenger lines, including the Hartford Line and Northeast Corridor (NEC), as well as private branches. Freight rail is used as a more efficient alternative to truck freight to move large quantities of bulk goods. Within the GHMS study area, all of the freight lines connect to the Hartford Line with interconnections in Berlin, Hartford, and Windsor Locks.

**Figure 5-6** provides an overview of freight rail operators within and adjacent to the GHMS study area.

There are currently six different freight rail providers operating in the GHMS study area.

- Pan Am Railways Inc. (PAR)
- Canadian National Railway (CNR)
- Connecticut Southern Railroad (CSO)
- CSX
- Central New England Railroad (CNZR)
- Providence and Worcester Railroad Company (P&W)



**Figure 5-6: Freight Rail Overview**



**5.4.1 Goods Movement**

Freight coming into Connecticut generally includes crushed stone (gravel and sand), primary metal products, grains and food products, lumber, pulp and paper products, chemicals, and petroleum. Outbound rail freight primarily consists of construction and demolition debris (wood debris, flooring, roofing,

etc.), which is first processed for recyclables then transported to the Midwest where the non-recyclable content is disposed of in large landfills. The future matrix of inbound and outbound goods will be dependent on changing market conditions within the state as well the continuity between the state and national freight rail systems. **Table 5-4** highlights top commodities carried by each freight operator.<sup>5</sup>

**Table 5-4: Top Commodities by Freight Operator (Placeholder – To be Completed)**

| Railroad                                 | Top Commodities |
|--|-----------------|
| <b>Providence and Worcester Railroad</b> |                 |
| <b>Connecticut Southern Railroad</b>     |                 |
| <b>Central New England Railroad</b>      |                 |
| <b>CSX</b>                               |                 |
| <b>Pan Am Railways</b>                   |                 |
| <b>Canadian National Railroad</b>        |                 |

Source: xxxx

<sup>5</sup> A more complete assessment of freight operations is on pause pending the initiation of the State Freight Study in

line with the State Rail Plan. This is being done to prevent the duplication of efforts in the collection of similar data.

**Table 5-5** presents the tonnage moved by the different operators between 2005 and 2010.

**Table 5-5: Freight Tonnage Moved in Connecticut (2005-2010)**

**(Placeholder - to be updated with recent data upon initiation of State Freight Study)**

| Freight Carrier                    | 2005             | 2006             | 2007             | 2008             | 2009             | 2010             |
|------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Pan Am Southern Railway (estimate) | 223,860          | 223,860          | 223,860          | 223,860          | 223,860          | 223,860          |
| Providence & Worcester RR          | 1,850,000        | 1,850,000        | 1,850,000        | 1,850,000        | 1,853,000        | 2,005,000        |
| CSX Transportation                 | 1,105,000        | 1,081,200        | 994,500          | 956,250          | 810,000          | 810,000          |
| Central New England RR             | 181,730          | 181,220          | 181,730          | 172,321          | 189,000          | 162,000          |
| Connecticut Southern Railroad Co.  | 2,210,000        | 2,252,500        | 2,210,000        | 2,125,000        | 1,710,000        | 1,710,000        |
| Housatonic RR                      | 513,480          | 530,880          | 512,040          | 412,560          | 305,880          | 339,240          |
| New England Central RR             | 1,066,700        | 1,160,600        | 1,024,427        | 1,085,782        | 950,000          | 980,000          |
| Tilcon/BSRR (estimate 2009/2010)   | 2,500,000        | 2,200,000        | 1,800,000        | 1,600,000        | 1,400,000        | 1,300,000        |
| <b>Total</b>                       | <b>9,650,770</b> | <b>9,480,260</b> | <b>8,796,557</b> | <b>8,425,773</b> | <b>7,441,740</b> | <b>7,530,100</b> |

Note: Naugatuck RR currently hauling less than 10,000 tons/year. Valley RR currently hauls for internal use only.

Source: CTDOT Connecticut State Rail Plan, 2012

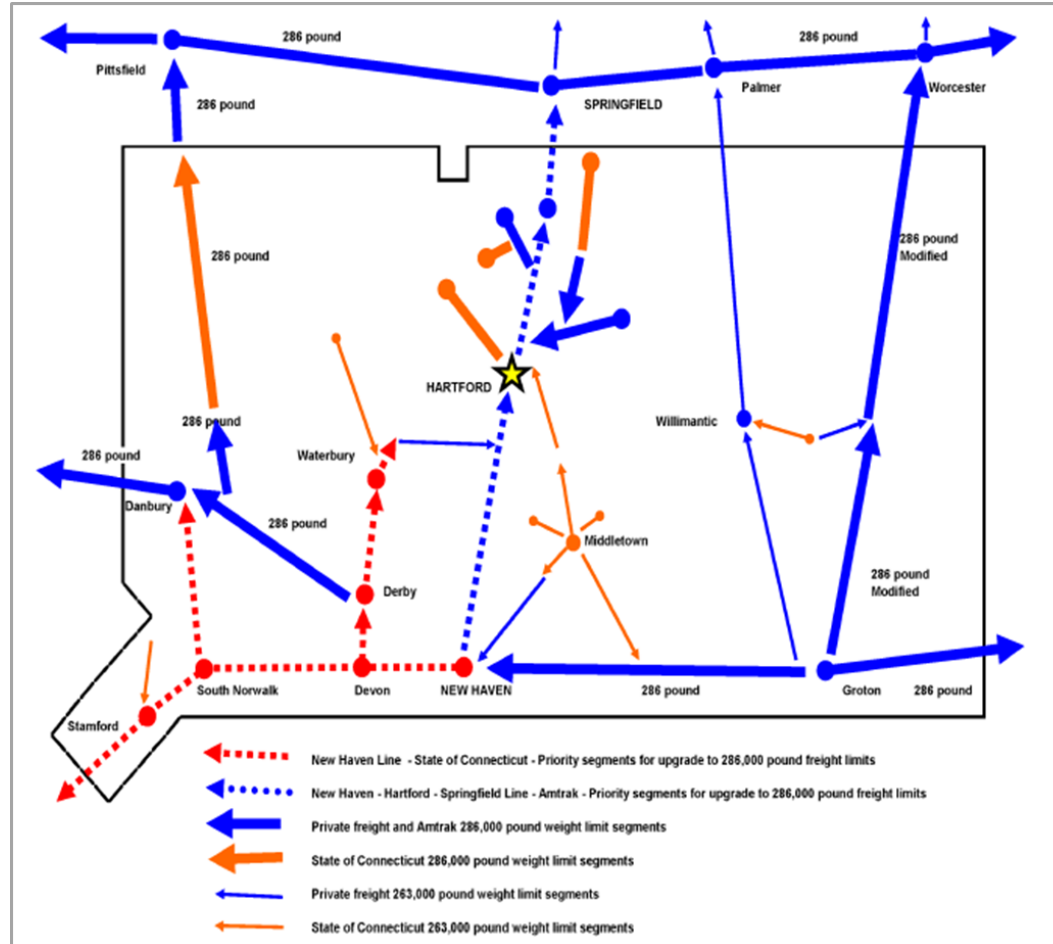
#### 5.4.2 System Capacity

The last State Rail Plan (2012) emphasized the need to address the weight capacity of the system to allow the Connecticut rail system to better integrate with the national freight network. The current national standard for freight rail is 286,000 pounds per car (also known as 286k), and in some instances this is being increased to 315,000 pounds per rail car. Rail lines that do not meet this standard are economically disadvantaged because operators are not able to

transport the same quantity of goods over the lower weight class territory, either making the shipping more expensive or unfeasible to use the system entirely. Under public ownership, both the Hartford Line and New Haven Line are not cleared for 286k capacity. While the track work undertaken as part of the NHHS Rail Program did lift certain sections up to the 286k standard there are still a significant number of structures over 100 years old which do not meet the standard, including the Connecticut River Bridge

in Windsor Locks. **Figure 5-7** provides a summary of freight rail weight classes statewide as well as

investment prioritization from the previous State Rail Plan.

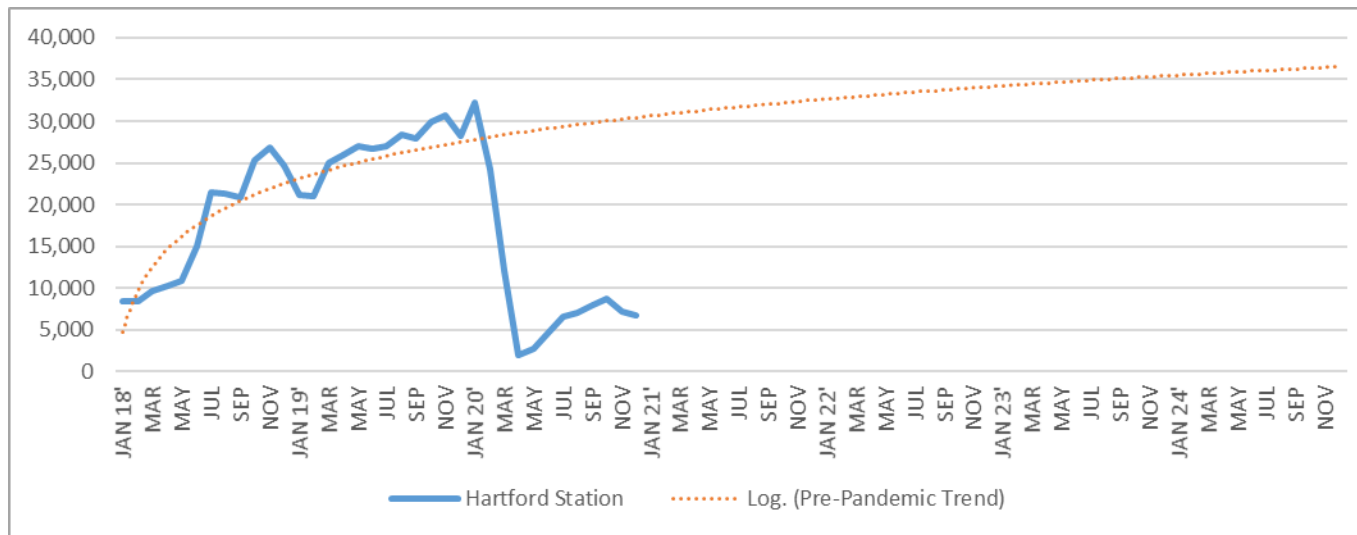


**Figure 5-7: Freight Rail 286K Upgrade Prioritization (2012 State Rail Plan)**

### 5.5 Hartford Union Station Ridership

The following section focuses on station boardings and alightings for the Hartford Union Station. The role of the station as a multimodal hub is discussed in Chapter 9. Boardings and alightings provide context for a given station’s use against broader ridership data (i.e. highlighting which stations see the greatest traffic).

Existing pre-pandemic data indicates that approximately 318,000 people boarded and alighted at Hartford Union Station in 2019 accounting for 43.6% of total Hartford Line ridership. Estimated monthly boardings and alightings at Hartford Union Station are shown in **Figure 5-8**.



**Figure 5-8: Estimated Hartford Union Station Boardings and Alightings (2018-2020)**

### 5.6 CTrail Future Service Plans

The Greater Hartford Mobility Study (GHMS) will become part of the broader collection of work that guides Connecticut’s investments and directions for its transportation system. The rail infrastructure within the GHMS study area will also be guided by the ongoing State Rail Plan Update, work completed under CTrail Strategies, as well as existing programmed investments. The following section summarizes future plans and investments as they relate to the Hartford Line to better understand how the GHMS can build on and support these efforts.

#### 5.6.1 Review of Existing Programmed Investments

While the Hartford Line has recently undergone nearly \$1 billion in improvements over the last decade, there are still additional investments planned or programmed to improve infrastructure, upgrade stations, and the possible construction of additional stations (**Table 5-6**).

#### 5.6.2 Future Rail Plans

Beyond existing programmed investment there are broader visions for rail improvement both within the state and regionally. Connecticut’s vision focusses on increasing the speed and density of rail service within the state network, while regional goals focus on the northeast as a single rail system with opportunities for modernization and improved efficiency.

**Table 5-6: Estimated Capital Costs for Proposed Hartford Line Improvements**

| Project Name  | Est. Cost              |
|---|------------------------|
| <b>Connecticut River Bridge Replacement – Windsor Locks, CT</b>                           | \$300 Million          |
| <b>Hartford Line - 12 Miles of double-tracking (Windsor to MA line)</b>                   | \$120 Million          |
| <b>Hartford Rail Viaduct</b>  | \$120 to \$150 Million |
| <b>CTrail New Rail Equipment (Initial 60 rail coaches followed by additional coaches)</b> | \$600 Million          |
| <b>New Rail Stations and Rail Station Improvements – Hartford Line (programmed)</b>       | <b>\$381 Million</b>   |
| <i>Windsor Locks Station</i>  | <i>\$67 Million</i>    |
| <i>Enfield Station</i>  | <i>\$70 Million</i>    |
| <i>North Haven Station</i>  | <i>\$52 Million</i>    |
| <i>Newington Station</i>  | <i>\$52 Million</i>    |
| <i>West Hartford Station</i>  | <i>\$70 Million</i>    |
| <i>Windsor Station</i>  | <i>\$60 Million</i>    |

### 5.6.2.1 Local Plans

**Pending additional information from the State Rail Plan Update.**

### 5.6.2.2 Regional Initiatives

The following regional initiatives are presented below because their proposals and visions either directly overlap the GHMS study area or affect operations on the Hartford Line corridor.

**NEC FUTURE:** The Northeast Corridor (NEC) is the general name for the rail alignment between Washington DC and Boston Massachusetts. Along this alignment, both regional and inter-city services are operated. NEC Future, the FRA sponsored Tier I EIS, has worked to establish a comprehensive vision for investment along the corridor to improve and modernize rail services. The selected alternative (see **Figure 5-9**) would allow for increased trips during peak hours, faster trip times, better job accessibility, reduced net pollutants and energy use, and better access to the region's airports.



**Figure 5-9: NEC FUTURE Selected Alternative Overview**

**East West Rail:** East West Rail is Massachusetts’s rail initiative to strengthen the rail connection across the state between Pittsfield and Worcester with a particular emphasis on the Springfield to Worcester connection (**Figure 5-10**). The initiative brings with it the possibility for a viable inland route between New Haven and Boston and would reduce the current inland travel time from 3hrs 51min to 2hrs 58min (for the fastest alternative, ultimately travel times will vary based on the final selected alternative). Projected capital costs for the proposed alternatives range between \$2.4 billion and \$4.6 billion (depending on the final selected alternative).

The study presented a preliminary investigation of possible alternatives and concluded with a series of recommendations to further understand the impacts of an expanded East West rail connection. Recommendations for further work included: additional coordination with CSX (freight operator and ROW owner), a detailed economic and community benefits study to more accurately capture the regional impact of the proposals, and an investigation of governance options for the potential rail service since is outside of MBTA jurisdiction and MassDOT is not equipped to be a rail operator.

**North Atlantic Rail Initiative:** The North Atlantic Rail initiative (**Figure 5-11**) is a regional vision to increase the capacity and capabilities of the entire region’s rail network and builds its argument on job creation, climate action, economic development, reduction of congestion, and travel efficiency, and

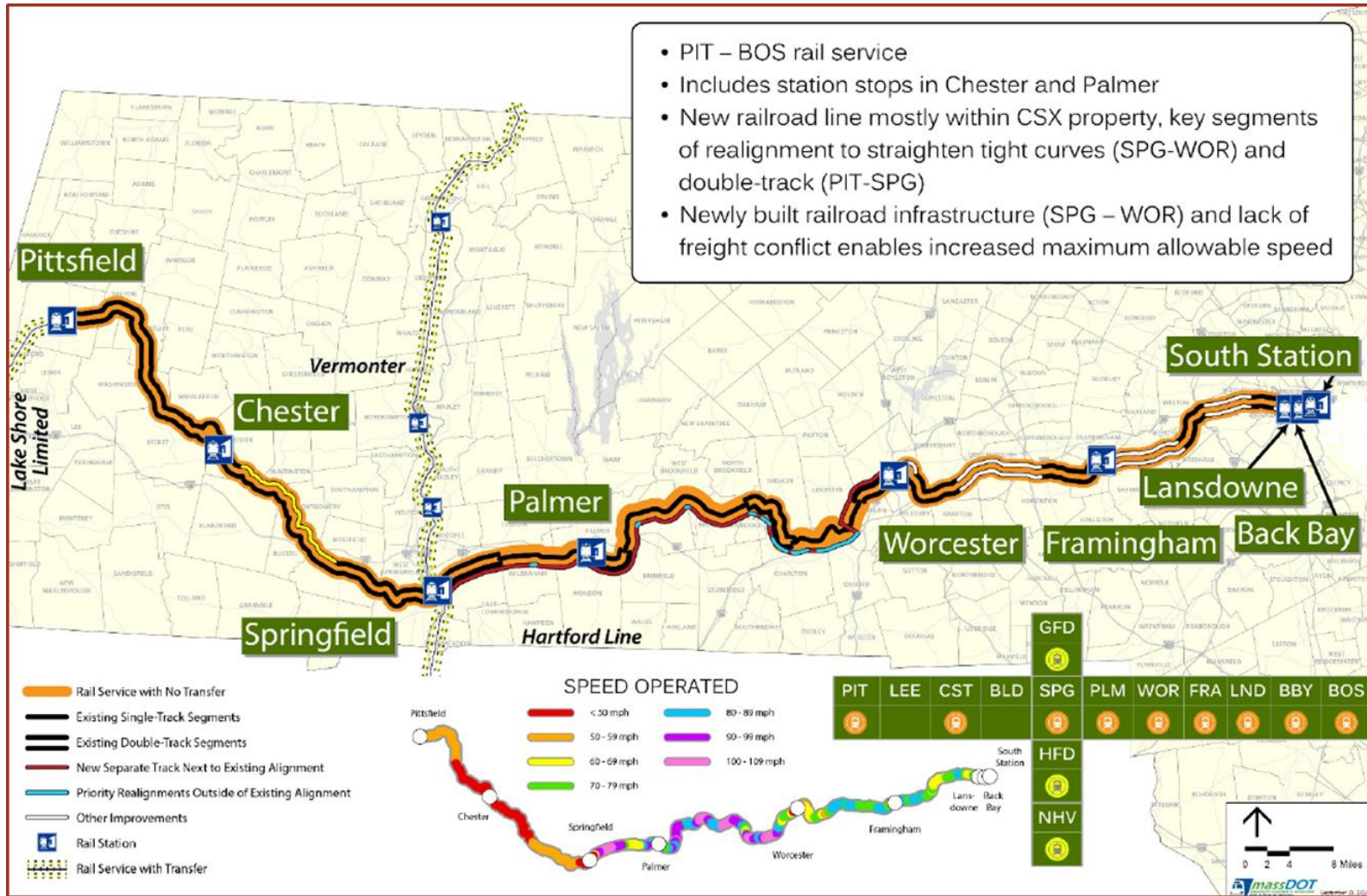
public health and housing affordability. The North Atlantic Rail initiative has been developed out of Reboot New England and is led by a group of public and private-sector regional leaders and rail advocates.

The initiative proposes investments across 5 categories and would roll out in three phases.

- High-Speed Rail
- Infrastructure
- Equipment Acquisition
- Operational Improvements
- Service Expansion

Phase I: Early Action Projects (\$35 billion) Early action projects are intended to focus on state of good repair concerns along the New Haven Line, finalizing working along the Hartford Line and establishing an East West regional rail connection.

Phase II: Completing High-Speed Rail (\$50 billion) This phase would work to establish a truly highspeed rail connection between New York and Boston, including a tunnel under Long Island Sound and a new alignment between Hartford, CT, and Providence, RI. The improvements would generate an estimated travel time between 90 and 100 minutes (NYC to Boston), far surpassing the travel time currently available on the NEC.



**Figure 5-10: MassDOT East West Rail Alternative 4/5 Overview**

Source: MassDOT East-West Passenger Rail Study



Phase III: Connecting the Dots (\$20 billion) This phase focuses on building out beyond the core alignment, including connections from Danbury to Pittsfield and Springfield to Brattleboro. This phase would bring increased rail access to regional mid-size areas and create a more contiguous regional rail system.

**The Economic Benefits of Regional Rail Investment in Metro Hartford-Springfield:** This study, initiated by the Capital Region Council of Governments (CROCG), presents a business case for completing Hartford Line improvements and the implementation of the Massachusetts East-West Rail project discussed above. The combination of completing Hartford Line improvements and the East-West rail initiative would reestablish a 21<sup>st</sup> century equivalent of the historic inland rail connection between New York City and Boston through Hartford, Springfield, and Worcester. These improvements are estimated to cost between \$6 and \$9 billion and would generate a projected \$47 to \$84 billion in new Regional Domestic Product (GDP) over a 30-year period. Additionally, the improvement would lead to significant growth in both housing units and commercial square footage.



**Figure 5-11: North Atlantic Rail Initiative Phase 1 to 3**

## 5.7 Transit Oriented Development (TOD) and Land-Use Impacts

Any changes to *CTrail* service or the location of stations would impact the surrounding land uses of communities. Often this means seeking ways to leverage the positive attributes of increased transit to encourage Transit Oriented Development (TOD). These developments are characterized by dense and mixed-use structures centered on the transit station and well connected to other modes (bicycle, pedestrian, and bus-transit). Historically, many communities in Connecticut would have met today's definitions of TOD. However, with development of the interstate system and penetration of cars, transit services were reduced, tracks were removed, and many moved away from the urban centers. With a renewed focus on transit accessibility, communities are working to reestablish the environment that had allowed dense and walkable communities to thrive.

Since 2018 many of the Hartford Line station communities and other towns in the corridor have made concerted efforts to plan for and facilitate the development of ancillary services, amenities, and developments that fit the model of TOD. Additionally, as part of the build-up to Hartford Line rail service, regional TOD planning efforts were undertaken to identify key areas for TOD and to help establish a framework for TOD Deployment. Below are overviews for the four stations within the GHMS study area addressed.

### 5.7.1 Berlin

The Berlin station was reconstructed as part of the NHHS rail program and received significant upgrades including new high-level platforms, an up-and-over, and increased parking capacity. In 2016 the town presented the results of a planning study arguing for TOD in Kensington Center (a subset of Berlin) within close proximity to the train station. More recently, (fall 2020) a developer broke ground on an \$18 million mixed-use development (known as Steele Center) adjacent to the Berlin station. The resulting development will include 76 market-rate apartments, medical offices, restaurants, and additional retail space. **Figure 5-12** below provides a rendering of the new development.



**Figure 5-12: Rendering of Steele Center project, Berlin (QA+M Architecture)**

Source: QA+M Architecture

### 5.7.2 Hartford

Hartford's Union Station received substantial upgrades to its platforms and the historic station building has been developed for office space. The station also serves as a multimodal transit hub and the northern terminus of the CTfastrak BRT service as well as other local and regional bus transit. The station is well-positioned in Hartford's downtown and is easy walking distance from the state capital, office buildings, Bushnell Park, the XL Center, and Dunkin Donuts Park (A minor league baseball stadium).

A major strategy for improving TOD in Hartford is to increase the number of housing units downtown through the reuse of existing structures and the development of new construction. Since 2013 more than 19 residential projects have been completed, adding more than 1,800 new residential units, most of which are within a half-mile of Union Station. Additional proposals focus on the opportunities for TOD along the CTfastrak corridor and the proposed West Hartford Rail station further out from downtown.

### 5.7.3 Windsor

Windsor was one of the original stations along the Hartford Line which was part of Amtrak's initial inter-city services and is one of only two stations that has not been reconstructed. Plans and funding have been programmed for the station's reconstruction which includes additional parking and high-level platforms. In 2014 Windsor published a TOD strategy to create a town center that is: walkable and connected, vibrant and has diverse uses, accessible and safe, and attractive and distinctive. **Figure 5-13** outlines the concept for the town's redevelopment strategy.



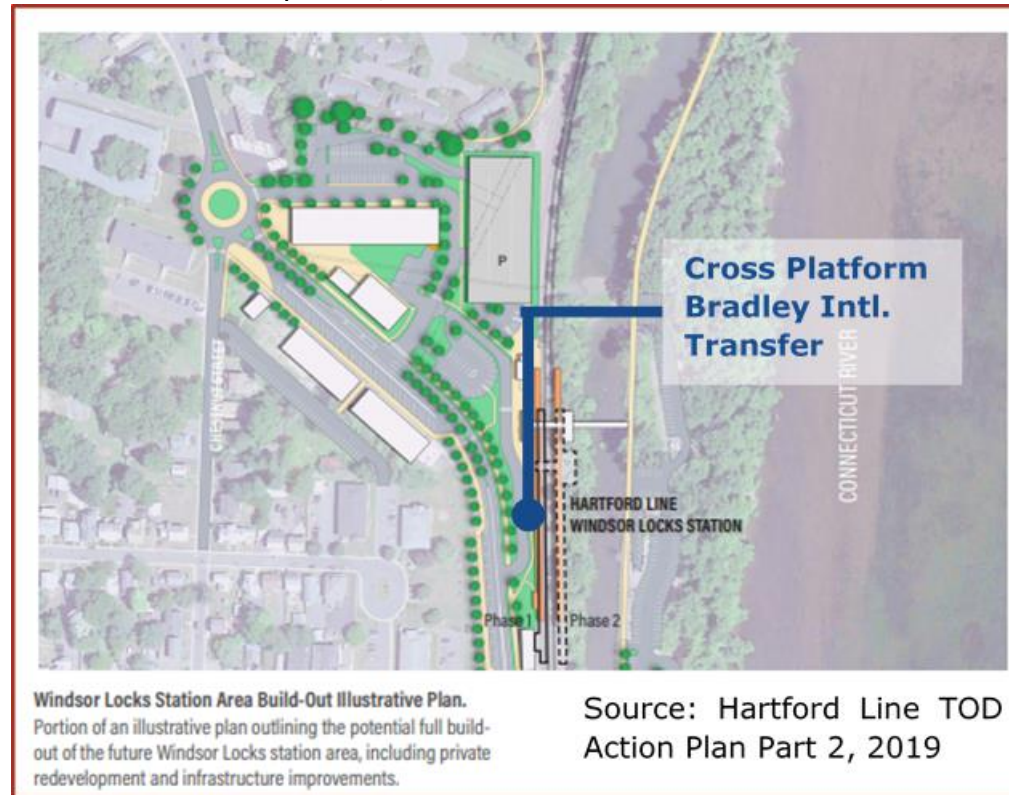
**Figure 5-13: Windsor Center TOD Redevelopment**

Source: Town of Windsor

#### 5.7.4 Windsor Locks

In 2019 CTDOT published the Hartford Line TOD Action Plan, which included illustrative plans for the relocation of the Windsor Locks Station. The report noted that the Town of Windsor Locks is actively working to create a vibrant town center around the relocation of the Windsor Locks Station to its historic downtown location along Main Street, by supporting mixed-use, context-sensitive redevelopment, and

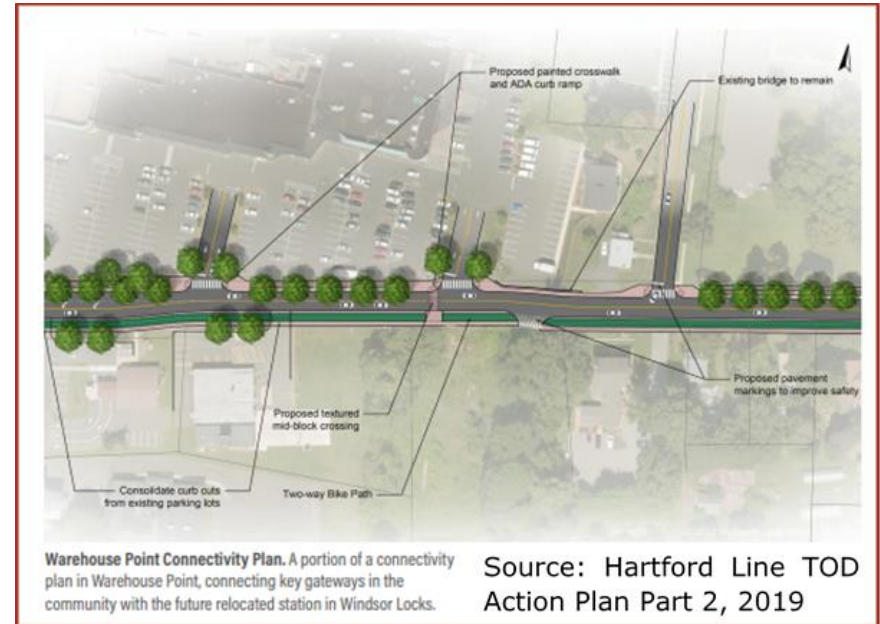
pedestrian-oriented infrastructure improvements. The illustrated plan highlighted the potential full build-out of the station area based upon ongoing and planned improvements and the overall Town vision. The purpose of this illustrative plan is to demonstrate the transformative effect these improvements could have on downtown Windsor Locks (**Figure 5-14**).



**Figure 5-14: Illustrative Station Layout for Windsor Locks Station**

Due to its proximity to the future relocated station in Windsor Locks, the TOD Plan included the East Windsor Warehouse Point Connectivity Plan. The plan focuses on key corridors and gateways within Warehouse Point including Main Street, Bridge Street, Water Street, Bridge Street and Main Street, and Bridge Street and the Interstate I-91 access ramps. The recommendations developed for the Connectivity Plan were based upon an existing conditions analysis and findings from the 2018 Complete Streets and Development Concept Plan for Warehouse Point. Ultimately, the connectivity plan presents a framework for improving multi-modal connections both within Warehouse Point and to the relocated station in Windsor Locks (**Figure 5-15**).

The most recent plan for the Windsor Locks Station acknowledges the coordination with the Main Street improvement project and illustrates the cross-platform multimodal interconnectivity between the proposed rail platform and the adjacent bus drop-off/pickup area linking the station with the airport shuttle and other potential local and regional transit services.



**Figure 5-15: Warehouse Point Connectivity Plan**

## 5.8 Existing Conditions Rail Assessment – Key Takeaways

- ❖ The GHMS Study Area covers four of the nine current stations on the Hartford Passenger Rail Line. Additionally, two of the five newly proposed stations will be located within the GHMS area. Thus, rail mode has significant potential to influence study area mobility if headways/frequency of service can be improved.
- ❖ The Hartford Line has 30 at-grade crossings over its alignment. Upgrades to existing grade crossings in Wallingford, West Hartford and Windsor helped allow for increases in maximum allowable speeds (MAS) and improved at-grade crossing safety.
- ❖ Between New Haven and Hartford, current travel time by rail mode is almost comparable to travel time by auto, making rail mode a viable and competitive option for long-distance trips.
- ❖ Significant infrastructure investment has resulted in operational improvements such as maximum allowable speed (MAS) of 110mph on the Hartford Line. However, due to equipment limitations the *CTrail* operation is restricted to a maximum speed of 80mph.
- ❖ The frequency/headways on the Hartford Rail Line are constrained by the infrastructure capacity (lack of double tracking between Windsor and the Connecticut/ Massachusetts border where the alignment is still in a single-track configuration).
- ❖ The abundance of parking in the ¼ mile area from the Hartford Union Station, while shared with non-transit users, is more than sufficient for the current outbound usage of Hartford Union Station.
- ❖ While the COVID-19 pandemic (beginning in March 2020) has significantly altered rail and transit ridership in the short-term, including on the Hartford Line, the Hartford Line had seen successive years of ridership growth since its inception. During the first year of operation, ridership exceeded pre-operation projections. January of 2020 (just prior to the beginning of COVID-10 pandemic in the United States) saw the highest single-month ridership with more than 73,000 riders.

## 6 Bicycle and Pedestrian Accommodations

### 6.1 Introduction

Bicycle and pedestrian mobility are core components of a multi-modal transportation system. Bicycle and pedestrian activity and demand is relatively high in urban areas, particularly in central business districts such as Downtown Hartford. The I-84/I-91 interchange area, located within Downtown Hartford, exhibits a strong influence on bicycle and pedestrian mobility in Downtown.

*A full understanding of bicycle and pedestrian activity and demand within the study core is central to understanding barriers, issues and opportunities for bicycle and pedestrian travel between Downtown Hartford and surrounding areas.*

This bicycle and pedestrian assessment is concentrated on a five-town focus area consisting of the Towns of Windsor, East Hartford, Wethersfield, West Hartford, and City of Hartford as shown in **Figure 6-1**.

A performance-based assessment approach was undertaken to identify locations within the five-town focus area that exhibit the most substantial bicycle and pedestrian trip generation and/or demand.



**Figure 6-1: Bicycle and Pedestrian Focus Area Map**

This assessment was compared to existing facilities to identify potential areas of need for the expansion or improvement of bicycle and pedestrian facilities.

## 6.2 Demand Analysis Approach/Methodology

The bicycle and pedestrian activity and demand analysis is based on twelve categories of bicycle and pedestrian trip generators and attractors. The output of the analysis is a heatmap that shows “hotter” colors in locations where bicycle and pedestrian trips and trip demand are expected to be higher and “cooler” colors in locations where trips and trip demand are expected to be lower.

The land use categories used in the analysis are as follows:

- K-12 Schools
- Colleges and Universities
- Parks and Playgrounds
- Hospitals
- Other Points of Interests (Town Halls, Churches, Restaurants, etc.)
- Areas with High Concentration of Employment
- Neighborhood Retail Centers
- Entertainment Sporting Venues
- Transit Stations
- Bus Stops
- Regional Trails (East Coast Greenway, Charter Oak Greenway, Riverfront Paths)

The following process was used in the analysis and in development of the map:

### 6.2.1 Data Sourcing

The data was sourced from existing State and Regional GIS Datasets, U.S. Census data, and other sources as indicated in **Table 6-1**. In some instances, the project team supplemented existing data as noted in **Table 6-1**.



**Table 6-1: Data Sources and Influences for Layers**

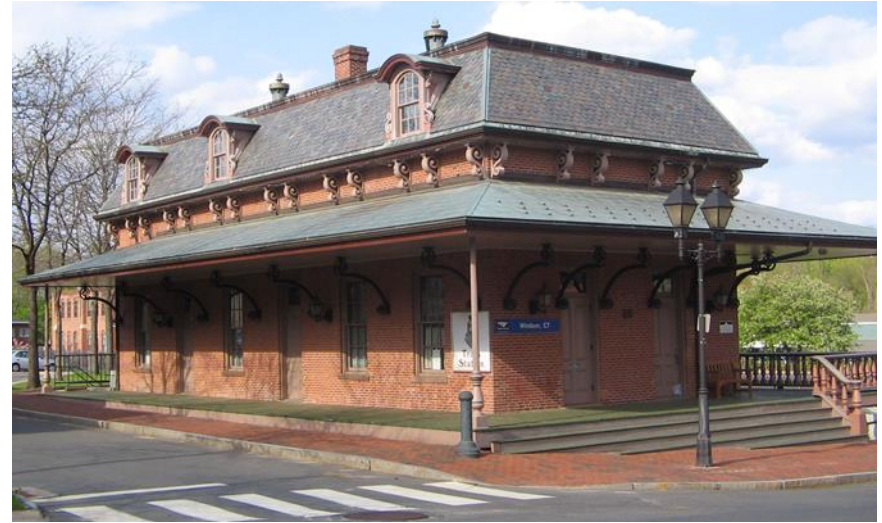
| <b>Data</b>   | <b>Source</b>   | <b>Influence Distance (miles)</b> | <b>Layer Scaling</b> | <b>Overall Weighting in Compiled Heatmap</b> |
|---|---|-----------------------------------|----------------------|--|
| <b>K-12 Schools</b>   | Common Core Data – 2012 – 2013 School Year  | 0.5                               | Enrollment           | 15%  |
| <b>Colleges and Universities</b>  | FHI Studio Created with enrollment figures based on published data  | 0.5                               | Enrollment           | 5%   |
| <b>Parks and Playgrounds</b>  | CRCOG 2016 Land Use GIS layer   | 0.5                               | N/A                  | 5%   |
| <b>Hospitals</b>  | FHI Studio Created – based on ArcGIS 2013 data  | 1.0                               | Number of beds       | 5%   |
| <b>Other Points of Interests (Town Halls, Churches, Restaurants etc.)</b> | Open Street Maps POI data   | 1.0                               | N/A                  | 5%   |
| <b>Employment Density</b>   | Longitudinal Employer-Household Dynamics (abbreviated “LEHD”, published by the US Census and available on the “OnTheMap” online platform). 2018 data utilized | 1.0                               | Number of Employees  | 15%  |
| <b>Population Density</b>   | 2010 US Census data (aggregated by census block)  | 0.5                               | Population           | 15%  |
| <b>Neighborhood Retail Centers</b>  | FHI Studio Created – based context zones found in the 2018 CRCOG Complete Street Plan showing commercial centers  | 1.0                               | N/A                  | 10%  |

| <b>Data</b>  | <b>Source</b>  | <b>Influence Distance (miles)</b> | <b>Layer Scaling</b> | <b>Overall Weighting in Compiled Heatmap</b> |
|--|--|-----------------------------------|----------------------|--|
| <b>Entertainment and Sporting Venues</b>   | FHI Studio Created   | 1.0                               | Capacity             | 5%   |
| <b>Bus Stops</b>   | CT transit – 2015 data   | 0.5                               | N/A                  | 5%   |
| <b>Train Stations</b>  | FHI Studio Created – Based on existing and proposed Hartford Line stations | 1                                 | N/A                  | 10%  |
| <b>Regional Trails (East Coast Greenway, Charter Oak Greenway, Riverfront Paths)</b> | 2019 CT Active Transportation Plan   | 0.5                               | N/A                  | 5%   |

### 6.2.2 Mapping of Land Uses

Land uses described above were mapped in an ArcGIS database for the five-town focus area. Unique symbols are used for each land use type. **Figure 6-2** reveals a dense concentration of bicycle and pedestrian attractor land uses in Downtown Hartford with clusters of attractors in surrounding neighborhoods and towns.

*Windsor's Amtrak and Hartford Line train station is an example of a bicycle and pedestrian attractor. The station is served by a pedestrian network but lacks a connecting bicycle network.*

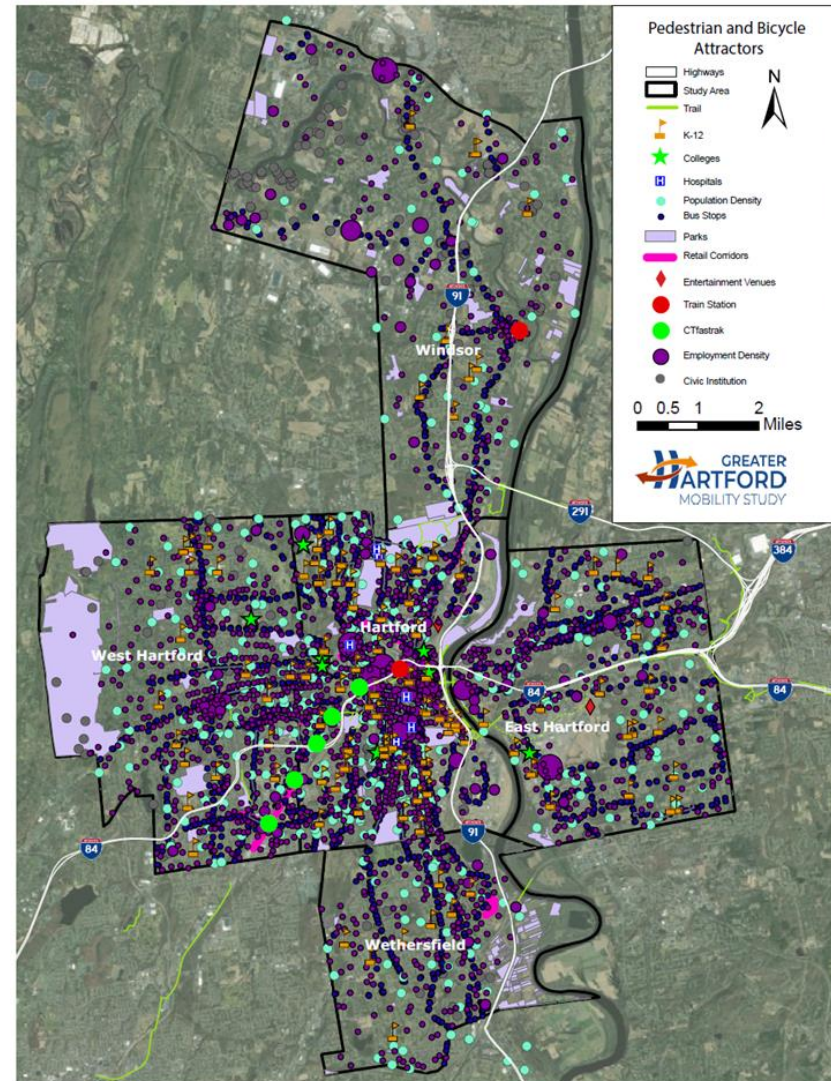


### 6.2.3 Individual Attractor Heatmaps

Based on each of the data sources described above, heatmaps for each of the individual categories of attractors were generated. The heat maps were developed utilizing the Kernel Density tool within ArcGIS (**Figure 6-3**). These heatmaps were based on the *Influence Distance* and *Layer Scaling* properties noted in **Table 6-1**. These properties contribute as follows:

*Influence Distance* – This defines the distance any one point in one of the data layers will have on the heatmap. For example, K-12 schools have an influence distance of 0.5 miles. This means that for any given school, a distance outside of this area would have no impact on the resultant heatmap.

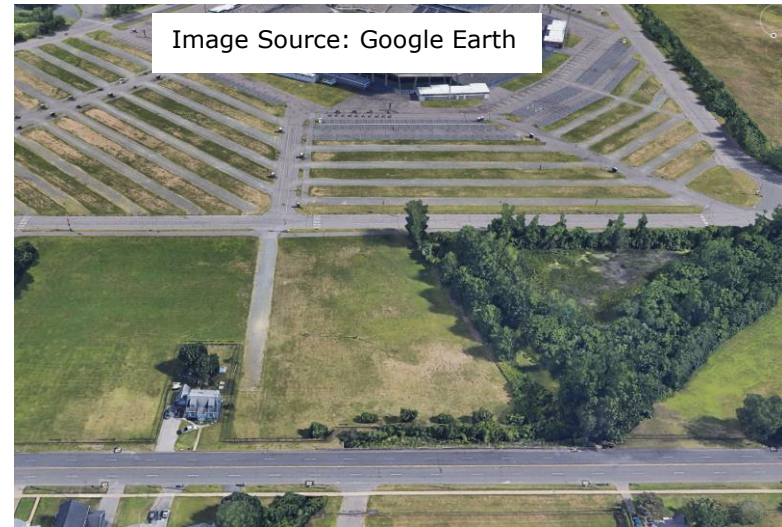
*Layer Scaling* – This defines the relative scale one feature may have over another in determining its contribution to the heatmap. For example, K-12 schools are scaled by enrollment. This means that a school with an enrollment of 1,000 students will be weighted 10-fold that of a school with an enrollment of 100 students. The scaling is utilized to account for differences in pedestrian and bicycle generation based on varying different sizes of individual attractor points.



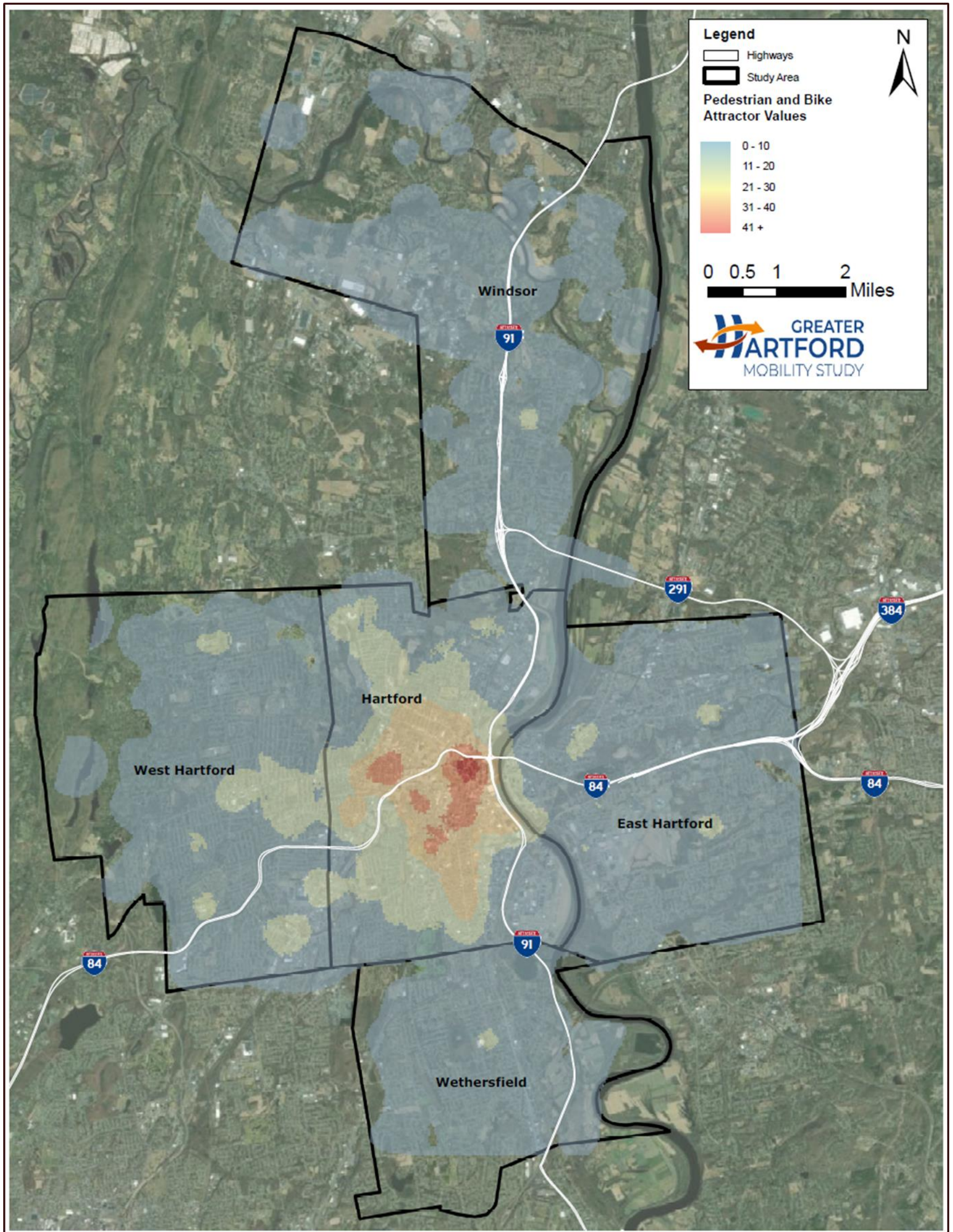
**Figure 6-2: Bicycle and Pedestrian Attractors in Study Area**

#### 6.2.4 Overall Bicycle and Pedestrian Activity Heatmap Compilation

The twelve separate heatmaps (one for each land use category) were then merged in ArcGIS. The merger was conducted based on the *Overall Weighting in Compiled Heatmap* parameter provided in **Table 6-1**. This resulted in an overall heatmap which includes a maximum theoretical value of 100 with lower number indicating less expected bicycle and pedestrian activity (blue colors) and values above 40 representing the highest levels of expected bicycle and pedestrian activity (red colors).



*Rentschler Field, the region's largest entertainment venue, is connected to points west including Downtown Hartford by Silver Lane (visible at bottom of the image). Silver Lane lacks bicycle facilities and lacks a sidewalk on the Rentschler Field side of the roadway. A shared-use pathway is currently planned.*



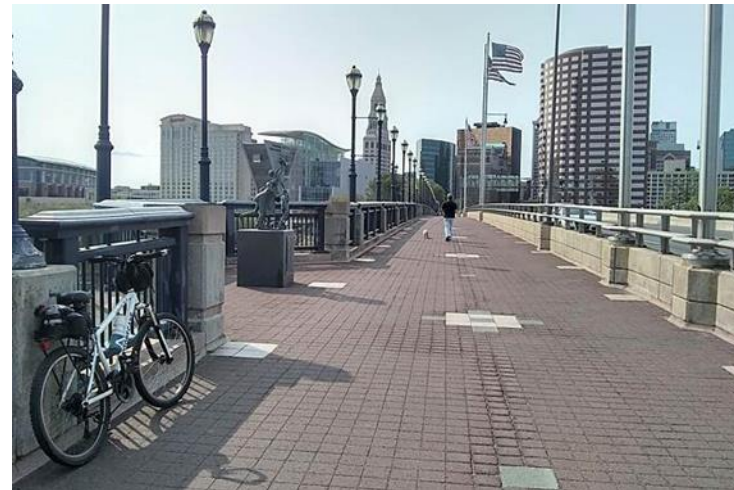
**Figure 6-3: Heat Map of Bicycle and Pedestrian Potential of Generation and Attraction**

Source: FHI Studio

### 6.3 Demand Analysis – Key Findings

1. **Downtown Hartford** was found to have the **highest level of bicycle and pedestrian generation and attraction (demand)** within the study area (**Figure 6-1** and **Figure 6-3**).
2. The highest levels of demand in the five-town study area are located in Hartford and are largely **aligned with major corridors** such as Albany Avenue, Farmington Avenue, and Franklin Avenue.
3. Areas of demand were also found through much of West Hartford and East Hartford and limited areas of Windsor and Wethersfield. **Areas of higher demand in the towns surrounding Hartford are largely correlated with Town and commercial centers, schools, and major institutions.**
4. Areas of high demand are **generally well served** by pedestrian facilities such as sidewalks although **major barriers**, primarily associated with **I-84, I-91 and active and inactive rail corridors** provide obstructions to bicycle and pedestrian connectivity.
5. Local greenways and pathways such as the East Coast Greenway, Charter Oak Greenway and Riverfront pathways, hold potential to provide regional connections between high demand areas such as Downtown Hartford and medium or lower demand areas in surrounding towns.

*Bicycle facilities are lacking in many of the highest demand areas and along corridors in high demand areas such as Hartford's Main Street, Albany Avenue, segments of Farmington Avenue, and Franklin Avenue.*



Route of East Coast Greenway on the Founders Bridge connecting East Hartford to Hartford.  
Image Source: TrailLink.com

### 6.4 First/Last Mile Connectivity

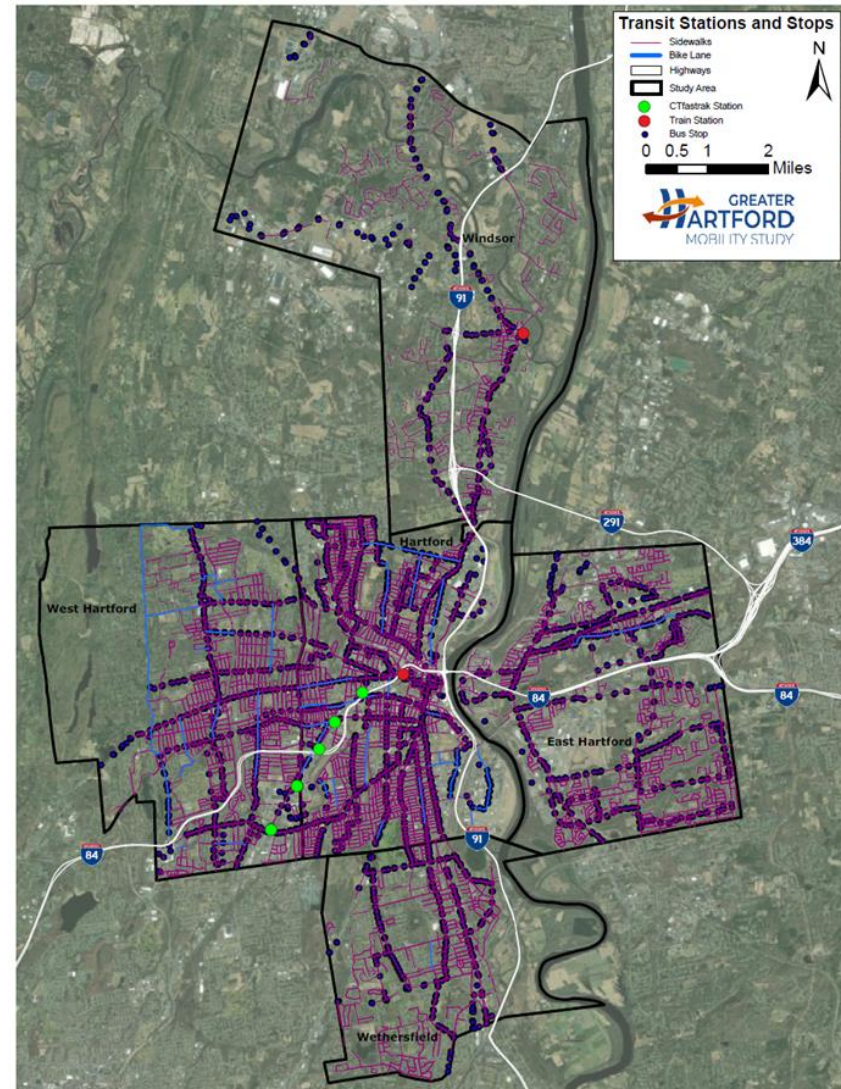
Transit stations and stops are located throughout the five-town study area with the greatest density of those stops and stations located in Hartford. Transit stations shown in **Figure 6-4** include CTfastrak stations and Hartford Line Rail stations. Bus stops are CT Transit bus stop locations.

Sidewalks are present at, or in proximity to, most of the study area's transit stations and stops although there are gaps in the network throughout the five towns.

*The most significant sidewalk gaps in proximity of bus routes and stops are found in Windsor.*

*Bicycle facilities are lacking in proximity of most of the transit stations and stops throughout the study area with the exception of limited facilities in Hartford, West Hartford, and East Hartford.*

West Hartford and East Hartford have comparable transit route, station, and stop density. Windsor has the lowest density of transit routes, stations, and stops and the lowest density of sidewalk and on-street bicycle facilities. Windsor's Hartford Line Rail station is well connected to a sidewalk network but there are no on-street bicycle facilities in proximity of the station or in the town.



**Figure 6-4: Transit Nodes/Stops in Bicycle Pedestrian Assessment Area**



The I-84/I-91 interchange area is proximate to a dense cluster of bus stops and routes and a complete sidewalk network. On-street bicycle facilities in the interchange area are, however, lacking.

*The pedestrian bridge shown in this photo is the route of the East Coast Greenway and connects to Hartford's Union Station.*



## 6.5 Identified Major Gaps in Bicycle and Pedestrian Facilities

A gap analysis was conducted by comparing areas with existing sidewalk and bicycle facility infrastructure to potential demand as expressed in the heatmap. This was done by referencing the geographic areas associated with five levels of demand as presented in the bicycle and pedestrian demand heatmap. The total length (linear feet) of sidewalk and bicycle facilities was then summarized for each demand level area (**Table 6-2**). This value was then equalized by geographic area for each demand level.

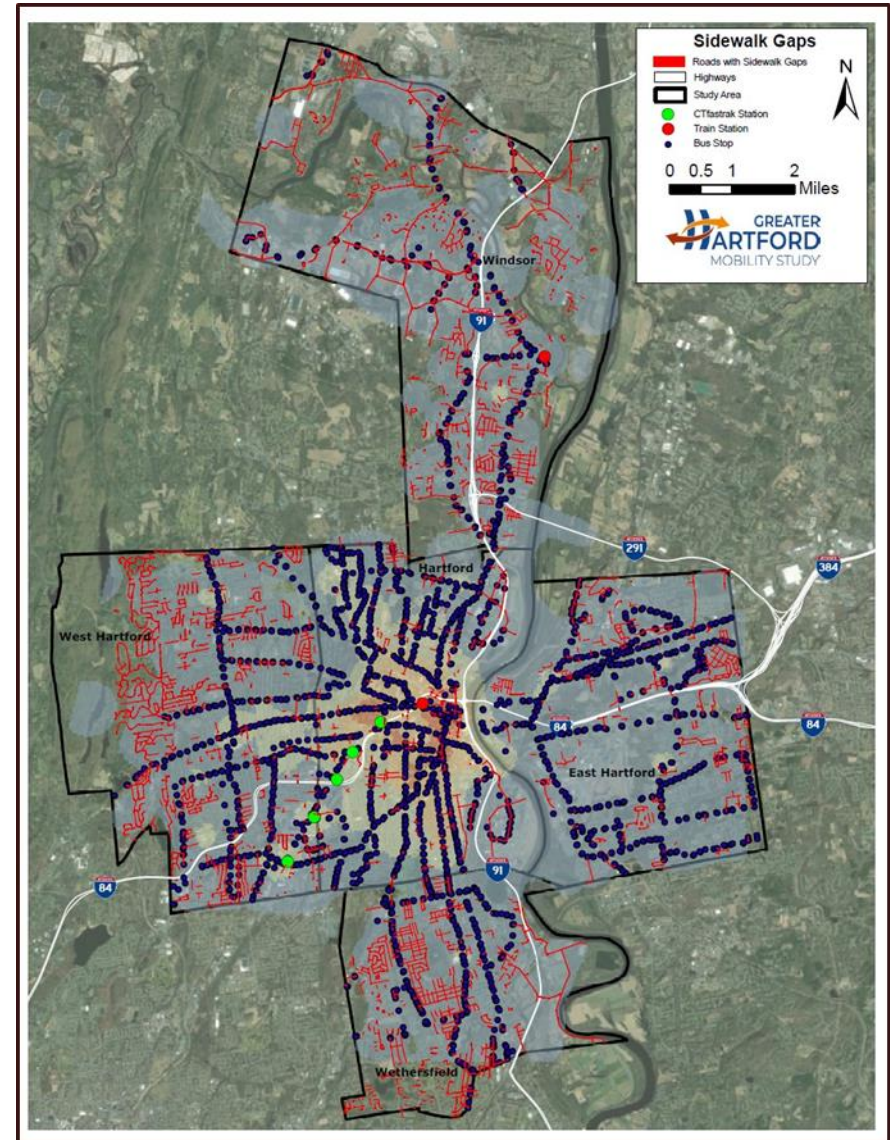
Sidewalk facilities are most highly concentrated in the areas of the most intense demand as established by the demand level. The relative quantity of available bicycle facilities, whether bike lanes or pathways did not correspond with the highest area of demand. The highest demand level (41+) is found in Downtown Hartford where there are no designated bicycle lanes or established pathways designated for bicycle use. The East Coast Greenway route traverses this area but there are no established facilities dedicated for bicycle use along the route. The second highest demand level (31-40), which covers much of central Hartford, is also underrepresented by bicycle lanes in comparison to areas within other tiers of demand (**Table 6-2**).

**Table 6-2: Extent of Bicycle and Pedestrian Facilities by Demand Level**

| Demand Level | Area (Acres) | Sidewalks (lf) | Sidewalks (lf/acre) | Bike Lanes (lf) | Bike Lanes (lf/acre) | Regional Paths or Greenways (lf) | Regional Paths or Greenways (lf/acre) |
|--------------|--------------|----------------|---------------------|-----------------|----------------------|----------------------------------|---------------------------------------|
| 1-10         | 45,047       | 6,893,661      | 153                 | 93,576          | 2                    | 78,994                           | 2                                     |
| 11-20        | 5,376        | 2,296,601      | 427                 | 59,002          | 11                   | 64,801                           | 12                                    |
| 21-30        | 2,154        | 1,010,676      | 469                 | 22,279          | 10                   | 38,995                           | 18                                    |
| 31-40        | 592          | 355,856        | 601                 | 3,354           | 6                    | 15,988                           | 27                                    |
| 41+          | 59           | 45,543         | 776                 | 0               | 0                    | 0                                | 0                                     |

## 6.6 Gap Analysis Key Findings

1. Areas of high bicycle and pedestrian demand are generally well served by sidewalks although major barriers, primarily associated with **I-84, I-91 and active and inactive rail corridors obstruct bicycle and pedestrian connectivity**. Bicycle facilities are lacking in many of the highest demand areas and along corridors in high demand areas such as Hartford's Main Street, Albany Avenue, segments of Farmington Avenue, and Franklin Avenue.
2. Sidewalk facilities are most highly concentrated in the areas of the highest bicycle and pedestrian demand. The relative quantity of available bicycle facilities, whether bike lanes or pathways did not correspond with the highest areas of demand. **The highest bicycle and pedestrian demand level (41+) is found in Downtown Hartford where there are no designated bike lanes or established facilities designated for bicycle use**. The East Coast Greenway route traverses this area but there are no established facilities dedicated for bicycle use along the route. The second highest demand level (31-40), which covers much of central Hartford, is also underrepresented by bicycle facilities in comparison to areas within other tiers of demand.



**Figure 6-5: Gaps in Sidewalk Network**

**3. Local greenways and pathways hold potential to provide regional connections between high demand areas such as Downtown Hartford and medium or lower demand areas in surrounding towns.** A contiguous north/south Connecticut Riverfront pathway holds potential to connect Wethersfield to Windsor, connecting through Hartford and the I-84/I-91 interchange. Similarly, a contiguous dedicated east/west greenway could accommodate the East Coast Greenway route and could provide a connection from West Hartford to East Hartford, passing through Downtown Hartford in proximity of the I-84/I-91 interchange.

*This riverfront area along I-91 south of Downtown Hartford represents a gap in the Riverfront pathway system. The riverfront pathways have potential to provide bicycle and pedestrian connectivity from Wethersfield to Windsor.*



## 7 Environmental Considerations

### 7.1 Introduction

The following section identifies key environmental constraints within the Study Area and Study Area sectors. This section is organized by resources (e.g. natural, cultural, socioeconomic and community-based). The presence of the following resources is illustrated on maps.

- Critical habitat
- Protected open space and DEEP property
- Prime farmland soils and soils of statewide importance
- Surface and groundwater resources
- Floodplains
- Wetlands
- Historic, architectural and archaeological resources
- Socioeconomic considerations – population and employment density, zero vehicle households, Environmental Justice and Title VI communities
- Institutional resources
- Land use and zoning
- Hazardous materials
- Noise sensitive land uses
- Air quality (areas of documented non-compliance)

This constraints-based mapping approach will aid in the identification of potential environmental and community issues and “fatal flaws” associated with the Universe of Alternatives.

The mapping will serve as a starting point for future, more detailed, alternatives analysis and resource field-verification to be conducted during the Phase 2 of GHMS.

This space has been intentionally left blank.

## 7.2 Critical Habitat

Mapped habitat from CT DEEP was reviewed for its general presence within the study area and sectors and its potential to constrain future mobility improvements. Critical habitat within the study area is primarily associated with riverfront areas adjacent to the Connecticut River and its tributaries.

Grassland habitat is also identified in the vicinity of the Bradley Airport runways. The presence of these critical habitats is most likely to affect the siting of river crossings and widening or new alignments adjacent to the existing Hartford Line.

**Table 7-1: Critical Habitat**

| Sector                  | Comments  |
|-------------------------|---|
| <b>Study Core</b>       | Habitat associated with the Hockanum River adjacent to I-84, Route 2, Route 15; Habitat associated with the Connecticut River between I-91 and I-291.   |
| <b>Northwest Sector</b> | No mapped habitat noted   |
| <b>North Sector</b>     | Grassland habitat at Bradley Airport; Habitat associated with Waterworks Brook near Route 20 / I-91; Habitat associated with the Farmington River (Pierson Lane, Mill Brook, Farmington River Mouth) adjacent to the Hartford Line; Habitat associated with the Connecticut River between I-91 and I-291. |
| <b>Northeast Sector</b> | Habitat associated with the Hockanum River adjacent to the I-84 / I-291 interchange.  |
| <b>Southwest Sector</b> | No mapped habitat noted   |
| <b>South Sector</b>     | Habitat associated with Wethersfield Meadows adjacent to the I-91 / Route 3 interchange; Habitat associated with Rocky Hill Meadows adjacent to I-91-Route 3 and the Connecticut Southern (G&W) rail line; Habitat associated with Folly Brook adjacent to I-91.  |
| <b>Southeast Sector</b> | Habitat associated with Glastonbury Meadows and Keeney Cove adjacent to Route 3 between I-91 and Route 2.   |

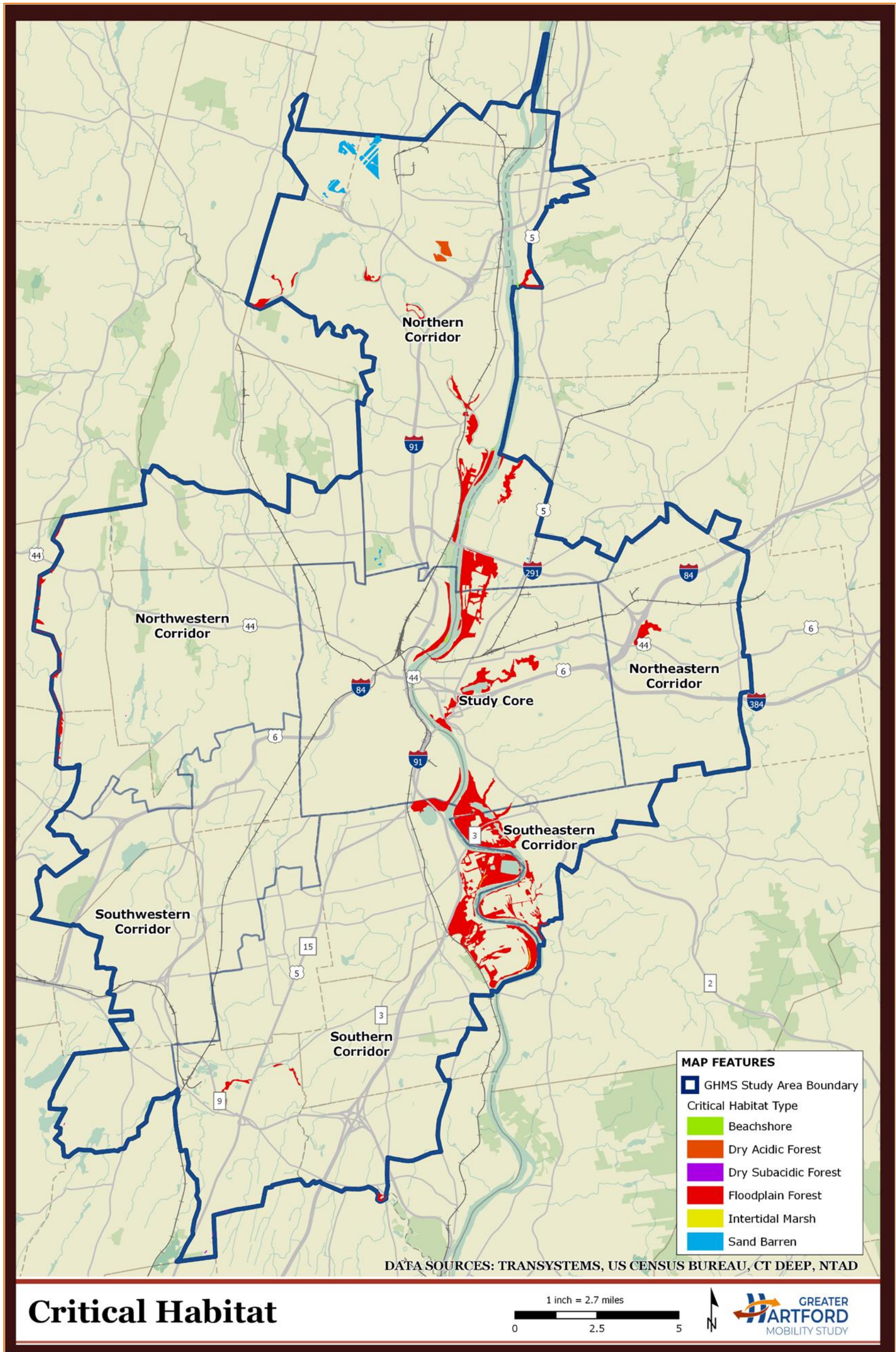


Figure 7-1: Critical Habitat

### 7.3 Protected Open Space and DEEP Property

Protected Open Space and DEEP Property were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements. In cases where public funds have been expended for their purchase, there are often regulatory conditions that restrict the taking of any portion of these properties without legislative approval. It is possible that active transportation links may be compatible with these properties. In addition, there are municipal parks and open space areas with similar protections.

Private parcels with conservation easements are not included as part of this review.

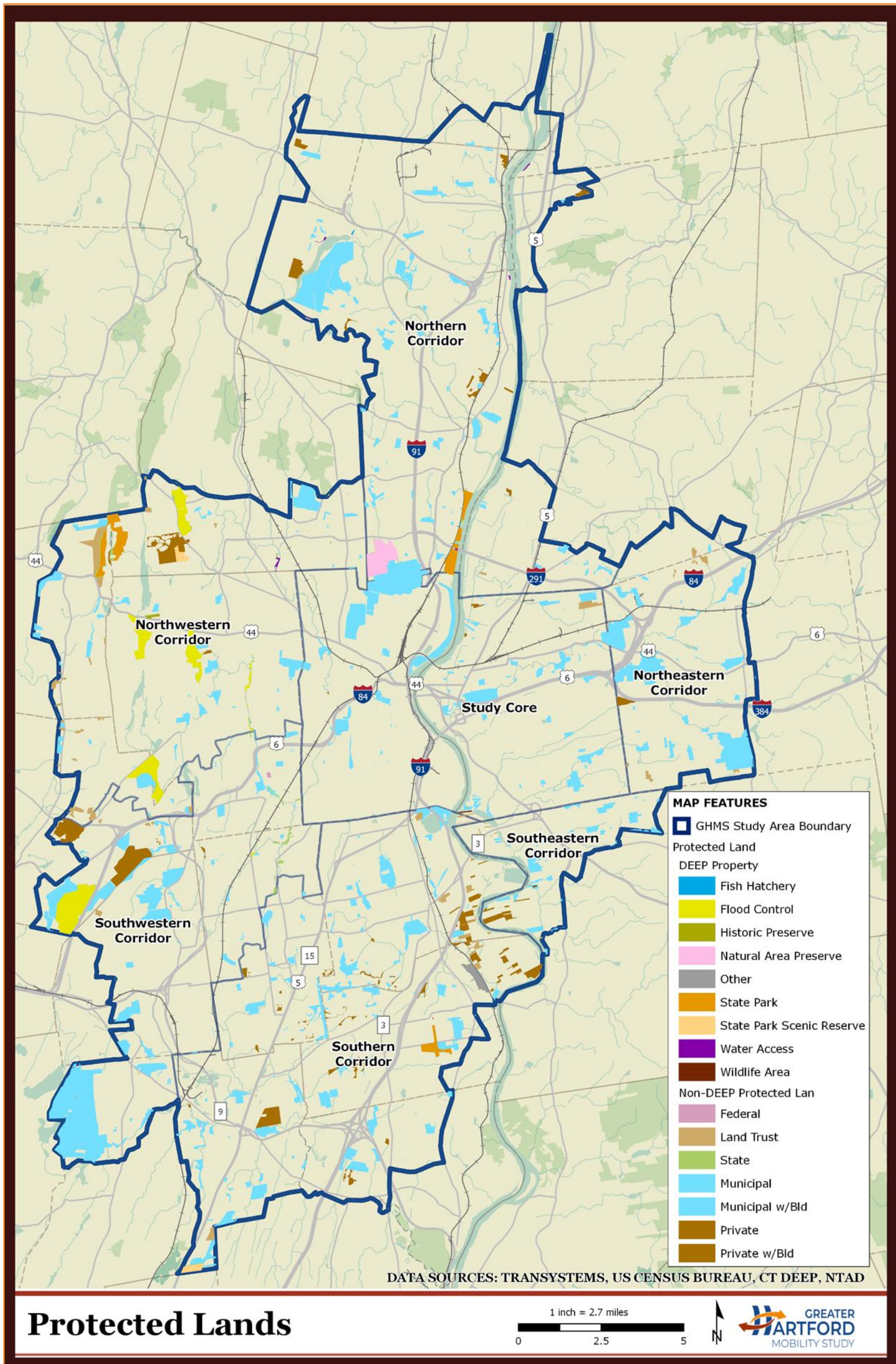
It should also be noted that improved transit and active transportation networks that connect these facilities would improve the ability of all residents to access healthy recreational opportunities.

The presence of protected open space and DEEP properties is most likely to affect widenings, new alignments and extensions of active transportation networks (greenways, multi-use paths, etc).

**Table 7-2: Protected Open Space and DEEP Property**

| Sector                  | Comments  |  |
|-------------------------|---|--|
|                         | DEEP Property   | Municipal Property (Representative Sample)   |
| <b>Study Core</b>       | Connecticut River Wildlife Management Area (East Hartford).   | Keney Park, Riverside Park, Pope Park, Colt Park, Bushnell Park, McAuliffe Park, Martin Park                   |
| <b>Northwest Sector</b> | Talcott Mountain State Park, North Branch Park River Flood Control site, South Branch Park River Flood Control sites, Auerfarm State Park Scenic Reserve. | Westmoor Park, Elizabeth Park, Fernridge Park  |
| <b>North Sector</b>     | Matianuck Sand Dunes Preserve, Windsor Meadows State Park, Rainbow Dam Fishway.   | Washington Park, Northwest Park, Southwest Park, Spring Park   |
| <b>Northeast Sector</b> | Hop River State Park Trail.   | Wickham Park, Center Spring Park   |
| <b>Southwest Sector</b> | South Branch Park River Flood Control site.   | Ragged Mountain Preserve, Hungerford Park, Willow Brook Park, Martha Hart Park, Walnut Hill Park, Stanley Park |
| <b>South Sector</b>     | Rocky Hill Quarry, Dinosaur State Park.   | Mill Woods Park, Candlewyke Park, Maxwell Park, Clem Lemire Sports Complex, Churchill Park                     |
| <b>Southeast Sector</b> | Glastonbury Meadows Wildlife Management Area.   | Addison Park, Gorman Park, Goodwin Playground Park   |





**Figure 7-2: Protected Open Space and DEEP Property**

Data Source: Connecticut Department of Energy and Environmental Protection (DEEP), CT State Historic Preservation Office (SHPO)

#### 7.4 Prime Farmland Soils and Soils of Statewide Importance

Prime Farmland Soils and Soils of Statewide Importance were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements.

Those lands may qualify to be protected in the Federal Farm and Ranch Lands Protection Program (FRPP) which is reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to protect working agricultural land from conversion to nonagricultural uses and the Connecticut Department of Agriculture, Farmland Preservation Program's goal of securing a food and fiber producing land resource base for the future of agriculture in Connecticut.

Prime Farmland Soils are those that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops, and are also available for these uses (the land could be cropland, pastureland, range-land, forestland, or other land, but not urban built-up land or water). It has the soil quality, growing season and moisture supply needed to economically produce sustained high yields or crops when treated and managed, including water management, according to acceptable farming practices.

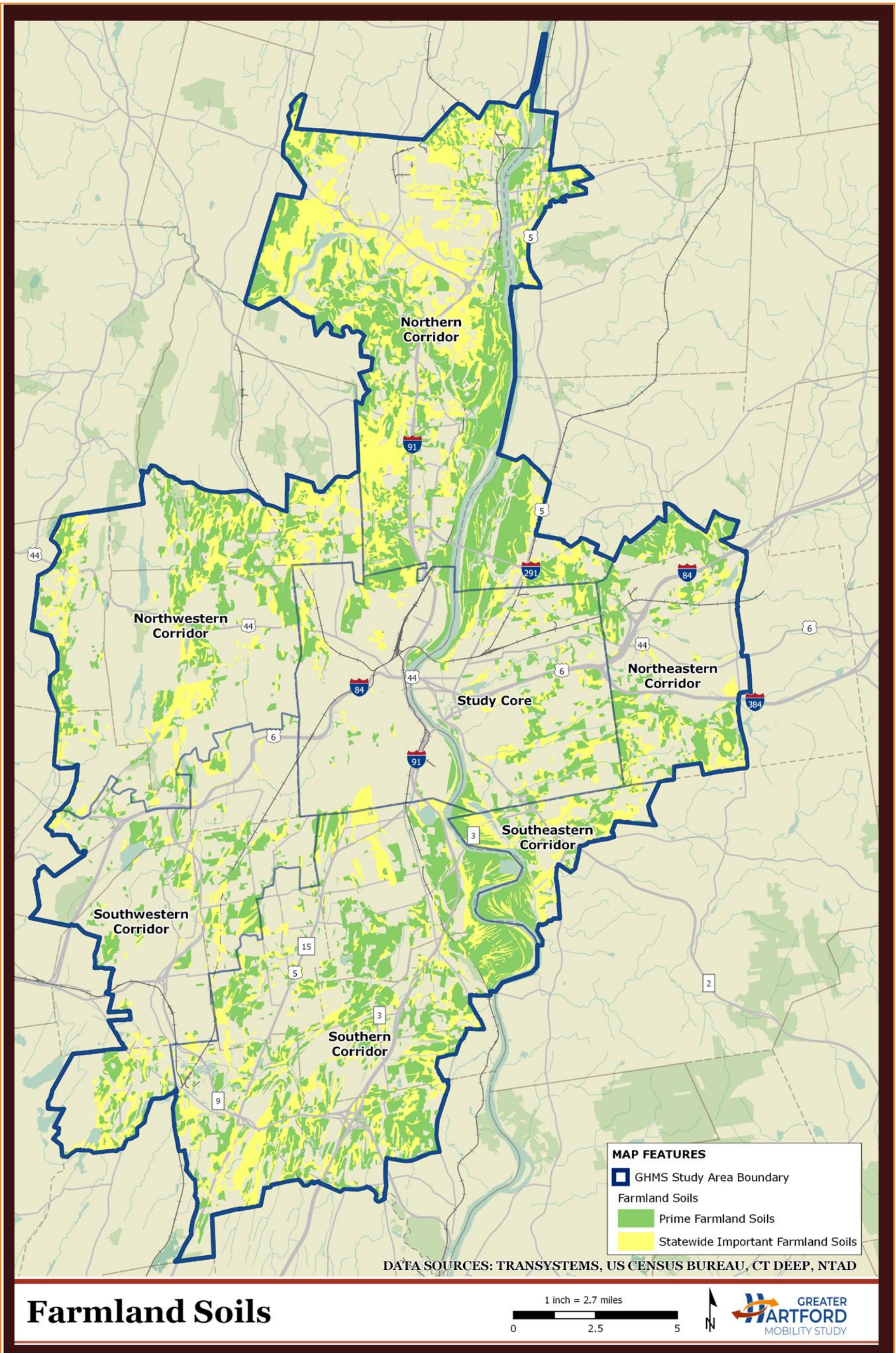
Soils of Statewide Importance are those that fail to meet one or more of the requirements of prime farmland, but are important for the production of food, feed, fiber, or forage crops. They include those soils that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

This information does not necessarily portray land that is used currently for farming; it identifies productive soils that are suitable to be farmed. This data set is not designed for use as a primary regulatory tool in permitting or siting decisions but may be used as a reference source.

Prime Farmland Soils and Soils of Statewide Importance within the study area are widespread, although Prime Farmland Soils are more concentrated along riverfront areas. The presence of these soils is most likely to affect the siting of river crossings and planned actions adjacent to the Hartford Line in the North Sector. If impacts cannot be avoided, mitigation often includes removing topsoil and transporting to a receiving farm or other agricultural use.

**Table 7-3: Prime Farmland Soils and Soils of Statewide Importance**

| Sector                  | Comments             |                               |
|-------------------------|----------------------|-------------------------------|
|                         | Prime Farmland Soils | Soils of Statewide Importance |
| <b>Study Core</b>       | Low prevalence       | Low prevalence                |
| <b>Northwest Sector</b> | Moderate prevalence  | Moderate prevalence           |
| <b>North Sector</b>     | High prevalence      | High prevalence               |
| <b>Northeast Sector</b> | Moderate prevalence  | Moderate prevalence           |
| <b>Southwest Sector</b> | Low prevalence       | Low prevalence                |
| <b>South Sector</b>     | High prevalence      | High prevalence               |
| <b>Southeast Sector</b> | High prevalence      | High prevalence               |



**Figure 7-3: Prime Farmland Soils and Soils of Statewide Importance**

### 7.5 Surface and Groundwater Resources

Surface and groundwater resources were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements.

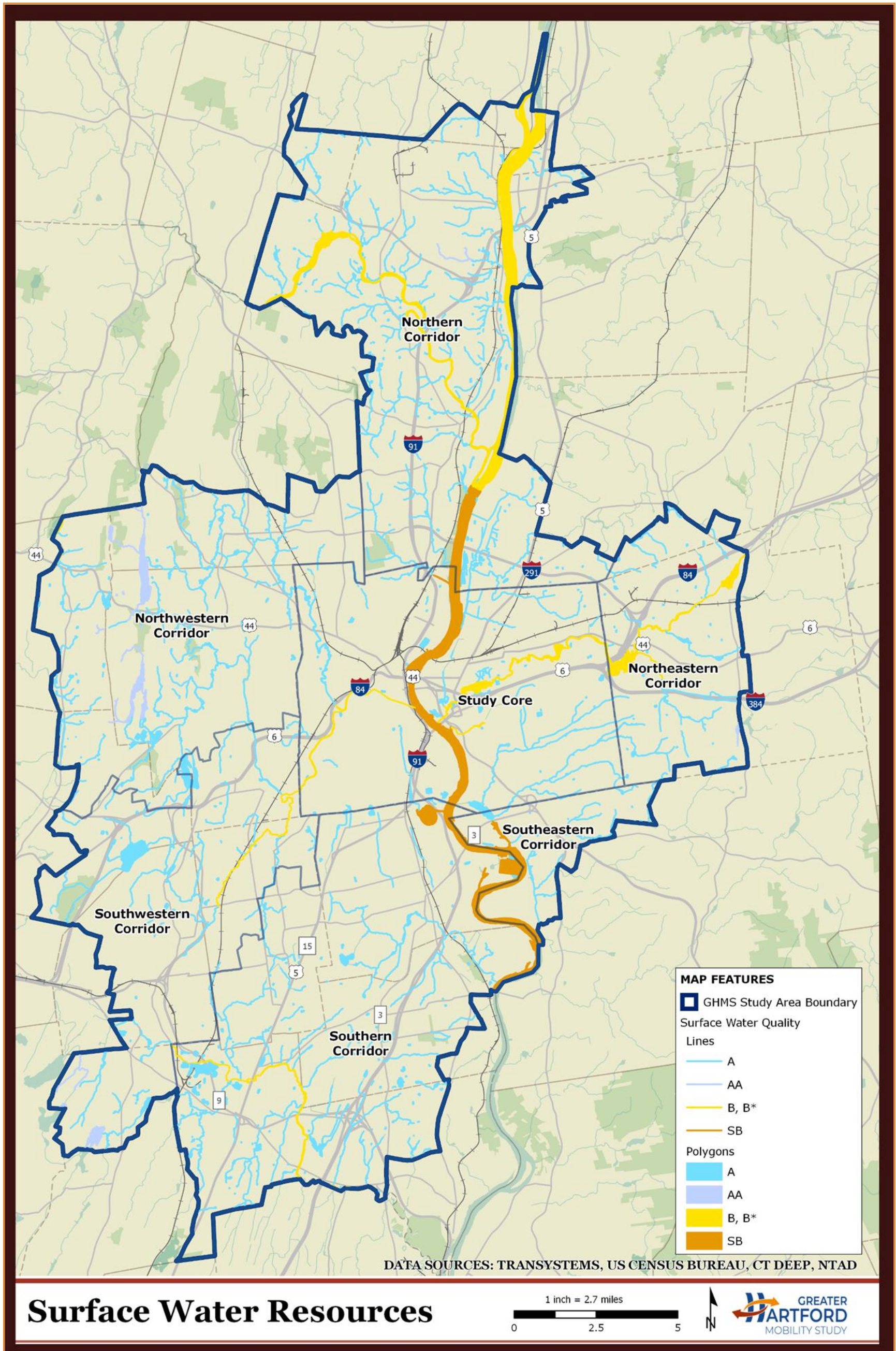
The presence of surface water resources is most likely to affect the siting of river and stream crossings, widenings or new alignments. These resources may have setbacks or protected zones and require additional levels of stormwater treatment.

Surface Water means the waters of Long Island Sound, its harbors, embayments, tidal wetlands and creeks; rivers and streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, federal jurisdictional wetlands, and other natural or artificial, public or private, vernal or intermittent bodies of water, excluding groundwater. The Surface Water Quality Classes are AA, A, B, SA and SB. All surface waters not otherwise classified are considered as Class A if they are in Class GA Ground Water Quality Classifications areas.

Class AA designated uses are: existing or proposed drinking water, fish and wildlife habitat, recreational use (maybe restricted), agricultural and industrial supply. Class A designated uses are: potential drinking water, fish and wildlife habitat, recreational use, agricultural and industrial supply. Class B designated uses are: fish and wildlife habitat, recreational use, agricultural and industrial supply and other legitimate uses including navigation. Class B\* surface water is a subset of Class B waters and is identical in all ways to the designated uses, criteria and standards for Class B waters except for the restriction on direct discharges. Coastal water and marine classifications are SA and SB. Class SA designated uses are: marine fish, shellfish and wildlife habitat, shellfish harvesting for direct human consumption, recreation and other legitimate uses including navigation. Class SB designated uses are: marine fish, shellfish and wildlife habitat, shellfish harvesting for transfer to approved areas for purification prior to human consumption, recreation and other legitimate uses including navigation.

**Table 7-4: Surface Water Resources**

| <b>Sector</b>           | <b>Comments</b>  |
|-------------------------|--|
| <b>Study Core</b>       | Connecticut River, Hockanum River, Willow Brook, Park River, Keeney Cove, Porter Brook, Pewterpot Brook, Goodwin Brook, Burnham Brook  |
| <b>Northwest Sector</b> | Hartford Reservoir 1,2,3,5,6, Dyke Pond, Hoe Pond, Ely Pond, Mead Pond, Willow Lake, Tumbledown Brook, Wash Brook, Indian Brook, Farmington River  |
| <b>North Sector</b>     | Connecticut River, Farmington River, Seymour Hollow, Strawberry Meadows Brook, Hathaway Hollow, Waterworks Brook, Adds Brook, Kettle Brook, Mundy Hollow, Phelps Brook, Goodwin Pond, Mill Brook, Meadow Brook, Deckers Brook, Podunk River, Newberry Brook, |
| <b>Northeast Sector</b> | Hockanum River, Hockanum River Reservoir, Union Pond, Lydall Brook, Bigelow Brook, Center Springs Pond, Porter Brook, Buckland Pond, Folly Brook, Hop Brook, Salmon Brook, Globe Hollow Reservoir  |
| <b>Southwest Sector</b> | Woodridge Lake, Wood Pond, Batterson Park Pond, Bass Brook, Piper Brook, Trout Brook, Mattabeset River, Hart Pond  |
| <b>South Sector</b>     | Wethersfield Cove, Connecticut River, 1860 Reservoir, Goff Brook, Fairlane Brook, Valley Brook, Beaver Brook, Saw Mill Brook, Mattabeset River, Spruce Brook, Chestnut Brook,  |
| <b>Southeast Sector</b> | Connecticut River, Salmon Brook, Porter Brook, Hubbard Brook, Keeney Cove  |



**Figure 7-4: Surface Water Resources**

Data Source: Connecticut Department of Energy and Environmental Protection (DEEP)

The CT DEEP Ground Water Quality Classes are GA, GAA, GAAs, GB and GC. Classes GAA and GA designate areas of existing or potential drinking water. All ground waters not otherwise classified are considered as Class GA. Class GAAs is for ground water that is tributary to a public water supply reservoir. Class GB is used where ground water is not suitable for drinking water. Class GC is used for assimilation of permitted discharges. Modified classes GA-Impaired, GAA-Impaired, GAA-Well-Impaired, GAA-Well and GA-NY are found in the

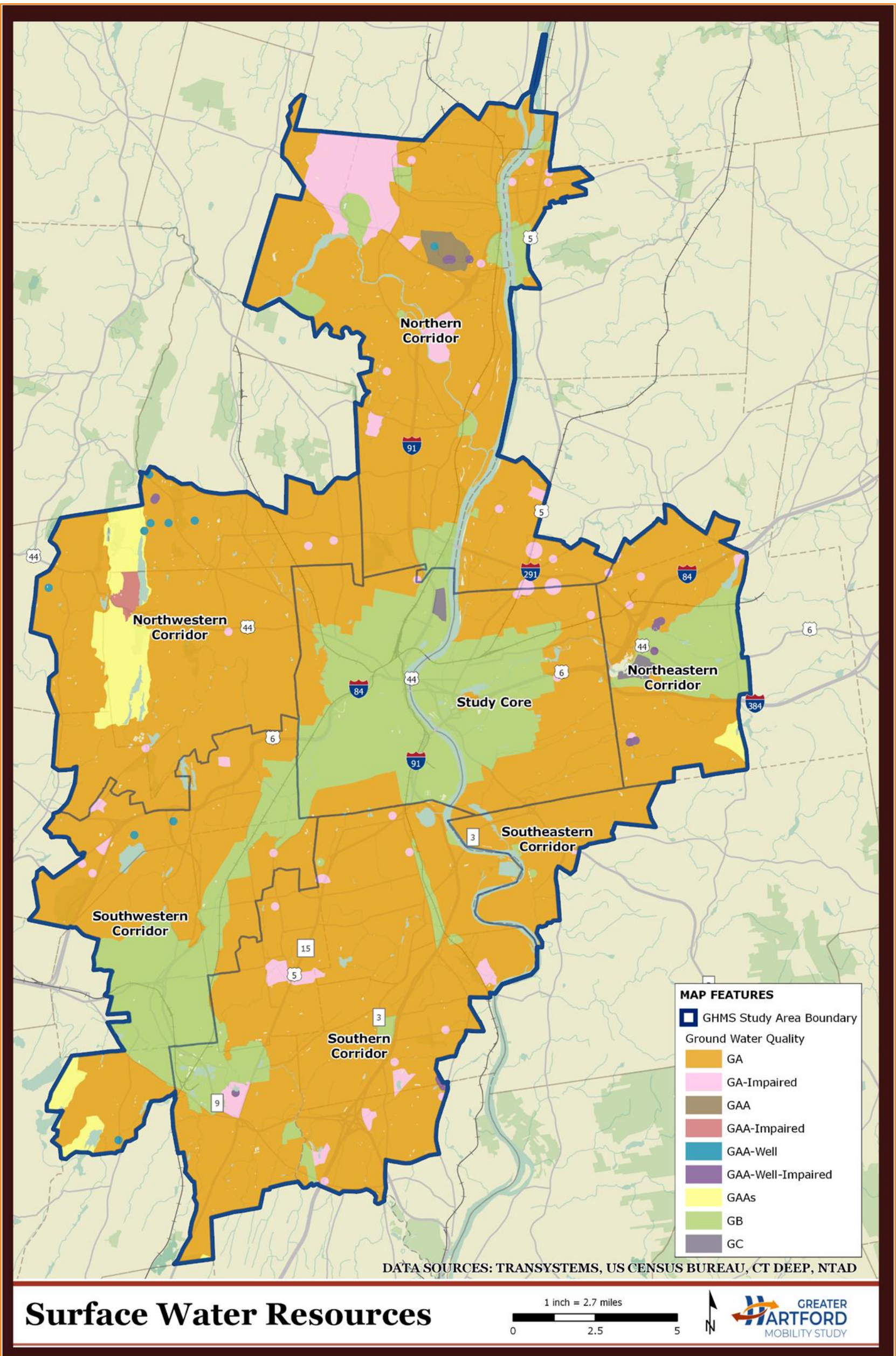
data layer to categorize special cases of GA or GAA that may not be meeting the goal (impaired), surround public water supply wells (Well) or contribute to a public water supply watershed for another state (NY).

Similar to surface water resources, the presence of groundwater resources is most likely to affect the siting of river and stream crossings, widenings or new alignments. These resources may have setbacks or protected zones and require additional levels of stormwater treatment.

**Table 7-5: Groundwater Resources**

| Sector                  | Comments  |
|-------------------------|---|
| <b>Study Core</b>       | Primarily GB (not suitable for drinking water) in central core of Hartford, East Hartford / GA outside central city (assumed suitable for drinking water) |
| <b>Northwest Sector</b> | Primarily GA (assumed suitable for drinking water) / GAA (near wells and tributaries contributing to the Hartford Reservoirs)                             |
| <b>North Sector</b>     | Primarily GA (assumed suitable for drinking water) / GA-Impaired and GB near Bradley International Airport  |
| <b>Northeast Sector</b> | Primarily GA (assumed suitable for drinking water) / GB (not suitable for drinking water) in central core of Manchester                                   |
| <b>Southwest Sector</b> | Primarily GA (assumed suitable for drinking water) / GB (not suitable for drinking water) in central core of New Britain and adjacent to Hartford Line    |
| <b>South Sector</b>     | Primarily GA (assumed suitable for drinking water)  |
| <b>Southeast Sector</b> | Primarily GA (assumed suitable for drinking water)  |





## Surface Water Resources

**Figure 7-5: Groundwater Resources**

Data Source: Connecticut Department of Energy and Environmental Protection (DEEP)

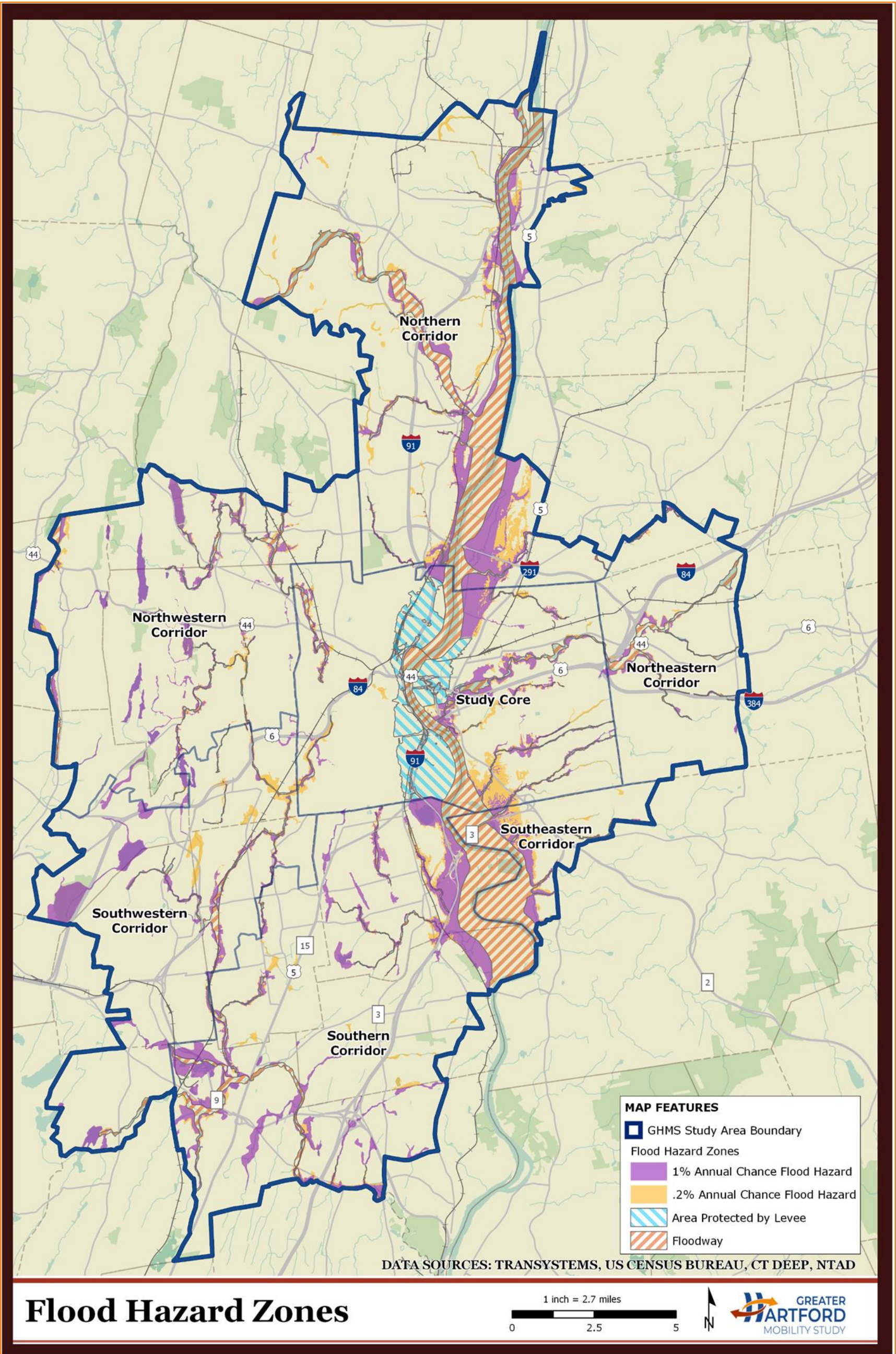
## 7.6 Floodplains

Floodplains (primarily the 100-year Flood Hazard) were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements. Floodplains within the study area are primarily associated with riverfront areas adjacent to the Connecticut River and its

tributaries. The presence of these floodplains is most likely to affect the siting of river crossings and widening or new alignments adjacent to the existing Hartford Line. Existing and proposed facilities within the vicinity of floodplain areas will also have to consider climate change and resiliency issues.

**Table 7-6: Floodplains**

| Sector                  | Comments            |
|-------------------------|---------------------|
| <b>Study Core</b>       | Moderate prevalence |
| <b>Northwest Sector</b> | Low prevalence      |
| <b>North Sector</b>     | Moderate prevalence |
| <b>Northeast Sector</b> | Low prevalence      |
| <b>Southwest Sector</b> | Moderate prevalence |
| <b>South Sector</b>     | Moderate prevalence |
| <b>Southeast Sector</b> | Low prevalence      |



**Figure 7-6: Floodplains**

Data Source: Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL)

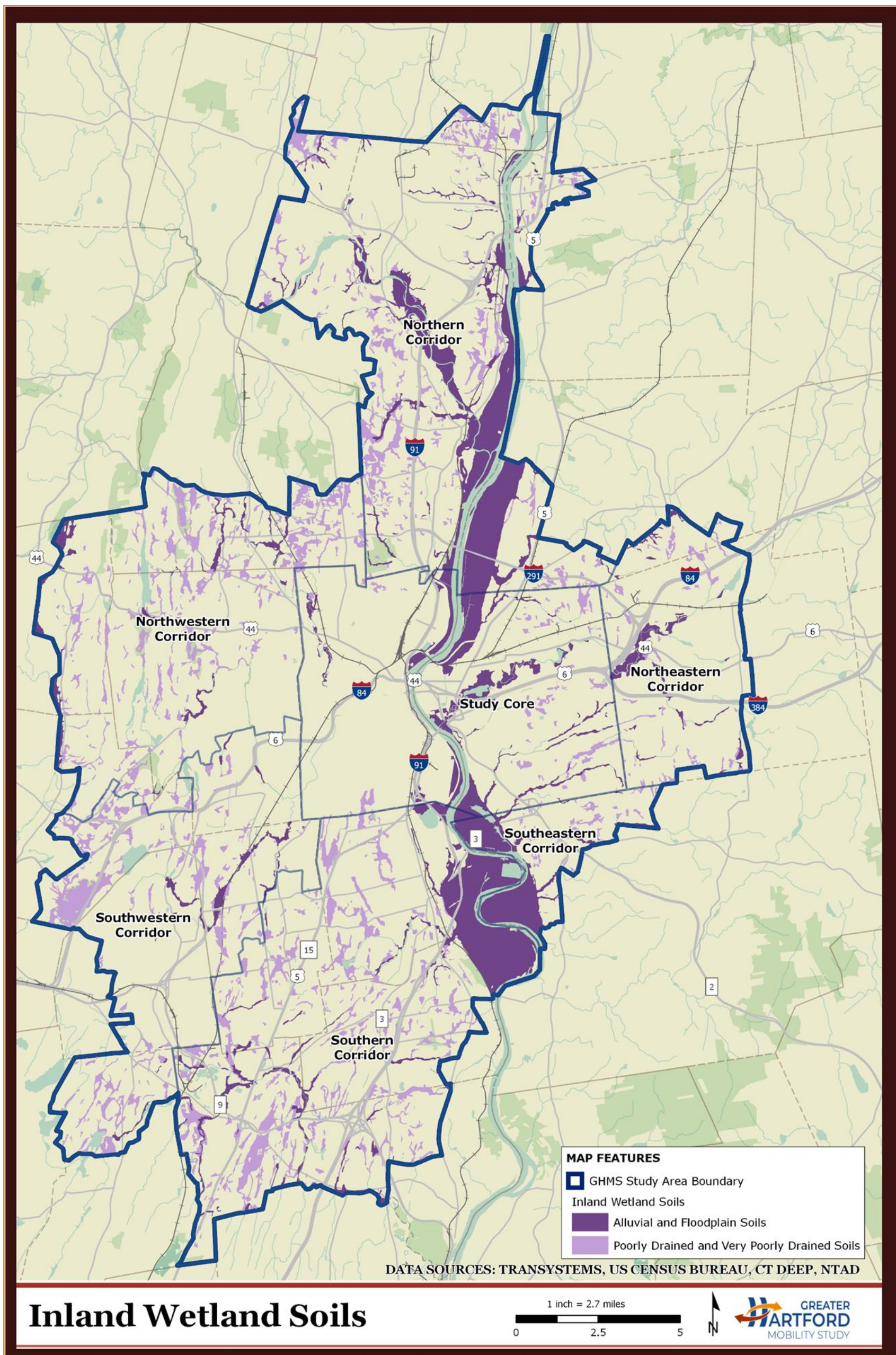
### 7.7 Wetlands

Wetlands (characterized by DEEP as Inland Wetland Soils) were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements. Wetlands within the study area are primarily associated with riverfront areas adjacent to the Connecticut River and its tributaries, as well as other streams and brooks. Isolated wetlands are present throughout the study

area and may be associated with open space or surface water resources. The presence of these floodplains is most likely to affect the siting of river crossings and widening or new alignments. Existing and proposed facilities within the vicinity of wetland areas will also have to consider climate change and resiliency issues. Impacts to wetland resources will necessitate permitting at the local, state and federal levels.

**Table 7-7: Wetlands**

| <b>Sector</b>           | <b>Comments</b>  |
|-------------------------|--|
| <b>Study Core</b>       | Wetland areas adjacent to the Connecticut River, Park River, Hockanum River, Parker River and Pewterpot Brook. Isolated wetlands near Keney Park (Meadow Brook) and Rentschler Field (Willow Brook). |
| <b>Northwest Sector</b> | Wetland areas adjacent to Route 44 and Route 218 associated with Beman Brook and Wash Brook, North Branch of the Park River, Tumbledown Brook and Hart Meadow Brook.                                 |
| <b>North Sector</b>     | Wetland areas adjacent to I-91 and the Hartford Line associated with the Connecticut River, Farmington River and Mill Brook.   |
| <b>Northeast Sector</b> | Wetland areas adjacent to I-84, I-384, Route 44, Route 6 associated with the Hockanum River, in Buckland Hills associated with Plum Gulley Brook and Farm Brook.                                     |
| <b>Southwest Sector</b> | Wetland areas adjacent to I-84, Route 9 and the Hartford Line associated with the Dead Wood Swamp, Quinnipiac River, Mill Brook, Piper Brook, and Mattabesset River.                                 |
| <b>South Sector</b>     | Wetland areas adjacent to I-91, Route 9, Route 3 and the Hartford Line associated with the Connecticut River, Mattabesset River, Hatchery Brook and Spruce Brook.                                    |
| <b>Southeast Sector</b> | Wetland areas adjacent to Route 3 and Route 2 associated with the Connecticut River and Salmon Brook.  |



**Figure 7-7: Wetlands**

Data Source: Connecticut Department of Energy and Environmental Protection (DEEP)

### 7.8 Historic, Architectural and Archaeological Resources

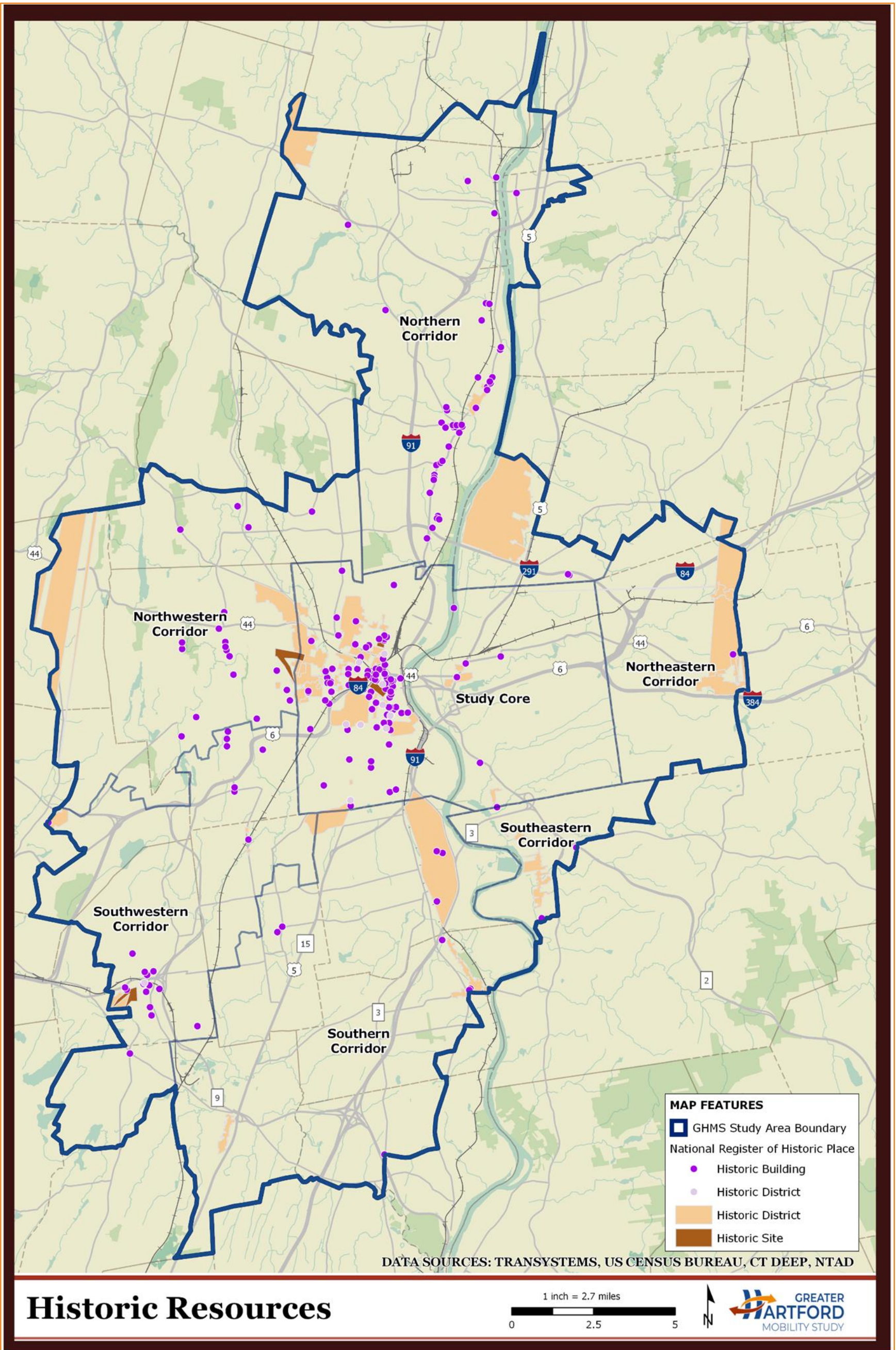
Historic and Architectural Resources were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements. It should be noted that concerns associated with archaeological resources are similar, but due to their sensitive nature are not provided in a publicly available searchable database.

There are over 400 historical and architectural properties within the study area that are listed in the National Register of Historic Places, including nearly 80 historic districts. The majority of these protected properties and districts are in Hartford within the Study Core.

In addition, there are countless properties and districts designated by local historical commissions as having local significance. The presence of these resources is most likely to affect widening, new alignments or placement of facilities that may alter the character or context of the property or district in question. A number of historic properties or transportation-related resources are located adjacent to the Hartford Line and may be integrated into potential solutions, such as railroad stations, depots and other support structures. If impacts to these properties cannot be avoided, context-sensitive solutions will be required, and an added layer of regulatory constraint must be addressed.

**Table 7-8: Historic, Architectural and Archaeological Resources**

| Sector                  | Comments   |
|-------------------------|--|
| <b>Study Core</b>       | High prevalence: over 50 historic districts          |
| <b>Northwest Sector</b> | Low prevalence: less than 5 historic districts       |
| <b>North Sector</b>     | Low prevalence: less than 5 historic districts       |
| <b>Northeast Sector</b> | Moderate prevalence: less than 10 historic districts |
| <b>Southwest Sector</b> | Low prevalence: less than 5 historic districts       |
| <b>South Sector</b>     | Moderate prevalence: less than 10 historic districts |
| <b>Southeast Sector</b> | Moderate prevalence: less than 10 historic districts |



**Figure 7-8: Historic, Architectural and Archaeological Resources**

Data Source: National Park Service (NPS)

### 7.9 Socioeconomic Considerations – Population and Employment Density

Population density was reviewed for its general presence within the study area and sectors and its potential to constrain mobility improvements (due to impacts) or serve as a catalyst for mobility improvements (due to critical mass and ability to benefit greater numbers of citizens).

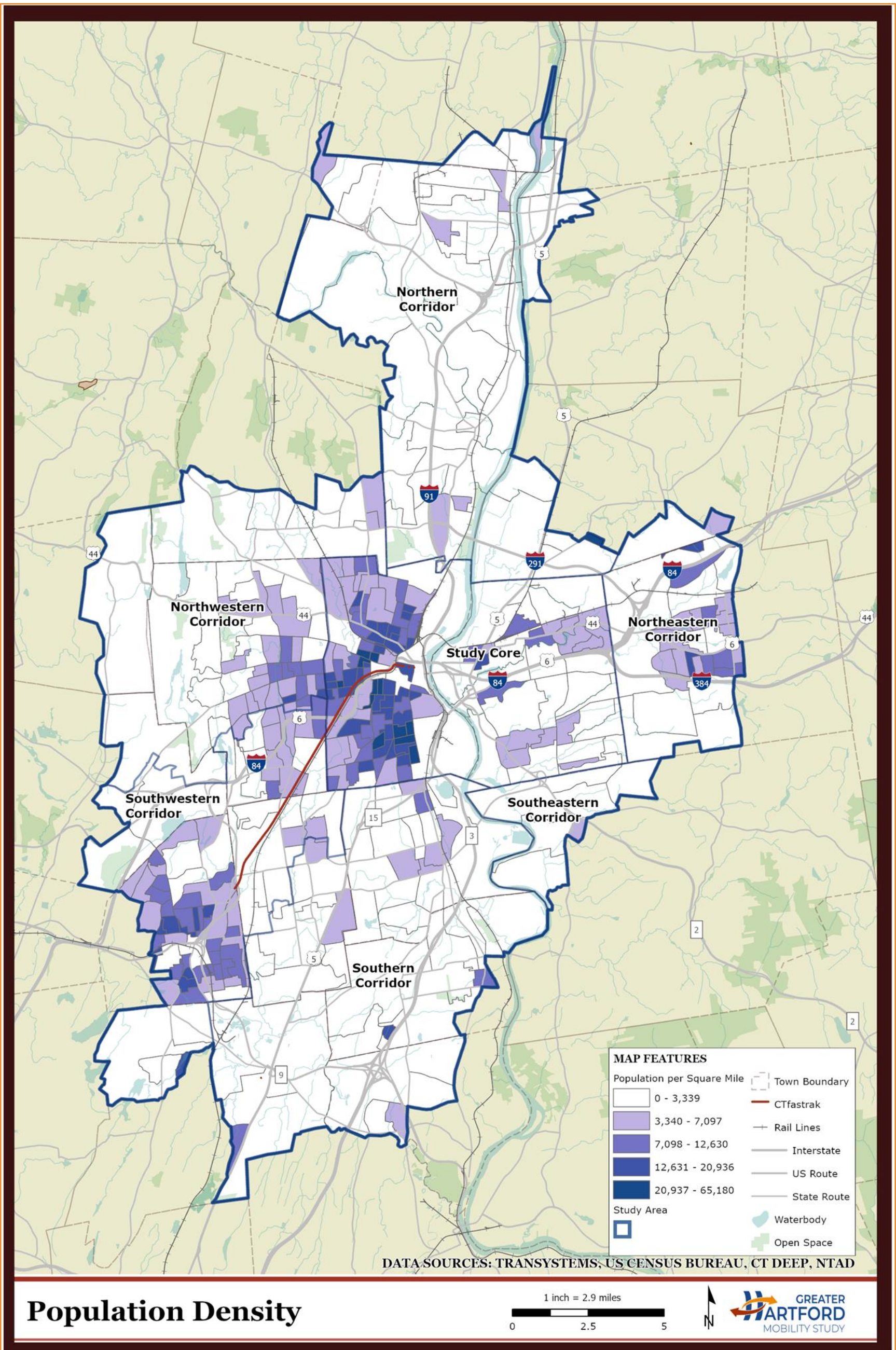
Population and employment trends within the study area have been the subject of analysis by CRCOG in two recent publications: the “Metropolitan Transportation Plan Long Range Transportation Plan for the Metro-Hartford Capitol Region – Connect 2045”

adopted in April, 2019, and “METRO HARTFORD FUTURE ACCELERATING SHARED AND SUSTAINED ECONOMIC GROWTH A Comprehensive Economic Development Strategy for the Capitol Region,” also published in 2019. Within the CRCOG region, population growth is expected to be 7.3% between 2010 and 2045. This growth is characterized as over three times the expected statewide growth during the same period. Both the Long Range Transportation Plan and the CEDS report reference an expected increase in the over-65 age cohort and stagnation or declines in other cohorts, which may inform the type of transportation and mobility improvements envisioned for the future.

**Table 7-9: Population Density**

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | High density: many areas with over 11,000 people per square mile                |
| <b>Northwest Sector</b> | Moderate density: some areas with over 10,000 people per square mile            |
| <b>North Sector</b>     | Low-to-moderate density: isolated areas with over 3,000 people per square mile  |
| <b>Northeast Sector</b> | Moderate density: some areas with over 11,000 people per square mile            |
| <b>Southwest Sector</b> | Moderate-to-high density: several areas with over 11,000 people per square mile |
| <b>South Sector</b>     | Low-to-moderate density: isolated areas with over 3,000 people per square mile  |
| <b>Southeast Sector</b> | Low density: few areas with over 3,000 people per square mile                   |





**Figure 7-9: Population Density**

Data Source: US Census Bureau

Regional employment projections show a 17% growth in the number of jobs between 2010 and 2045, or less than 1% per year. The Long Range Transportation Plan notes that this growth exceeds the projected population growth during the same period and will continue the region's status as a net importer of employees, requiring continued solutions to regional transportation issues.

A review of annual community population estimates from the Connecticut State Department of Public Health for the last five reporting years (2015-2019) indicate that population growth in Hartford County and the region as a whole is either flat or slightly (<1.5%) negative during that time period. The only recent population growth among the study area sectors during that time is in the Northern Sector.

Despite the decline in population over the last five years, data from the US Census American Community Survey indicates a slight growth in the number of households during the same five-year period. The number of households in Hartford County was estimated to increase by 2%, while the increase in the city of Hartford was nearly 8%. A corresponding drop in average household size is attributable to this finding.

## **Employment Centers**

Employment centers were reviewed for their general presence within the study area and sectors and potential to constrain (due to potential property impacts) or support (due to socioeconomic benefits) future mobility improvements. The presence of employment centers is most likely to affect widenings or new alignments, transit routing and service, and active transportation connections. Potential benefits could include improved access to jobs and transit service that connects zero-vehicle households to employment centers outside the Study Core.

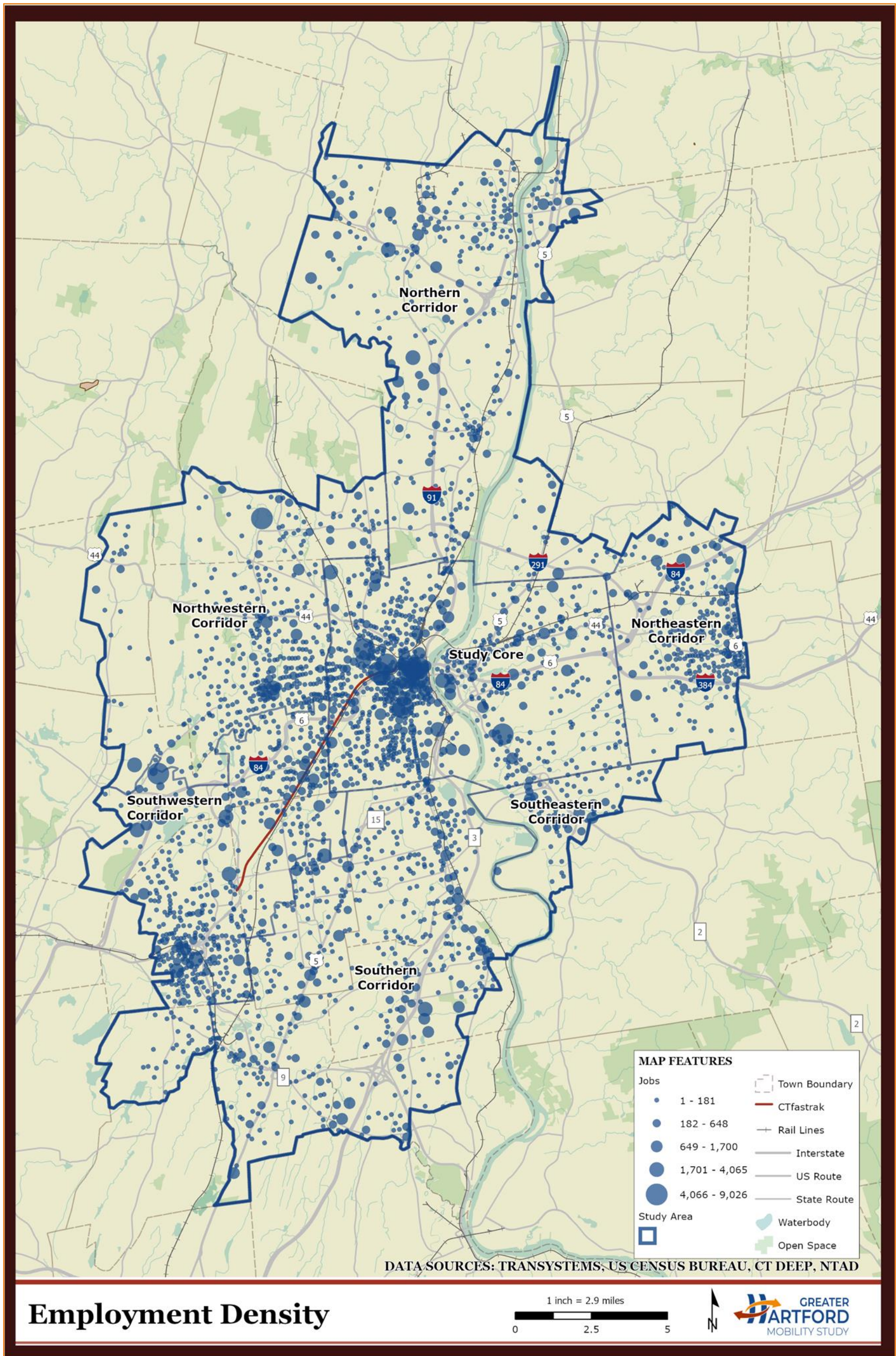
Using the US Census Longitudinal Employer-Household Dynamics dataset and the associated "On the Map" tool, employment center data was identified for Hartford County. Within the county, approximately 50% of workers live less than ten miles from their residence. Another 33% work between 10 and 24 miles from home and the balance work over 25 miles from home. Employment density (jobs per square mile) by sector is summarized below.

**Table 7-10: Employment Density**

| <b>Sector</b>           | <b>Comments</b>  |
|-------------------------|--|
| <b>Study Core</b>       | High density: some areas with over 50,000 jobs per square mile                 |
| <b>Northwest Sector</b> | Moderate density: some areas with 13,000-30,000 jobs per square mile           |
| <b>North Sector</b>     | Low-to-moderate density: isolated areas with 3,000-13,000 jobs per square mile |
| <b>Northeast Sector</b> | Low-to-moderate density: isolated areas with 3,000-13,000 jobs per square mile |
| <b>Southwest Sector</b> | Low-to-moderate density: isolated areas with 3,000-13,000 jobs per square mile |
| <b>South Sector</b>     | Low-to-moderate density: isolated areas with 3,000-13,000 jobs per square mile |
| <b>Southeast Sector</b> | Low-to-moderate density: isolated areas with 3,000-13,000 jobs per square mile |

It should be noted that the data summarized above is based upon pre-pandemic conditions and do not reflect an anticipated post-pandemic increase in work-from-home options. The data still provides a baseline for future scenario planning that is focused more on frequency (number of days at the workplace vs. number

of days working from home) than on geography at this time. As mobility options are developed, further inquiries to specific large employers may be required to understand how post-pandemic working options may affect the role of employment centers and the workplace of the future.



**Figure 7-10: Employment Density**

Data Source: US Census Bureau

### 7.10 Socioeconomic Considerations – Zero Vehicle Households

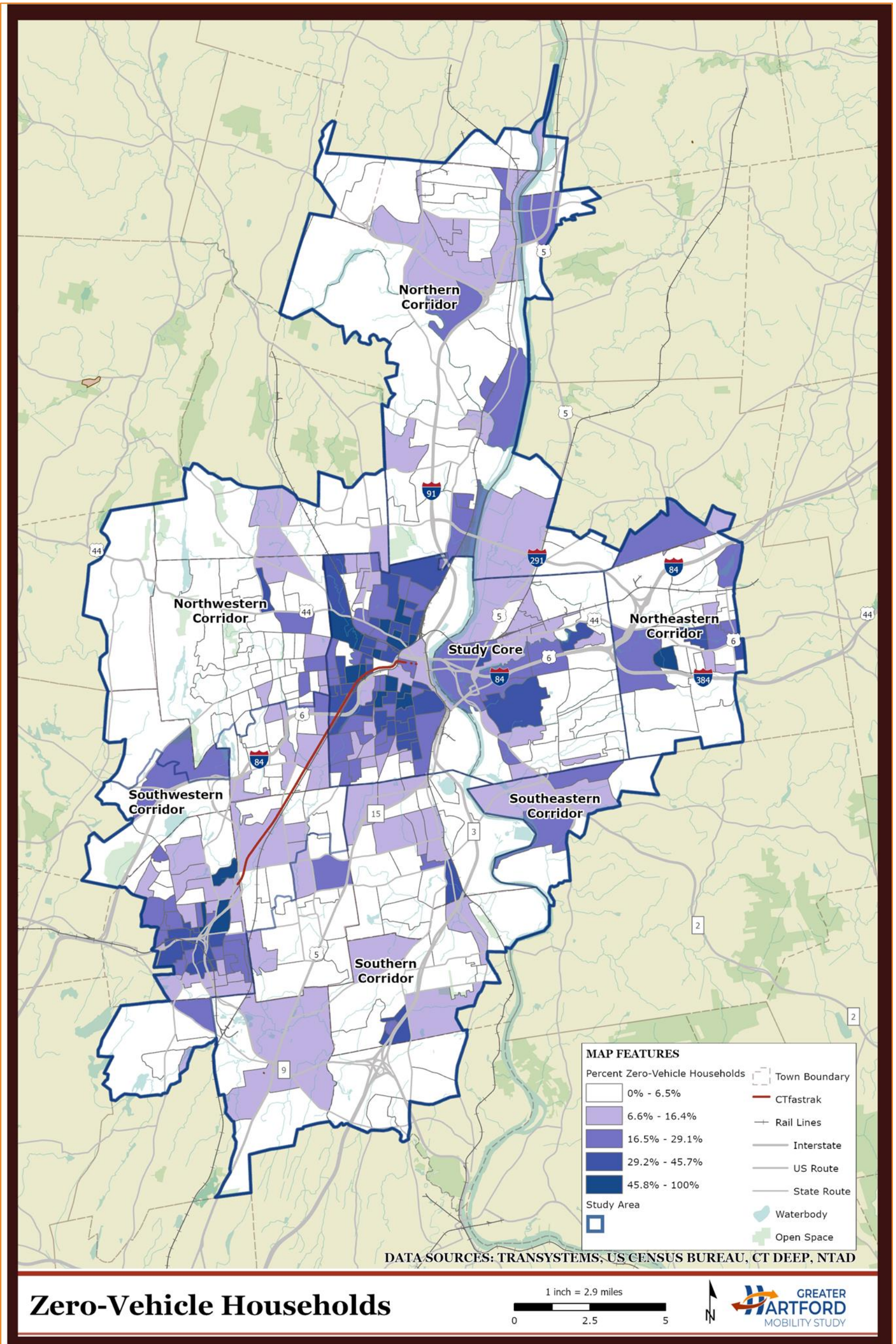
Zero-vehicle households represent a segment of the population that are either transit-dependent or must rely on bicycle travel, carpooling or walking to fulfill job responsibilities and obtain basic human services. These households are often part of low-income populations as well.

Demographic data on zero-vehicle households was reviewed for its general presence within the study area and sectors and potential to be positively or negatively

affected by future mobility improvements. Hartford, East Hartford (Study Core) and New Britain (SW Sector) are all communities with concentrations of zero-vehicle households. The presence of these zero-vehicle households is most likely to affect the siting of new transit alignments or routes, stations or terminals, as well as consideration of transit links to regional employment centers. Improvements to access, mode choice, convenience and travel time savings will have to be balanced with potential noise and air quality impacts.

**Table 7-11: Zero Vehicle Households**

| <b>Sector</b>           | <b>Comments</b>     |
|-------------------------|---------------------|
| <b>Study Core</b>       | High prevalence     |
| <b>Northwest Sector</b> | Low prevalence      |
| <b>North Sector</b>     | Low prevalence      |
| <b>Northeast Sector</b> | Moderate prevalence |
| <b>Southwest Sector</b> | High prevalence     |
| <b>South Sector</b>     | Low prevalence      |
| <b>Southeast Sector</b> | Low prevalence      |



**Figure 7-11: Zero Vehicle Households**

Data Source: US Census Bureau

### 7.11 Socioeconomic Considerations – Environmental Justice / Title VI Communities

A primary purpose of Environmental Justice is to ensure that disadvantaged populations are not disproportionately affected by the impacts of transportation improvements. Similarly, Title VI regulations are in place to ensure that disadvantaged populations have equal access and opportunity to learn about and comment on proposed transportation improvements. The CRCOG 2019 Title VI / Environmental Justice Atlas was the data source for identification of Environmental Justice and Title VI communities within the study area.

Recipients of federal transportation funds for planning and other activities are required to comply with the provisions of Title VI of the Civil Rights Act of 1964 (42 U.S.C. Section 2000d). United States Department of Transportation (USDOT) guidance<sup>1</sup> on the responsibilities to specific populations states that “Title VI of the Civil Rights Act of 1964, 42 U.S.C. 2000d, et seq., and its implementing regulations provide that no person shall be subjected to discrimination on the basis of race, color, or national origin under any program or activity that receives Federal financial assistance.” The Federal Transit Administration’s (FTA) guidance<sup>2</sup> on Title VI responsibilities also has the following objectives:

a. Ensure that the level and quality of transportation service is provided without regard to race, color, or national origin;

b. Identify and address, as appropriate, disproportionately high and adverse human health and environmental effects, including social and economic effects of programs and activities on minority populations and low-income populations;

c. Promote the full and fair participation of all affected populations in transportation decision making;

d. Prevent the denial, reduction, or delay in benefits related to programs and activities that benefit minority populations or low-income populations;

e. Ensure meaningful access to programs and activities by persons with limited English proficiency.

Related to Title VI is Executive Order 12898 of 1994 (59 FR 7629), which focuses attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving Environmental Justice (EJ) for all communities. This Executive Order directs federal agencies and their programs to avoid disproportionately high and adverse health or environmental effects on minority and low-income populations, to the greatest extent possible. The order is intended to promote nondiscrimination in federal programs as well as to provide minority and low-income communities access to public participation. The objectives of Title VI and EJ serve as a basis for a recipient of any federal transportation funds to adopt as the goals of its own program.

**Minority Populations**

As defined in the CRCOG documentation and the U.S. Census Bureau, minority populations are those groups who are members of the following racial or ethnic groups:

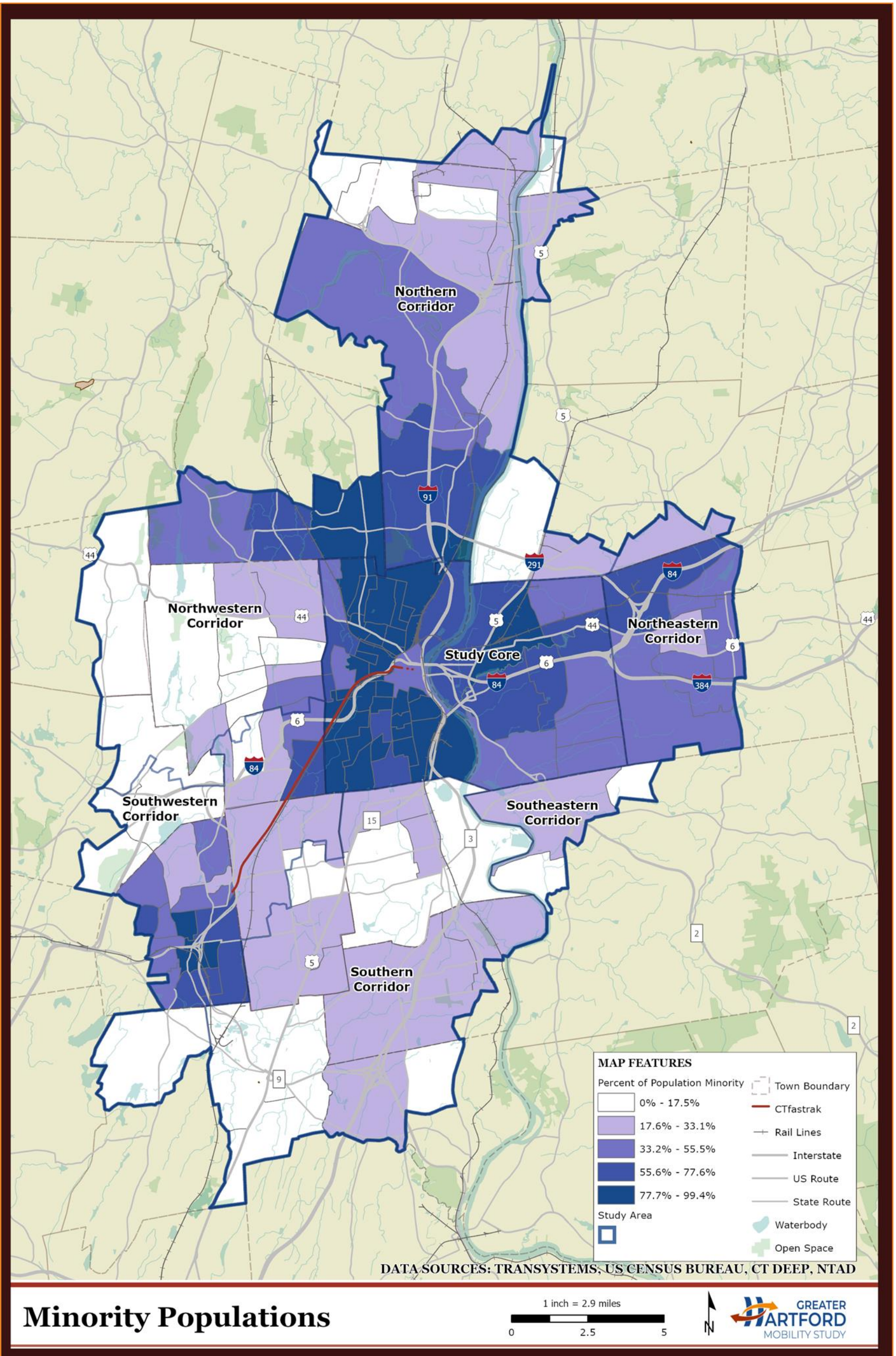
- Hispanic or Latino (of any race);
- African-American or Black;
- Asian, Native Hawaiian, other Pacific Islander;
- American Indian, Alaska Native;
- Some other race; or
- Two or more races.

Demographic data on minority populations was reviewed for their general presence within the study area and sectors and potential to be positively or negatively affected by future mobility improvements. Hartford, East Hartford (Study Core) and New Britain (SW Sector) are all majority-minority communities. The presence of these minority populations is most likely to affect the siting of new transit alignments or routes, as well as stations or terminals. Improvements to access, mode choice, convenience and travel time savings will have to be balanced with potential noise and air quality impacts.

**Table 7-12: Minority Population**

| <b>Sector</b>           | <b>Comments</b>     |
|-------------------------|---------------------|
| <b>Study Core</b>       | High prevalence     |
| <b>Northwest Sector</b> | Moderate prevalence |
| <b>North Sector</b>     | Moderate prevalence |
| <b>Northeast Sector</b> | Moderate prevalence |
| <b>Southwest Sector</b> | High prevalence     |
| <b>South Sector</b>     | Low prevalence      |
| <b>Southeast Sector</b> | Low prevalence      |





**Figure 7-12: Minority Population**

Data Source: US Census Bureau

**Low-Income Populations**

Low-income populations are typically those who are defined as being below the federal poverty level as defined by the US Department of Health and Human Services for purposes of calculating eligibility for certain federal assistance programs. The poverty level is calculated annually and is broken out by number of family members.

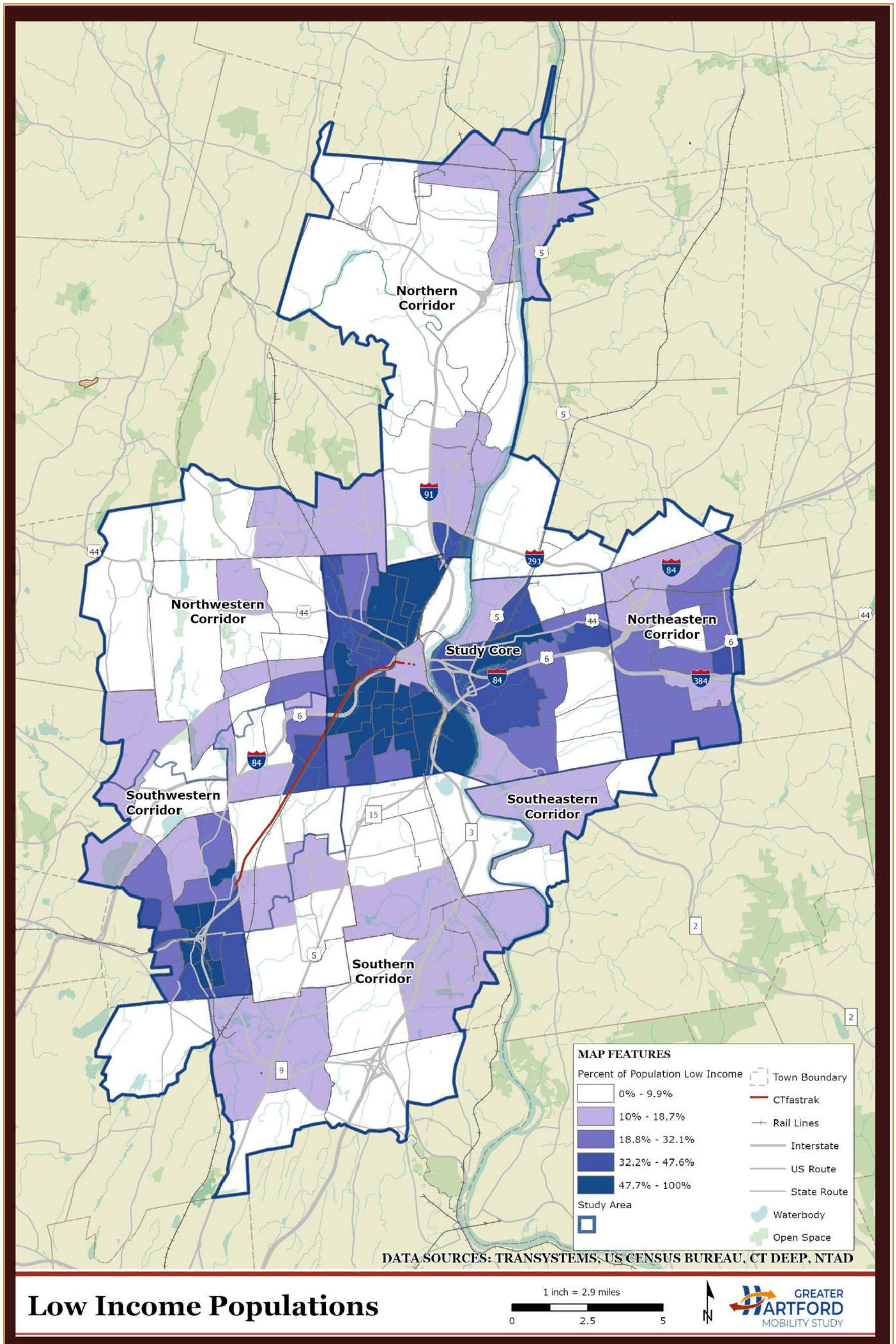
Demographic data on low-income populations was reviewed for their general presence within the study area and sectors and potential to be positively or negatively affected by future mobility improvements. The CRCOG Atlas uses the federally-defined Poverty

Level as well as a second level of 150% of the federal poverty level. A total of 10.7% of residents in the CRCOG Region live below poverty level, and 17.0% at below 150% of the poverty level.

Hartford (Study Core) and New Britain (SW Sector) exhibit the highest incidence of persons below the poverty level. The presence of these low-income populations is most likely to affect the siting of new transit alignments or routes, stations or terminals, and transit fare structures. Improvements to access, mode choice, convenience and travel time savings will have to be balanced with potential noise and air quality impacts.

**Table 7-13: Low-Income Populations**

| <b>Sector</b>           | <b>Comments</b>     |
|-------------------------|---------------------|
| <b>Study Core</b>       | High prevalence     |
| <b>Northwest Sector</b> | Low prevalence      |
| <b>North Sector</b>     | Low prevalence      |
| <b>Northeast Sector</b> | Moderate prevalence |
| <b>Southwest Sector</b> | High prevalence     |
| <b>South Sector</b>     | Low prevalence      |
| <b>Southeast Sector</b> | Low prevalence      |



## Low Income Populations

**Figure 7-13: Low-Income Populations**

Data Source: US Census Bureau

**Limited English Proficiency**

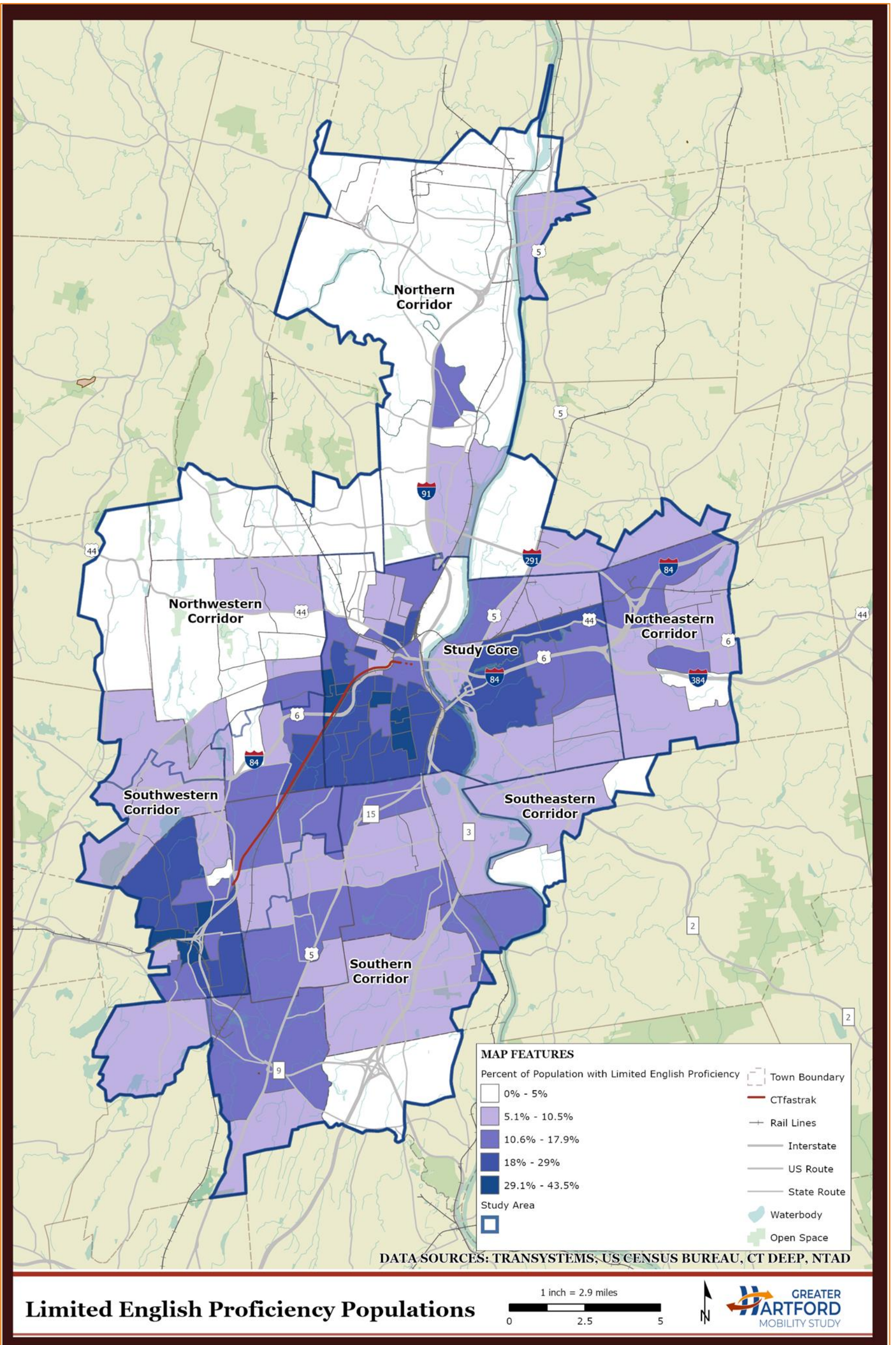
Limited English Proficiency (LEP) is the term used in federal regulations to define persons who have difficulty speaking English. LEP individuals are identified through the American Community Survey as persons who primarily speak a language other than English and speak English less than “very well.”.

Demographic data on LEP was reviewed for its general presence within the study area and sectors.

LEP is a Title VI concern regarding equal access and opportunity to learn about and comment on proposed transportation improvements. The CRCOG data is presented as an absolute number of residents: the LEP population in the Capitol Region represents over 8% of the total overall population. Nearly half of the LEP population is Spanish-speaking, followed by Polish and Chinese.

**Table 7-14: Population with Limited English Proficiency**

| <b>Sector</b>           | <b>Comments</b>     |
|-------------------------|---------------------|
| <b>Study Core</b>       | High prevalence     |
| <b>Northwest Sector</b> | High prevalence     |
| <b>North Sector</b>     | Moderate prevalence |
| <b>Northeast Sector</b> | High prevalence     |
| <b>Southwest Sector</b> | High prevalence     |
| <b>South Sector</b>     | High prevalence     |
| <b>Southeast Sector</b> | Moderate prevalence |



**Figure 7-14: Population with Limited English Proficiency**

Data Source: US Census Bureau

### 7.12 Socioeconomic Considerations –Institutional Resources

Institutional uses were reviewed for their general presence within the study area and sectors and potential to constrain (due to potential property impacts, noise, emissions) or support (due to socioeconomic and connectivity benefits) future mobility improvements. The presence of institutional uses is most likely to affect widenings or new alignments, transit routing and service, and active transportation connections. Institutional uses identified for this purpose are hospital / health care facilities and post-secondary educational facilities.

The location of hospitals and health care facilities are identified below. Access to these facilities is a key public health metric.

The locations of post-secondary educational facilities are also identified below. Unlike primary and secondary facilities that typically provide their own transportation services within the community, post-secondary educational facilities serve a regional population.

**Table 7-15: Institutional Resources**

Hospitals / Health Care Facilities

| Sector                  | Comments  |
|-------------------------|---|
| <b>Study Core</b>       | Hartford Hospital, St. Francis Hospital and Medical Center, Connecticut Children’s Medical Center, Institute of Living, Oak Hill School, Capitol Region Mental Health Center, Connecticut Institute for the Blind, Burgdorf Health Center, Northend Senior Center, Mount Sinai Hospital |
| <b>Northwest Sector</b> | Hospital at Hebrew Health Care, West Hartford; UConn Health Center, Farmington  |
| <b>North Sector</b>     | Hartford HealthCare, Windsor  |
| <b>Northeast Sector</b> | Manchester Memorial Hospital, Manchester  |
| <b>Southwest Sector</b> | UConn John Dempsey Hospital, Farmington; Hospital of Central Connecticut, New Britain;  |
| <b>South Sector</b>     | VA Connecticut Healthcare, Newington; Veterans Home and Hospital, Rocky Hill;   |
| <b>Southeast Sector</b> | None  |

Post-Secondary Educational Facilities

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | University of Hartford, Trinity College, UConn-Hartford, Capitol Community College, Rensselaer at Hartford, Goodwin College |
| <b>Northwest Sector</b> | University of St. Joseph, West Hartford   |
| <b>North Sector</b>     | None  |
| <b>Northeast Sector</b> | Manchester Community College, Manchester  |
| <b>Southwest Sector</b> | Central Connecticut State University, New Britain; UConn School of Medicine, Farmington                                     |
| <b>South Sector</b>     | None  |
| <b>Southeast Sector</b> | None  |

### 7.13 Socioeconomic Considerations – Land Use and Zoning

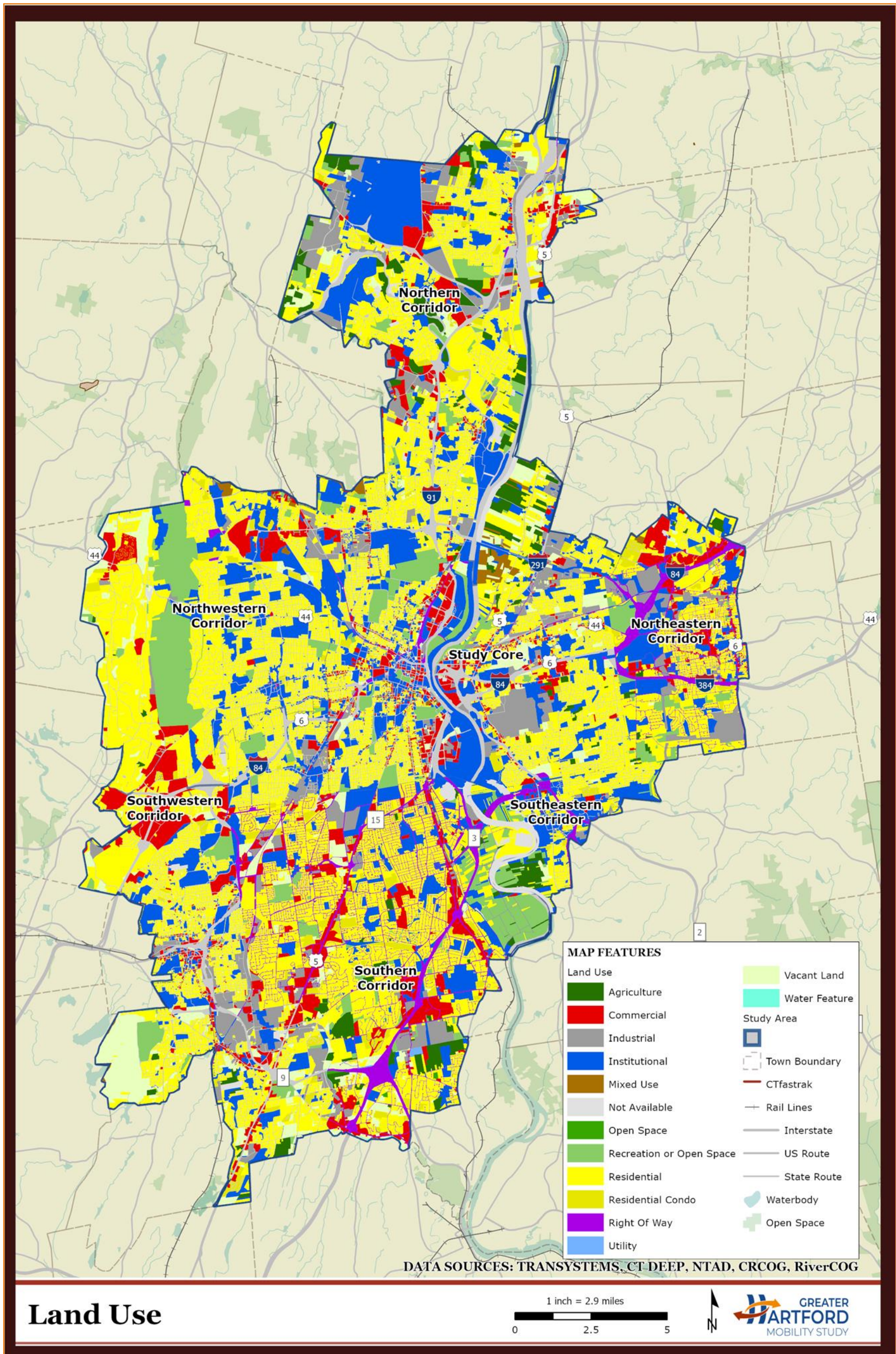
Regional land use patterns were reviewed for their general presence within the study area and sectors and potential to influence future mobility improvements. Specific land use clusters may serve as nodes to be connected in a network as part of potential transit service or goods movement, such as employment

centers, with the understanding that mobility is connected to where people reside. In other cases, land uses can be analyzed for the potential to be compatible with mobility improvements, whether from a physical, social or public health perspective. A summary of notable land use types within the individual sectors is provided below.

**Table 7-16: Predominant Land Use**

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | Institutional, commercial and recreational uses             |
| <b>Northwest Sector</b> | Institutional, industrial, commercial and mixed-use         |
| <b>North Sector</b>     | Institutional, industrial, commercial and agricultural uses |
| <b>Northeast Sector</b> | Industrial, institutional and commercial uses               |
| <b>Southwest Sector</b> | Institutional, industrial and commercial uses               |
| <b>South Sector</b>     | Institutional, commercial and industrial                    |
| <b>Southeast Sector</b> | Institutional, agricultural and industrial uses             |





**Figure 7-15: Land Use**

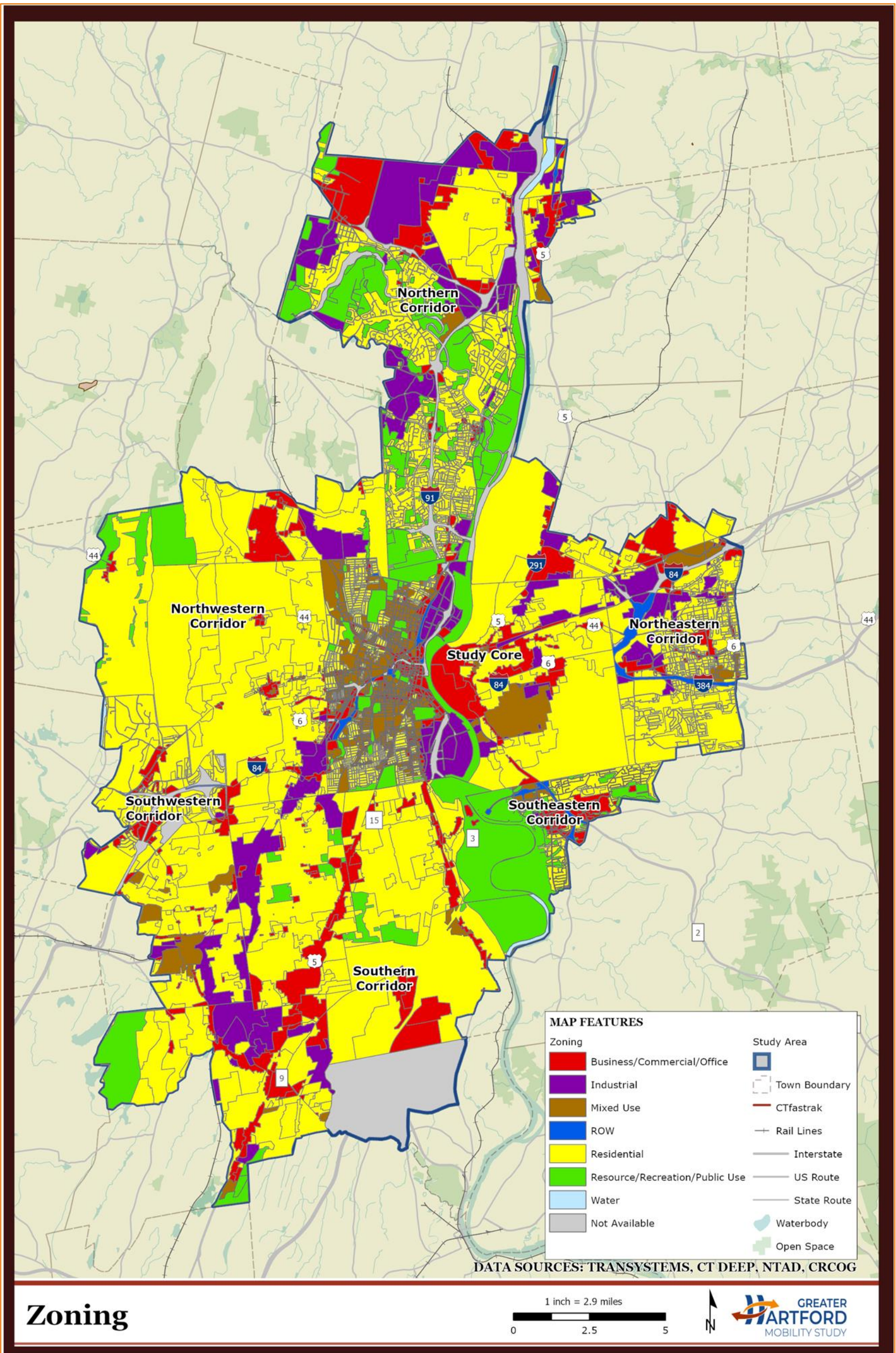
Data Sources: Capitol Region Council of Governments, Lower Connecticut River Valley Council of Governments

Zoning regulations for each community were reviewed for their potential to promote Transit-Oriented

Development (TOD) and take advantage of future mobility improvements.

**Table 7-17: Zoning**

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | The city of Hartford has specific Transit-Oriented Development (TOD) zoning.  |
| <b>Northwest Sector</b> | No communities with TOD-specific zoning.  |
| <b>North Sector</b>     | The town of Windsor allows increased residential density and building height in the redevelopment area of Windsor Center. In Windsor Locks, the Main Street Overlay Zone includes provisions to “take maximum advantage of the potential relocation of the Windsor Locks Train Station to its proper location back in the historic downtown setting and providing appropriate transit-oriented development land use and densities.” |
| <b>Northeast Sector</b> | The town of Manchester provides density incentives in its Comprehensive Urban Development Zone and General Business Zone for areas within one-half mile of mass transit.  |
| <b>Southwest Sector</b> | No communities with TOD-specific zoning.  |
| <b>South Sector</b>     | The town of Newington has a TOD Overlay District.   |
| <b>Southeast Sector</b> | The City of New Britain has a specific Incentive Housing Zone / Transit-Oriented Design District.   |



**Figure 7-16: Zoning**

Data Source: Capitol Region Council of Governments

#### 7.14 Hazardous Materials

Hazardous materials records were reviewed for their general presence within the study area and sectors and potential to constrain future mobility improvements. The presence of hazardous materials is most likely to affect widenings or new alignments, transit routing and service, and active transportation connections.

CT DEEP maintains a “List of Contaminated or Potentially Contaminated Sites in Connecticut” (<https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/List-of-Contaminated-or-Potentially-Contaminated-Sites-in-Connecticut>). Sites are listed by community. The majority of sites in the CT DEEP database are spills or leaks associated with underground storage tanks (USTs) such as those at gas stations. Other sites include those subject to the Property Transfer Act, Federal Resource Conservation and Recovery Act (RCRA), sites included in the EPA Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and sites with Environmental and Land Use Restrictions (ELUR), among others.

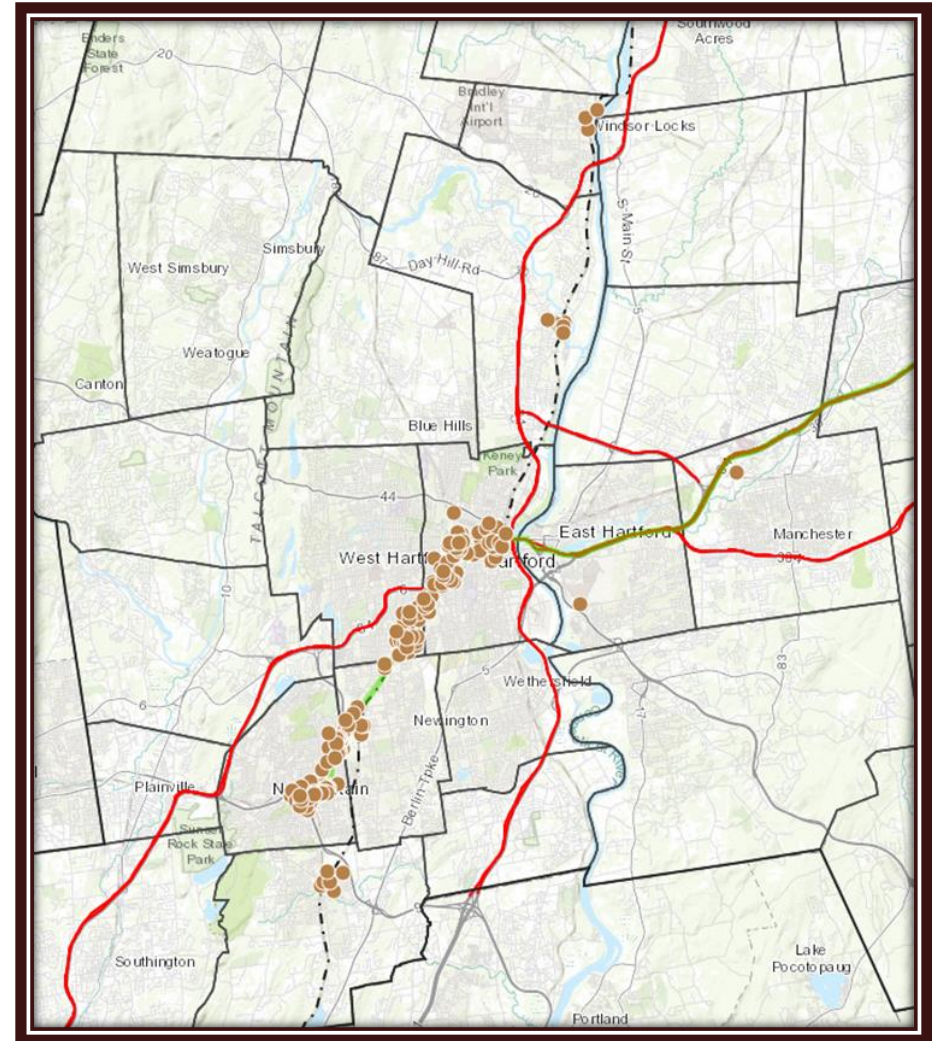
Table 18 summarizes the number of listings in each sector community, the number of sites that are not associated with USTs, the number of CERCLIS sites, and the number of ELUR sites. These summaries will provide an order-of-magnitude need for further consideration as sector-specific and site-specific future mobility improvements are proposed and potential barriers to these improvements.

CRCOG has developed a targeted inventory of sites within the CTfastrak and the CTrail-Hartford Line corridors to identify the need for brownfield assessment and remediation and to support transit-oriented development (TOD). Using a Geographic Information System (GIS) they are able to show parcels within a half-mile radius of the CTfastrak and the CTrail stations which have been identified through state or federal brownfields databases or by municipalities as brownfields sites. The goal of this work is to identify sites with TOD potential which need environmental assessment and/or remediation. The focus is on non-residential sites. Existing planning and environmental assessment reports can be linked to the inventory. The inventory currently includes 245 potential and known brownfields sites. CRCOG continues to expand this online inventory to include additional brownfield sites throughout the region.

**Table 7-18: Hazardous Materials**

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | Hartford:621 total sites / 489 USTs / 0 CERCLIS sites / 0 ELUR sites / 130 other sites;<br>East Hartford: 267 total sites / 185 USTs / 1 CERCLIS site / 0 ELUR sites / 81 other sites;<br>West Hartford: 530 total sites / 471 USTs / 4 CERCLIS sites / 1 ELUR site / 54 other sites.   |
| <b>Northwest Sector</b> | West Hartford: 530 total sites / 471 USTs / 4 CERCLIS sites / 1 ELUR site / 54 other sites;<br>Bloomfield: 175 total sites / 120 USTs / 1 CERCLIS site / 1 ELUR site / 53 other sites;<br>Farmington: 160 total sites / 117 USTs / 21 CERCLIS sites / 1 ELUR site / 21 other sites;<br>Avon: 77 total sites / 53 USTs / 1 CERCLIS sites / 0 ELUR sites / 23 other sites.          |
| <b>North Sector</b>     | Windsor: 179 total sites / 102 USTs / 1 CERCLIS site / 0 ELUR sites / 76 other sites;<br>Windsor Locks: 98 total sites / 68 USTs / 0 CERCLIS sites / 0 ELUR sites / 30 other sites;<br>South Windsor: 132 total sites / 79 USTs / 3 CERCLIS sites / 1 ELUR site / 49 other sites;<br>East Windsor: 87 total sites / 61 USTs / 5 CERCLIS sites / 0 ELUR sites / 21 other sites.    |
| <b>Northeast Sector</b> | South Windsor: 132 total sites / 79 USTs / 3 CERCLIS sites / 1 ELUR site / 49 other sites;<br>Manchester: 262 total sites / 175 USTs / 8 CERCLIS sites / 1 ELUR site / 78 other sites;<br>Glastonbury: 115 total sites / 75 USTs / 3 CERCLIS sites / 0 ELUR sites / 37 other sites.   |
| <b>Southwest Sector</b> | West Hartford: 530 total sites / 471 USTs / 4 CERCLIS sites / 1 ELUR site / 54 other sites;<br>New Britain: 251 total sites / 167 USTs / 1 CERCLIS site / 2 ELUR sites / 81 other sites;<br>Farmington: 160 total sites / 117 USTs / 21 CERCLIS sites / 1 ELUR site / 21 other sites;<br>Newington: 179 total sites / 127 USTs / 3 CERCLIS sites / 2 ELUR sites / 47 other sites. |
| <b>South Sector</b>     | Wethersfield: 93 total sites / 72 USTs / 0 CERCLIS sites / 0 ELUR sites / 21 other sites;<br>Newington: 179 total sites / 127 USTs / 3 CERCLIS sites / 2 ELUR sites / 47 other sites;<br>Rocky Hill: 83 total sites / 54 USTs / 5 CERCLIS sites / 0 ELUR sites / 24 other sites;<br>Cromwell: 84 total sites / 57 USTs / 0 CERCLIS sites / 0 ELUR sites / 27 other sites.         |
| <b>Southeast Sector</b> | Glastonbury: 115 total sites / 75 USTs / 3 CERCLIS sites / 0 ELUR sites / 37 other sites.   |

In addition, CRCOG works with the MetroHartford Alliance on the Capitol Region MetroHartford Brownfields program to inventory and assess properties contaminated by petroleum products and/or hazardous substances in communities throughout the combined CRCOG/MetroHartford Alliance region. Since 2004, the MetroHartford Brownfields Program has managed six US EPA assessment grants totaling \$1,600,000 and a \$200,000 grant from the State Department of Economic and Community Development (DECD). The MetroHartford Brownfields Program has conducted environmental site assessments and/or remediation planning on 40 sites in twelve municipalities with funds from six EPA and one CT DECD assessment grants. The MetroHartford Brownfields Program has undertaken 68 assessments: 25 Phase I, 31 Phase II and/or Phase III, 4 hazardous building materials assessments, and 8 remedial action/clean-up plans. A map of the locations included in the program is provided here.



Source: MetroHartford Brownfields Program

### 7.15 Noise Sensitive Land Uses

Noise-sensitive land uses are typically identified as health care facilities, schools and, to some degree, open space and recreational facilities. Noise-sensitive land uses were reviewed for their general presence within the study area and sectors and potential to constrain (due to potential noise impacts) or support future mobility improvements (due to network linkage or service benefits). The presence of noise-sensitive uses is most likely to affect facility widenings or new alignments, transit routing and service, and active transportation connections.

### 7.16 Air Quality (Areas of Documented Non-Compliance)

Air quality information from CT DEEP was reviewed for the general presence and characterization of emissions levels within the study area and sectors, and its relationship to future mobility improvements. Depending on specific modes and/or scale of improvements, projects may be required to be included in State Implementation Plan analysis. Transit and rail project impacts will need to reflect the difference between emissions reduced by mode shifts from passenger vehicle use (reduction in vehicle-miles travelled and vehicle-hours travelled) and emissions from transit vehicles and rail locomotives. The location of support facilities (storage yards, maintenance facilities, garages, etc.) may also be a consideration from a public health and environmental justice perspective.

Air quality standards are measured at a regional level: the overall study area is part of a single EPA-designated area, namely Hartford County. For ozone planning efforts, Hartford County (and all of Connecticut) is classified as nonattainment, although further classified as marginal rather than moderate. All other measured air quality pollutants are classified as unclassifiable or in attainment.

CT DEEP identifies major stationary sources of air pollution through its Title V operating permit program. The program is a means to ensure that sources are in compliance with Clean Air Act requirements for maximum achievable control technologies. Major stationary sources within the study area sectors are identified below.

**Table 7-19: Major Stationary Sources of Air Pollution**

| <b>Sector</b>           | <b>Comments</b>   |
|-------------------------|---|
| <b>Study Core</b>       | Capitol District Energy Center Cogeneration Associates, Capitol Avenue, Hartford; Metropolitan District Commission Incinerator, Brainard Road, Hartford; Materials Innovation and recycling Authority Resource Recovery Facility and South Meadow Station Energy Facility, Reserve Road, Hartford; Pratt & Whitney, Main Street, East Hartford. |
| <b>Northwest Sector</b> | None.   |
| <b>North Sector</b>     | Algonquin Power Energy Facility, Canal Bank Road, Windsor Locks; HSC/UTC, Hamilton Road, Windsor Locks.   |
| <b>Northeast Sector</b> | Manchester Landfill, Landfill Way, Manchester.  |
| <b>Southwest Sector</b> | None.   |
| <b>South Sector</b>     | Algonquin Gas Compressor Station, Shunpike Road, Cromwell; Mattabasset District Water Pollution Control Facility, Main Street, Cromwell.  |
| <b>Southeast Sector</b> | None.   |



## 8 Land-Use Considerations

### 8.1 Introduction

The existing conditions land use assessment places special emphasis on those portions of the study area where current land use and/or desired or expected land use change will play an important role in economic development and quality of life for the Greater Hartford region. The location, type, and intensity of various land uses – particularly those serving employment, residence, shopping and services, education, and leisure – are intrinsically connected to structure and performance of the multi-modal transportation network. Greater mix and intensity of land use can reduce travel need and trip distance. Presence of multiple convenient transportation mode options in developed areas can serve the region’s population, businesses, and institutions more inclusively by accommodating the unique travel needs and preferences of different people. It also makes economic activity and the overall transportation system more resilient in face of disruptions.

### 8.2 Land Use Priorities Serving Economic Development in the GHMS Area

The 2019 Metro Hartford Future plan by the Capitol Region Council of Governments (CRCOG) outlines an economic development strategy with important implications for regional land use and its interactions with the transportation system.

*While the region has a relatively strong and varied job base, and rates highly in levels of education, young college graduates entering the workforce, and other criteria relative to peer regions, its stagnant population growth is a potential weakness threatening future prosperity.*

Important goals of the plan include helping current underemployed residents participate fully in the region’s job opportunities and growing the population by retaining most of the people who move to the region each year for college or for jobs. This is relevant to the GHMS because it means encouraging development of additional housing, including formats that differ from current housing stock, and improving transportation connections between where people live, work, study, and obtain services. The Metro Hartford Future plan specifically calls for these strategies to counter current weaknesses:

- Invest in the region’s downtowns as desirable places to live and important places serving overall quality of life – because downtowns offer the active mix of uses, good pedestrian network, and other transportation options that are valued by the talented workforce the region seeks to attract and retain.

- Expand new housing development near transit – because this expands transportation choices, reduces car dependence, can reduce household transportation costs, and makes more efficient use of the region’s multi-modal infrastructure.
- Prepare sites for development through brownfields remediation and infrastructure projects – because many of the sites that are vacant and close to transit also face brownfields challenges from former industrial use, and require street and/or pedestrian infrastructure to connect across major rail and road corridors and into established neighborhood street networks.

*Metro Hartford Future Plan Strategies for promoting region’s growth:*

- 1. Invest in region’s downtowns*
- 2. Expand new housing near transit*
- 3. Development through brownfields remediation and infrastructure projects*

These policy strategies are important because the past 20 years have demonstrated that the region will not retain and grow a talented workforce without active effort. Housing production has not occurred at

<sup>1</sup> Capitol Region Council of Governments, Metro Hartford Alliance, and Hartford Foundation for Public Giving. *Metro Hartford Future: Accelerating Shared and Sustainable Economic Growth* (2019).

significant levels on its own because of limited demand and because sites in the most desirable areas often have development cost premiums. A proactive approach to making development sites available in places with transportation choices and quality of life amenities is necessary to attract and retain the population needed for ongoing prosperity.<sup>1</sup>

*A recent study by CRCOG, The Economic Benefits of Regional Rail Investment in Metro Hartford-Springfield, indicates that portions of the northeast with better access to transit service have outperformed the Hartford-Springfield region in economic development.*

The GHMS study area includes a major portion of the Hartford-Springfield region’s population and economy. Communities along the Northeast Corridor rail spine, excluding cities of Washington, New York and Boston as outliers, have seen average annual job growth of 1.1% since 1990 compared to 0.6% annual job growth for the Hartford-Springfield region, barely half as much.<sup>2</sup> The Information, Finance, and Professional Services industry sector, a foundation of the GHMS economy and strategic priority for growth,

<sup>2</sup> Capitol Region Council of Governments. *The Economic Benefits of Regional Rail Investment in Metro Hartford-Springfield* (2021), p. 4.

especially gravitates toward places with high transit ridership. Travel associated with this sector in 2019 utilized transit for 29.4% of trips in the Northeast Corridor as a whole, but for only 2.7% of trips in the Hartford-Springfield region. While New York City's high transit use skews the Northeast Corridor figure, even the nationwide average of 7.7% transit trips by the Information, Finance, and Professional Services sector is nearly three times the Hartford region's rate.<sup>3</sup> A majority of workforce moving to the GHMS study area comes from metropolitan New York City, and thus is habituated to a greater opportunity to use transit, as well as to walk, than the GHMS area provides.<sup>4</sup>

Downtowns, transit station areas, and bus corridors therefore make sense as priority areas for development in the GHMS area. Other areas with significant retail and office use concentrations are also anticipated by CRCOG and GHMS municipalities as places where land use change may happen due to market factors that could increase or decrease

viability of current uses. This could present a need to anticipate market-driven development in some places, and to proactively encourage redevelopment with alternate uses in others. These areas include commercial/retail corridors, office parks, and industrial sites where parcels are underutilized and offer potential for mixed-use redevelopment. Background trends for retail and office land use categories, significantly influenced by the COVID-19 pandemic, will shape the future of these areas.

### 8.3 Land Use Changes Accelerated by COVID-19 Pandemic

Nationwide, many large-format retail stores, including mall anchor stores, are downsizing or closing entirely due to changed retail buying patterns, particularly online shopping. The COVID-19 pandemic has tended to accelerate this established trend. As shown in **Table 8-1**, since 2014 three mall anchor stores closed at the two large malls within the GHMS study area, and five more closed at malls in Enfield and Meriden just outside the study area<sup>5</sup>. The cities and towns

<sup>3</sup> Ibid., p. 5.

<sup>4</sup> Capitol Region Council of Governments, Metro Hartford Alliance, and Hartford Foundation for Public Giving. *Metro Hartford Future Executive Summary: Accelerating Shared and Sustained Economic Growth* (2019), p. 13.

<sup>5</sup> Information for this table came from multiple articles:

*Gosselin, Kenneth (May 7, 2020). "Nordstrom will remain as key anchor tenant in Westfarms Mall amid closures elsewhere". Hartford Courant.*

*Schott, Paul (December 14, 2020). "[Lord + Taylor set to close CT stores within weeks](#)". Stamford Advocate.*

*Rhatigan, Chris (January 7, 2020). "Meriden Mall Anchor Store to Close". Meriden Patch.*

*Journal Inquirer Staff (Jan 8, 2021). "Macy's to close 2 Conn. stores; Shoppes at Buckland Hills mall stores to stay open". Journal Inquirer.*

where these malls and other large-format retail are located have already focused on the large sites as areas to seek alternative land use, to counter the economic loss from store closures. A mixed-use development approach is often sought, both to broaden market options and to capture the value benefit that can arise when employment, residential, education, and/or service uses are co-located. Many of these sites have the benefit of excellent roadway access and established bus service, though most are not adjacent to rail or BRT stations.

Storefront retail in traditional mixed-use urban settings has seen a decline over decades as many stores that sell goods gravitated first to large-format stores in auto-oriented shopping centers, and then to online sales. Today, food and drink establishments make up a large portion of local storefront retail, complemented by other retail that serves local populations such as pharmacies, banks, and convenience stores. The extent and prosperity of local retail is thus closely tied to local population density in many places. The presence of a safe, inviting pedestrian network, as well as transit and bike facilities, further increases economic opportunity for storefront retail by making it accessible to a larger

*Dehnel, Chris (November 13, 2020). "Liquidation Sale Commences At Doomed Manchester Sears". Manchester Patch.*

*Wenzel IV, Joseph (December 28, 2016). "Sears in Enfield Square to close next year". Eyewitness News 3.*

immediate market and reducing the need to provide parking.

*Nationwide, many large-format retail stores are downsizing or closing entirely due to changed retail buying patterns, particularly online shopping. In the past seven years, eight mall anchor stores have closed among the two large malls in the GHMS area and two nearby malls in Enfield and Meriden.*

**Table 8-1: Mall Anchor Store Closures**

| Mall   | Anchor Store   | Closure Year |
|--|--|--------------|
| <b>Westfarms Mall, Farmington/West Hartford (GHMS SW Sector)</b> | Lord & Taylor<br>Sears (at adjacent Corbin's Corner shopping center) | 2020<br>2017 |
| <b>Shoppes at Buckland Hills, Manchester (GHMS NE Sector)</b>    | Sears  | 2021         |

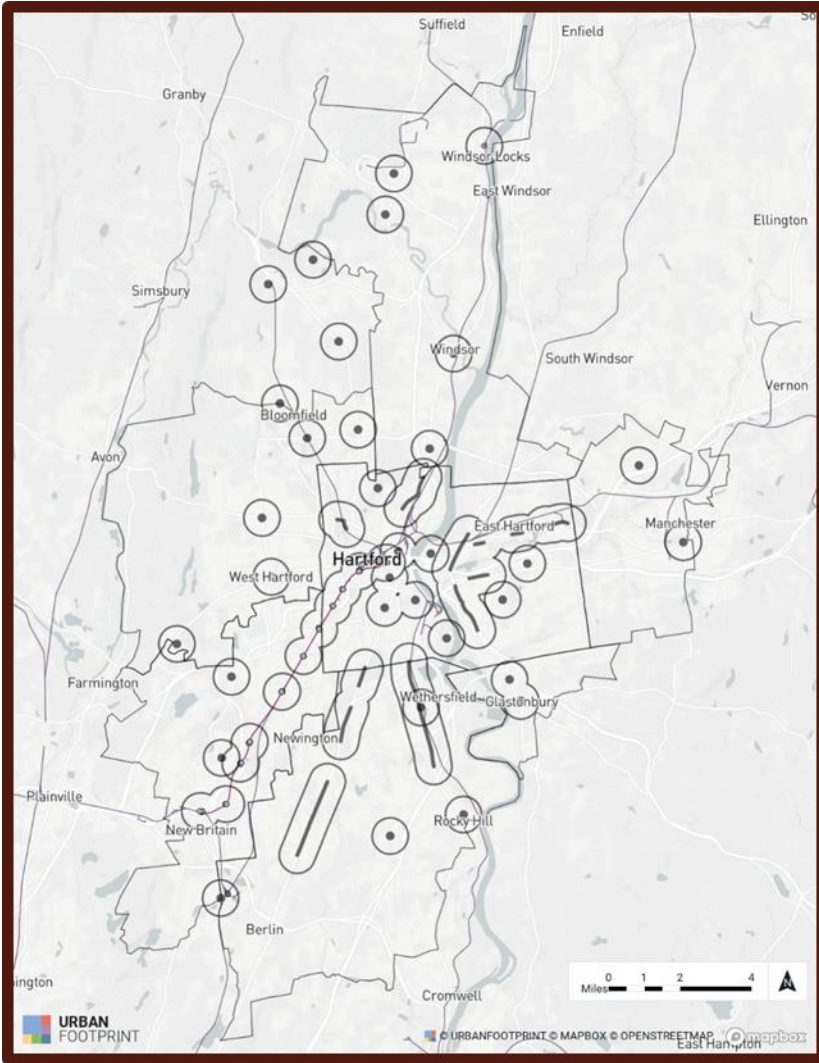
*(November 3, 2016). "Sears in West Hartford to Close". NBC News Connecticut.*

|   |                              |                      |
|---|------------------------------|----------------------|
| <b>Westfield Meriden Mall, Meriden (approximately 4 miles south of GHMS South sector)</b> | Macy's<br>Sears<br>JC Penney | 2020<br>2019<br>2014 |
| <b>Enfield Square Mall, Enfield (approximately 6 miles north of GHMS North sector)</b>    | Sears<br>Macy's              | 2017<br>2016         |

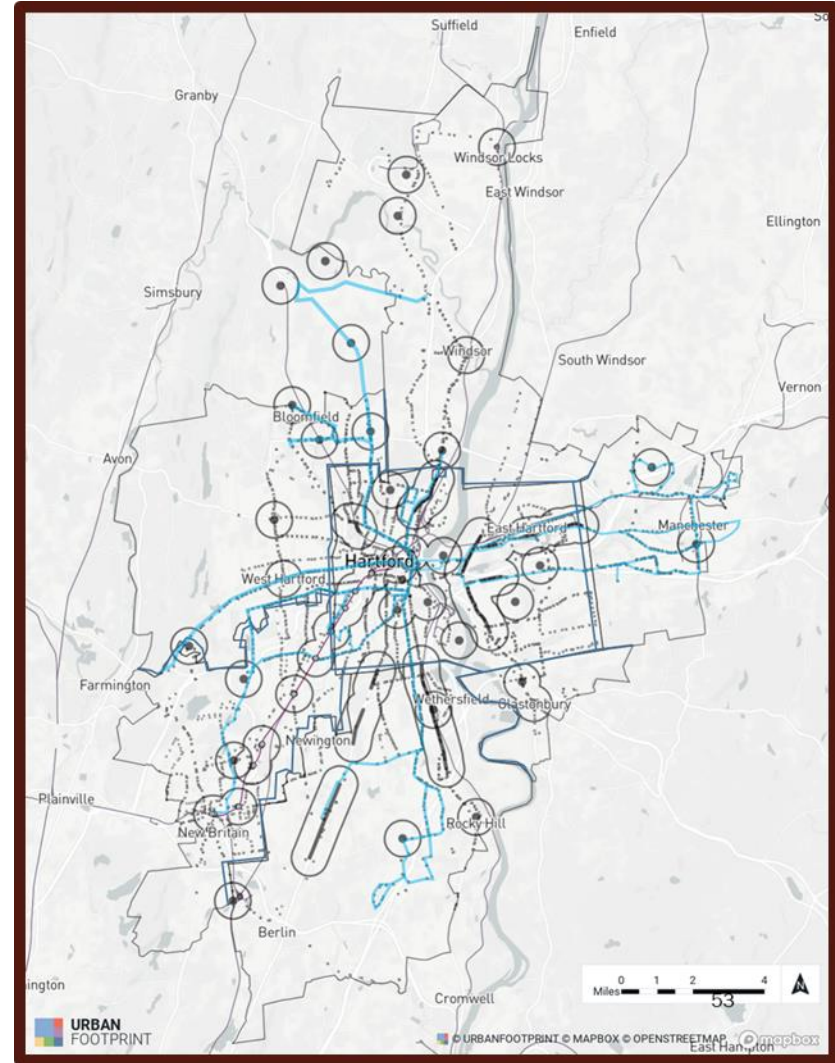
Office land use has been significantly impacted by the COVID-19 pandemic, as many employers and employees have grown accustomed to working from home using web connections. Even when public health conditions allow for full resumption of office space use, employers in many office-based industries anticipate that working from home will have a greater ongoing presence in work patterns. Some staff may commute to an office a few days per week and work from home on other days. Some firms may shift more permanently to a largely virtual workplace. While existing and newly constructed office space are expected to continue having important roles enabling the interpersonal collaboration that is important to productivity in many industries, and providing work facilities that can't be matched at home, demand for new office space is likely to slacken. Developers with older office space that struggles to be competitive sometimes convert it to residential or hotel use if the locations and buildings are suitable.

#### 8.4 GHMS Study Area Integrated Land Use and Transportation Opportunities

Based on the factors above – recognizing downtowns and transit station areas previously designated as places to focus land use growth, as well as other places where trends may impact land use – Figures 8-1 through 8-3 highlight these anticipated places of land use growth and change. The circles and ovals represent places within about ½ mile or a 10-minute walk of transit stations, mixed-use district centers, or corridors with regular bus service. The actual amount and type of development appropriate in each area varies significantly depending on availability of development sites, market factors, and potential development density. It may be appropriate to designate some of these focus areas as having higher priority for development and supportive infrastructure than others. Land use scenario analysis in further phases of this study can identify such priorities.

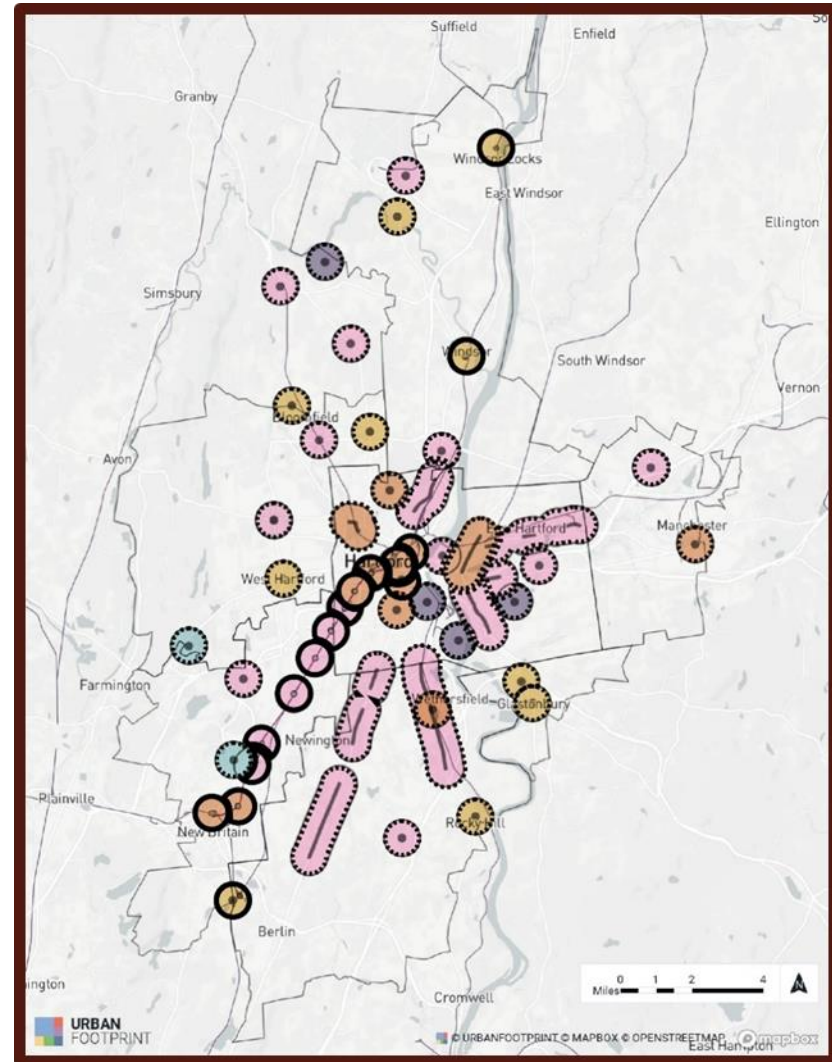
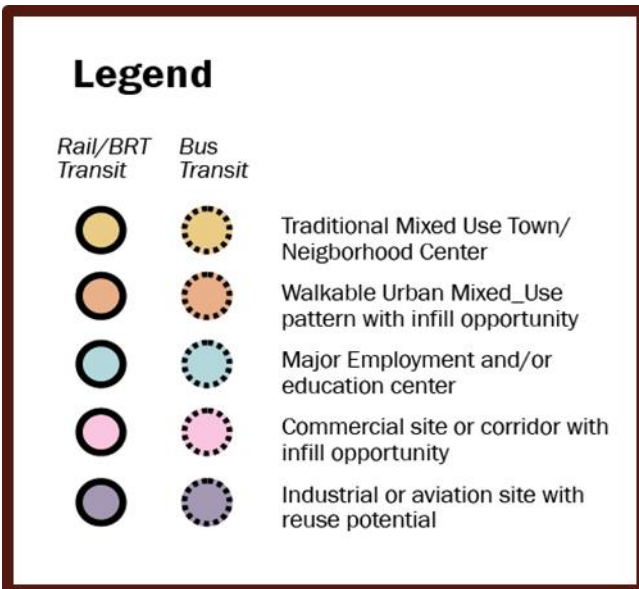


**Figure 8-1: Land Use Growth & Change Focus Areas**



**Figure 8-2: Land Use Growth & Change Focus Areas with Bus Services**

**Figure 8-1** shows a 1/2 mile (10-minute) walk distance around rail and BRT transit stations or other centers of growth. The actual extent of development opportunity varies widely between different areas according to site availability and potential density. See **Figure 8-2** for overlay with bus services. Blue lines indicate the eleven bus routes with heaviest ridership. **Figure 8-3** shows differentiation of these areas by land use patterns and transit access. All locations are priority areas not just for development, but for a mix of land uses that complement one another, like employment, housing, and/or education. Some locations have traditionally served a mix of uses while others would need to evolve to include more diverse land use.



**Figure 8-3: Land Use Growth & Change Focus Areas by Development Type**

The focus area categorization shown in **Figure 8-3** provides a general distinction of development patterns and level of transit access. Areas outlined with a solid line have (or are planned to have) rail or BRT (CTfastrak) transit service. Areas outlined with a dashed line have conventional bus service. Many of these are on or close to lines with especially high ridership (see **Figure 8-2**). Land use and development patterns are summarized in these categories:

- **Traditional mixed-use town/neighborhood center.** These are areas that have had a mix of residential, commercial, institutional, and/or civic uses for a century or more, reflecting early settlement patterns. Most have decent walkability thanks to sidewalk networks and relatively little traffic, though roadways are a barrier in some places like Rocky Hill. These areas generally have low to moderate density development; their development opportunities may be minor in the regional context but significant locally in terms of quality of place and economic development.
- **Walkable urban mixed-use pattern with infill opportunity.** These areas have a traditional pattern of blocks and were usually developed around transit services prior to widespread car ownership. Streets generally have sidewalks and are spaced 300 to 500 feet apart, making walking convenient. A mix of commercial, residential, institutional, and/or civic uses is present within

walking distance. Development opportunities vary in scale; large development sites are relatively uncommon, but some significant opportunities are present.

- **Major employment and/or education center.** This category includes two large institutions, UCONN's medical center in Farmington and Central Connecticut State University in New Britain. Both campuses have adjoining private sites with opportunity for complementary residential, commercial, or other development. While both institutional campuses are internally walkable, they both would benefit from more inviting and extensive pedestrian connections with their contexts.
- **Commercial site or corridor with infill opportunity.** This category characterizes a large proportion of land area identified for change. Some, particularly several CTfastrak station areas, have excellent transit service and have had zoning changes or other steps taken to encourage mixed-use redevelopment. Others line highly accessible auto corridors like the Berlin Turnpike. The Westfarms Mall and Shoppes at Buckland Hills are successful retail centers with good bus service and highway access and may be candidates for additional uses like housing or recreation. Sites vary significantly in terms of market potential, size, and redevelopment feasibility. Proactive efforts may be required to improve pedestrian



facilities, street connections, or otherwise provide infrastructure needed for higher-value development.

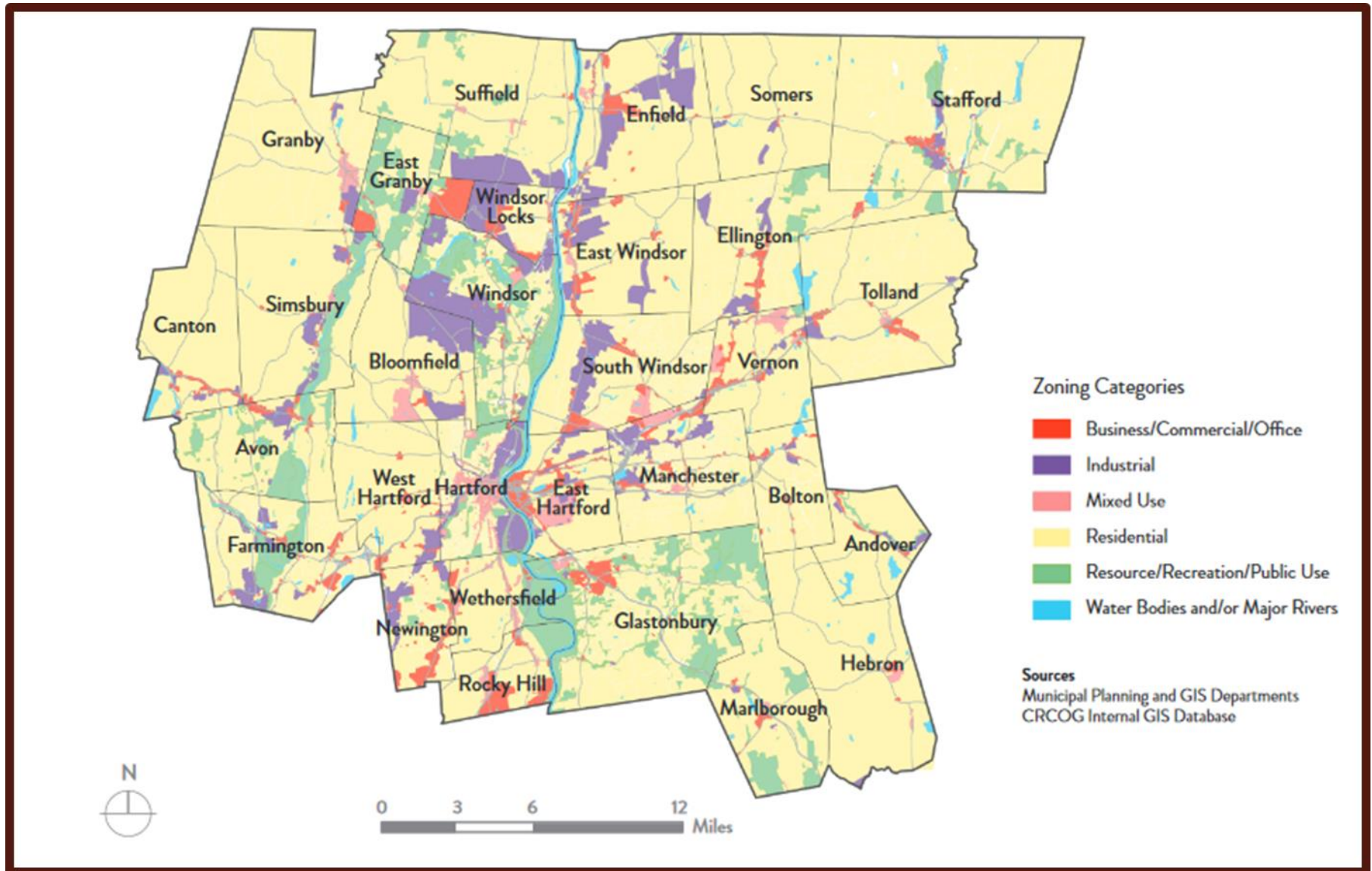
- **Industrial or aviation site with reuse potential.** These sites – the Colt Factory, Brainard Airport, Rentschler Field, and Windsor’s Great Pond area – contain large contiguous areas where new uses can replace obsolete ones. In each case, new multi-modal transportation infrastructure is needed to support significant levels of new development.

The focus areas generally avoid sensitive natural areas and historic resources identified in Chapter 7 and emphasize land that has already been developed. The following focus areas are examples of places where natural or historic context may pose greater limitations on development.

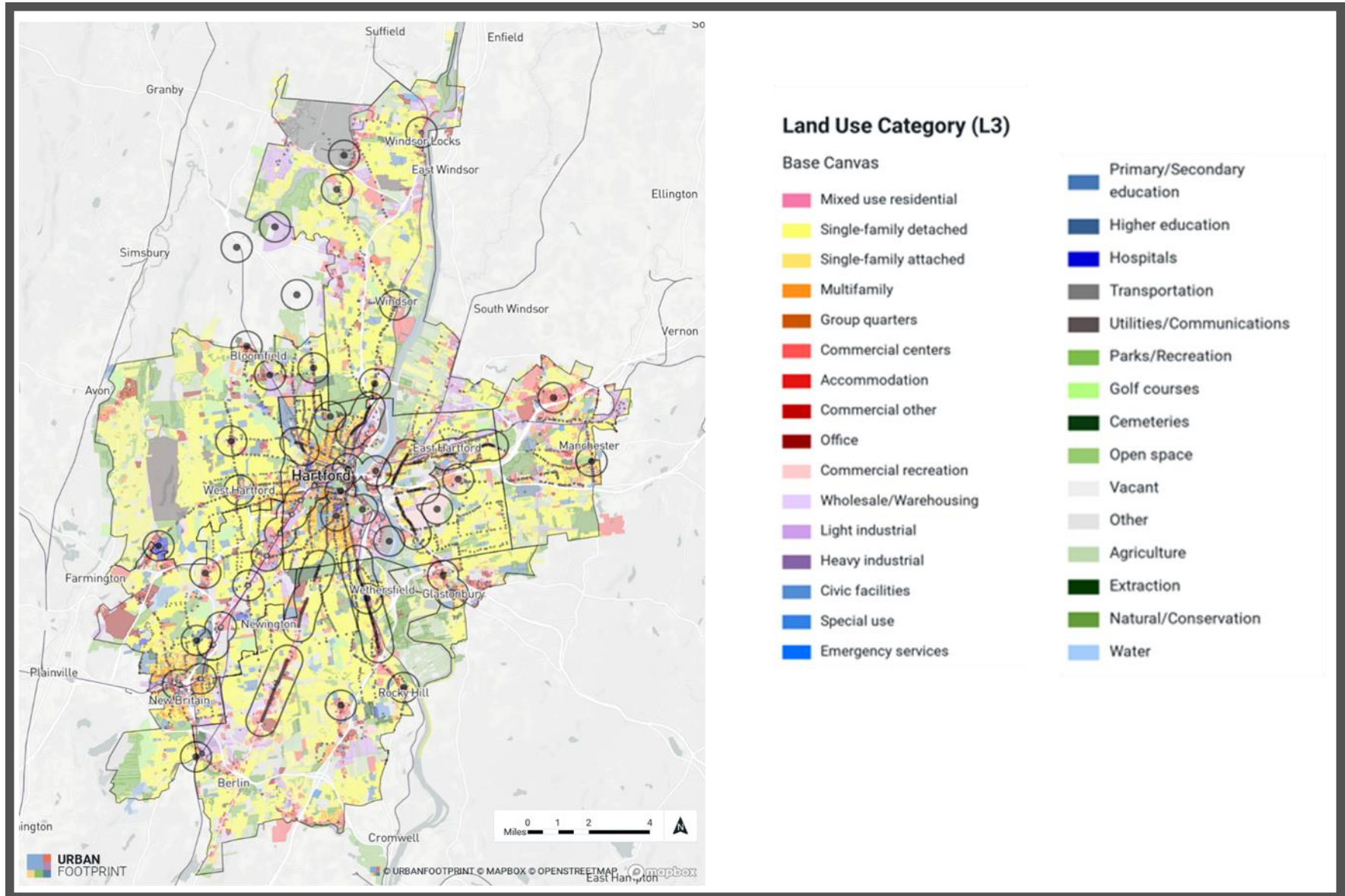
- Protected green space is present in some focus areas, particularly in the form of municipal parks (see section 7.3, Protected Open Space and DEEP protected areas). Examples include Pope and Keney Parks in Hartford, Manchester Center Springs Park near downtown Manchester, and Trout Brook Trail at the Elmwood CTfastrak station. Development is generally welcome near parks, and should leverage them as amenities, as long as it does not reduce the quality of these places.

- Prime farmland soils are especially present in some focus areas in Windsor and Bloomfield (see section 7.4, Prime Farmland Soils).
- Significant floodplain is present near Berlin’s Kensington neighborhood and downtown Windsor (see section 7.6, Floodplain).
- Hartford and Glastonbury include significant historic district areas that overlap focus areas (see chapter 7.8, Historic, Architectural and Archaeological Resources). These historic districts do not necessarily constrain new development but require new development to demonstrate design approaches that are compatible with historic context. While this design attention may impose some cost premiums, it also commonly results in development that delivers higher and more enduring value to its owners, users and context.

**Figure 8-4** shows CRCOG’s designated growth centers in the region. This map shows planned land use across multiple communities as of 2014. Growth is typically prioritized in areas designated as mixed use, business/commercial/office, and underutilized. Focus areas for growth and change indicated in Figures 8-1 through 8-3 are consistent with this regional Plan. **Figure 8-5** shows existing land use, for comparison with Figures 8-1 through 8-3.



**Figure 8-4: CRCOG Plan of Community Development (extends beyond GHMS study area)**



**Figure 8-5: Current Land Use in the GHMS Study Area**

Most of the focus areas for growth and change in **Figure 8-5** are in red, pink, orange, or purple areas where there is current or potential flexibility for a variety of land uses and relatively greater development intensity. Yellow areas zoned for single family housing tend to lack opportunity for more intense or varied use due to community goals, development policy, and physical development patterns.

The focus areas include a number of areas with notable socioeconomic characteristics mapped in Chapter 7. Many of these are directly related to land use and related economic development goals. Examples include:

- Population and employment density (see section 7.9, Socioeconomic Considerations – Population & Employment Density). Focus areas tend to emphasize areas where higher densities are present or appropriate relative to other areas within the GHMS study area and within individual communities. Figures 8-6 and 8-7 below provide additional analysis of population and employment density relative to land use.
- Zero vehicle households (section 7.10, Socioeconomic Considerations – Zero Vehicle Households) are highly correlated with renter-occupied housing as shown in figure 13 below, and Environmental Justice/Title VI communities identified in section 7.11. Many focus areas are intentionally located amidst concentrations of low vehicle ownership, minority residents, low-income households, and limited-English households, because new development and improved multi-modal transportation options can provide especially significant economic development benefits for these communities. These benefits also translate to regional economic development benefit as more residents and employers gain access to each other.

- Focus areas are well aligned with established land use and zoning policies as shown in section 7.13, Socioeconomic Considerations – Land Use & Zoning, and multiple figures below.
- Some focus areas, particularly those along the New Haven-Hartford-Springfield rail corridor, include significant concentrations of brownfields sites (see section 7.14, Hazardous Materials). Remediation of these sites poses development cost premiums, but also offers significant benefits in return as underutilized land becomes useful again for economic and community use. Many of these sites are also well-located to take advantage of rail and CTfastrak transit service. Their redevelopment would provide the additional benefit of improving pedestrian connectivity and property value in their surrounding transit-served districts.

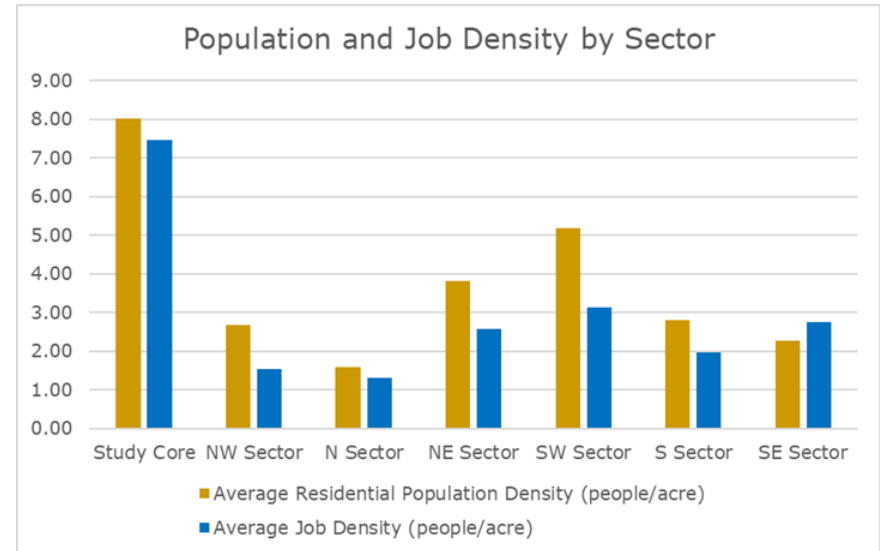
### 8.5 Density and Transportation Mode Share across the Study Area

The focus areas for growth and change reflect broader patterns of population and employment density, and of transportation mode choice, within the GHMS study area and its sectors. The Study Core – Hartford and East Hartford – retain significantly higher concentrations of population, jobs, and real estate development than the rest of the area, in spite of the gradual dispersal of population and jobs across the area in past decades. The Southwest and Northeast Sectors, dominated by New Britain and Manchester respectively, are also relatively denser than the remaining sectors, continuing historic settlement patterns.

*Study Core of Hartford and East Hartford contains at least twice the density of residents and jobs as most other sectors.*

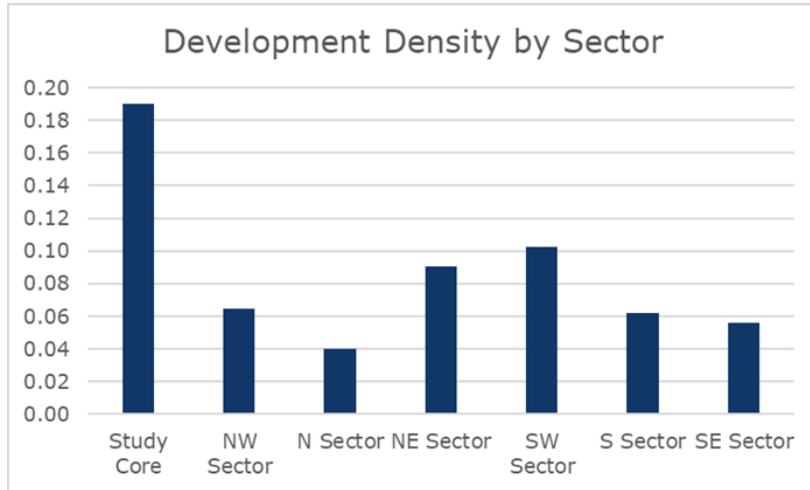
**Figure 8-6** shows that the study area core of Hartford and East Hartford contains at least twice the density of residents and jobs as most other sectors. It also has a relatively close match of residential and job density, indicating that residents may have access to a wide variety of jobs relatively close to home. The NW, NE and SW sectors jump out for having relatively higher population density than job density. This suggests these sectors have relatively high numbers of residents commuting out to jobs elsewhere. They

may merit more transportation assets to serve this travel, and/or efforts to locate more jobs close to their residents to reduce commute distance and time.



**Figure 8-6: Population and Job Density by GHMS Study Area Sector**

**Figure 8-7** indicates that the amount of developed real estate floor area in each sector is highly proportional to residential and job density. Areas with relatively high existing density tend to also have more of the walkable downtown and urban districts that are priority growth areas. Thus, land use density may be most likely to increase where it is already high.

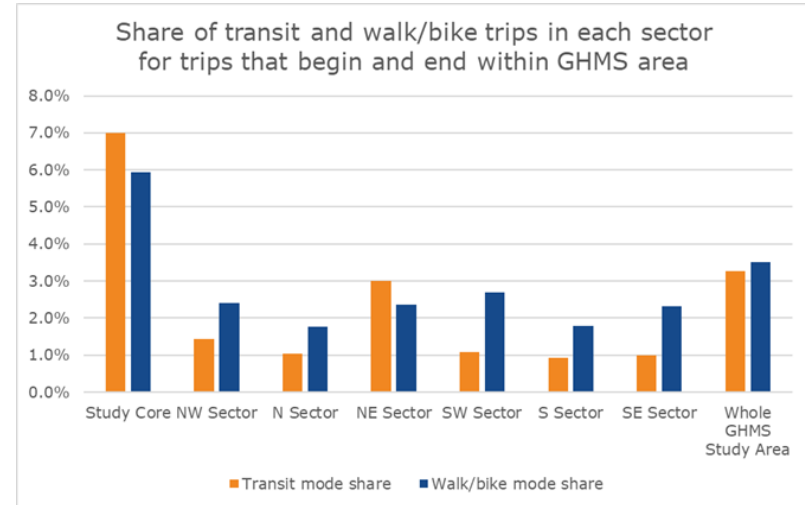


**Figure 8-7: Development Density by GHMS Sector**

Density and legacy urban development patterns correlate directly to choices in transportation mode. While driving is the dominant means of trips throughout the study area, sectors with relatively denser population and development see significantly higher shares of transit, walk, and bike trips than other sectors.

**Figure 8-8** represents transit and non-motorized trip mode shares within GHMS as a whole. These represent trips that begin within individual sector and end anywhere in the GHMS area<sup>6</sup>. They do not include trips that begin or end outside of the GHMS area.

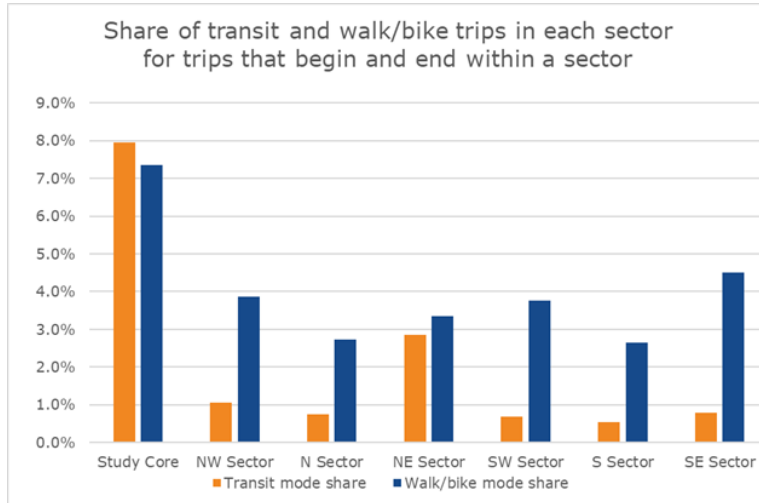
<sup>6</sup> The mode choice model was developed with information from the 2016 'Let's Go CT' Household Travel Survey (HTS), 2016 CRCOG On-Board Transit Survey (On-Board), U.S. Census American Community Survey (ACS) and Census Transportation



**Figure 8-8: Transit and Non-Motorized Trip Mode Share within GHMS Study Area**

**Figure 8-9** shows transit and non-motorized trips that have both the trip ends within the individual study sector. Walk shares are higher than in figure 8, as they are inherently local. Transit shares are lower than in figure 8, since many transit trips begin and end in different sectors.

Planning Program (CTPP). These data served as the foundation for the development of mode choice calibration targets. For the CRCOG mode choice calibration process, calibration targets were developed by mode, travel market segment, and trip purpose.



**Figure 8-9: Transit and Non-Motorized Trip Mode Share Within Individual Sector**

In the study core, the transit mode share is as high as 8% for local trips, well over twice the share in any other sector. While this demonstrates good availability of transit as a travel choice among homes, jobs, and other destinations, it is significantly lower than the 12% transit mode share common in other portions of the Northeast Corridor exclusive of New York City.<sup>7</sup>

*The 8% transit mode share in the Study Core is significantly lower than the 12% transit mode share common in other portions of the Northeast Corridor exclusive of New York.*

Transit mode share is relatively similar across the other sectors with the exception of the northeast sector, which is relatively high. This could possibly be explained by transit’s convenience for making one of the few river crossings from the sector to Hartford, or significant clustering of jobs and homes around common transit routes. The chart may underrepresent current transit mode share in the southwest sector because data is from 2016, very shortly after inauguration of CTfastrak service.

Walk and bike mode share follows population and development density more closely than transit share. Walk trips typically comprise about 60 to 70% of the combined walk and bike trips, depending on sector. The northwest and southeast sectors show relatively high walk and bike mode shares for their density, possibly due to more complete sidewalk networks.

<sup>7</sup> Capitol Region Council of Governments. *The Economic Benefits of Regional Rail Investment in Metro Hartford-Springfield* (2021), p. 5.

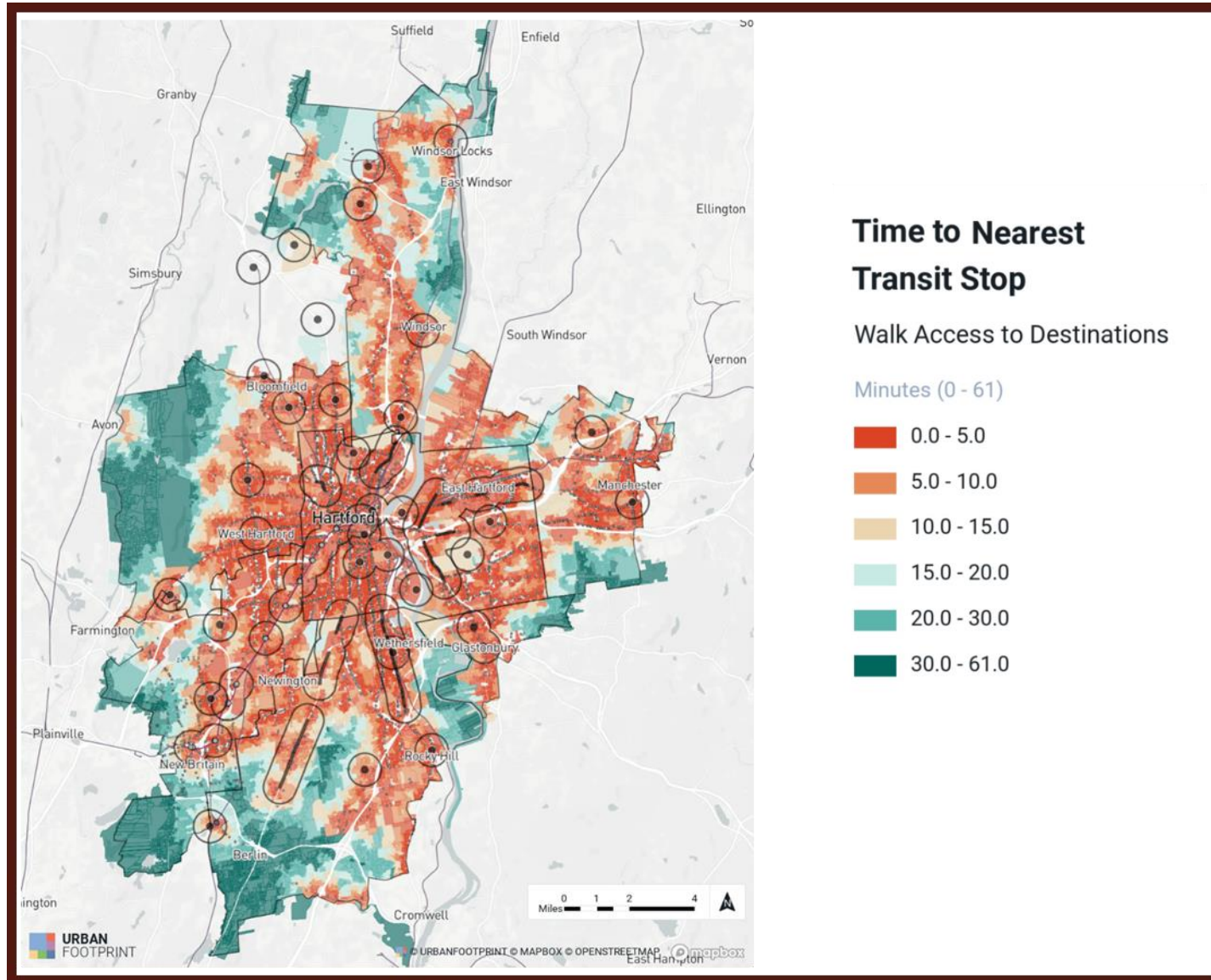
*In general, the Study Core offers the study area's most significant opportunities to locate development where it will benefit from the variety of transportation choices that attract and retain workforce and jobs important to the region's economy.*

In general, the Study Core offers the study area's most significant opportunities to locate development where it will benefit from the variety of transportation choices that attract and retain workforce and jobs important to the region's economy. However, specific conditions in the land use growth & change focus areas will determine actual opportunities to leverage transportation choice for economic development. Certain focus areas in all sectors have the pedestrian, bike, and transit choices available to attract high-value development; others in all sectors may require more or better transportation choices to optimize development opportunity. Proactive efforts to co-locate mixed-use development concentrations with good transit service, sidewalks and bike facilities would help make the GHMS area more competitive with other regions.

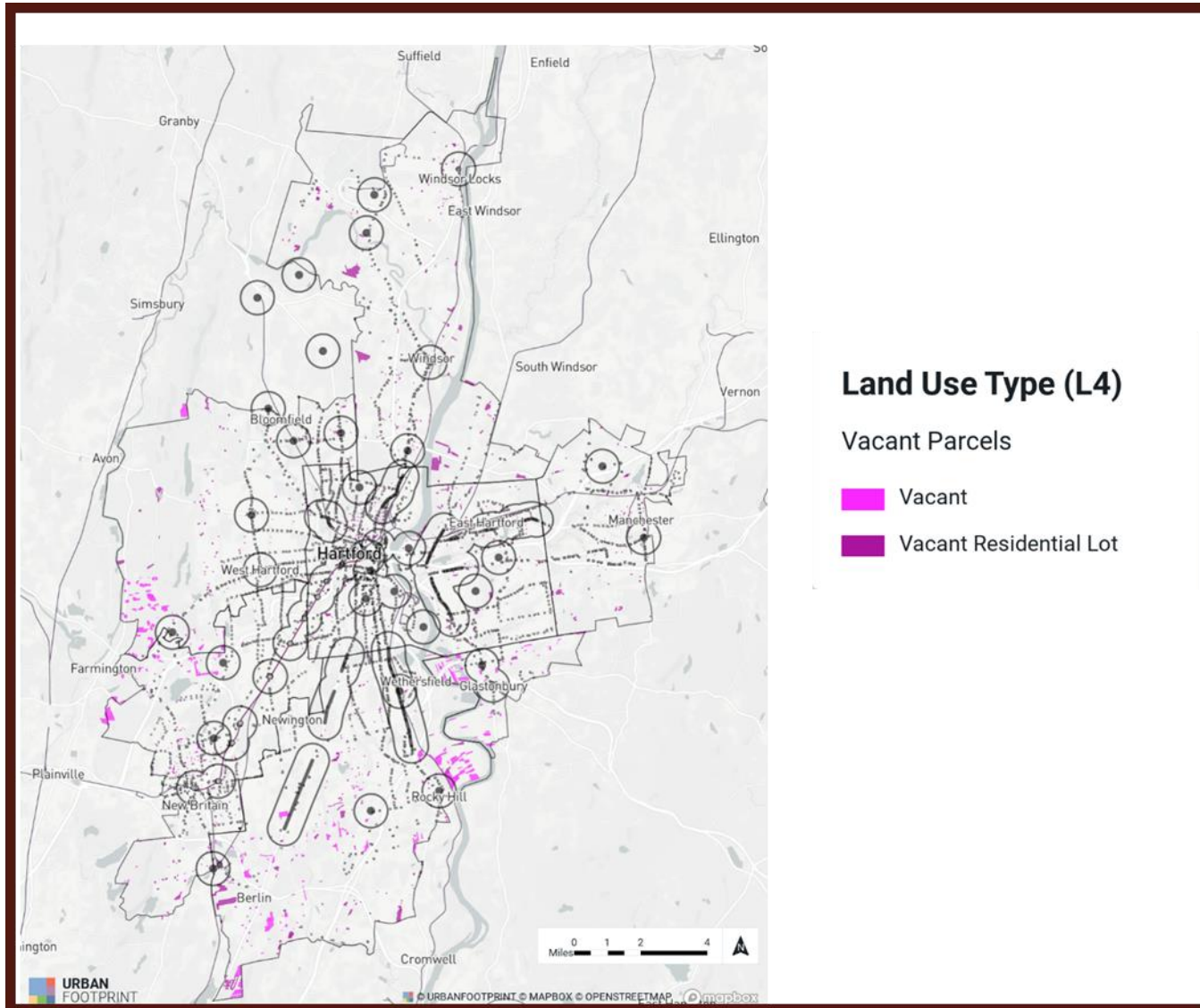
Figures 8-10 through 8-14 show how the focus areas overlay selected characteristics of land use and demographics. **Figure 8-10** highlights areas within 10-minute walking distance of bus, BRT or rail stops. Much of the study area, and especially the focus areas for growth and change, is within a ten-minute walk of a bus, BRT or rail stop (areas colored red and orange).

**Figure 8-11** shows parcels designated as either vacant or with commercial parking. These parcels represent some that might be considered relatively easy attractive for development. Yet, focus areas for growth and change contain relatively few of these sites. Enlarged maps would show some as present in the focus areas, but these parcels still represent a relatively small share of land area. In many cases, development will need to take place on previously developed sites. This often entails a cost premium and/or greater complexity, but may be justified by proximity to transportation, complementary uses, amenities, or other assets.



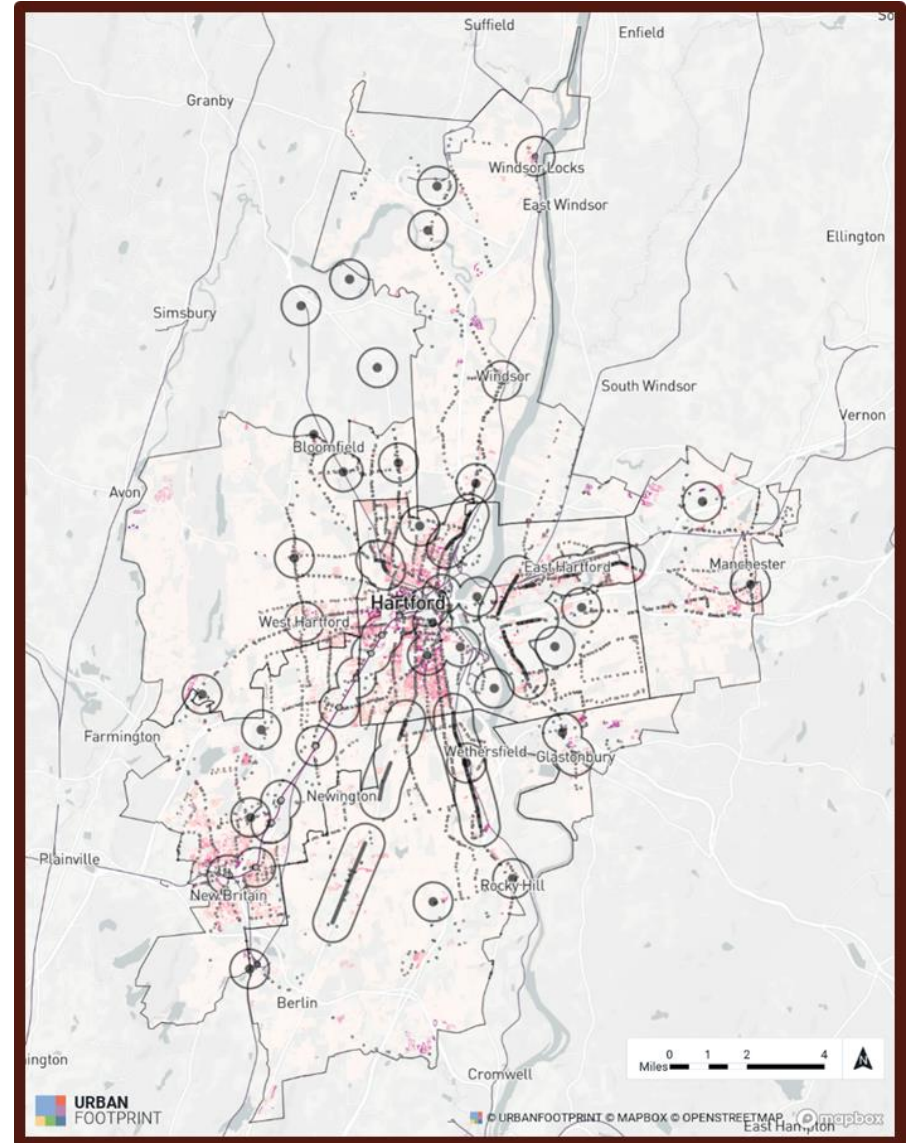
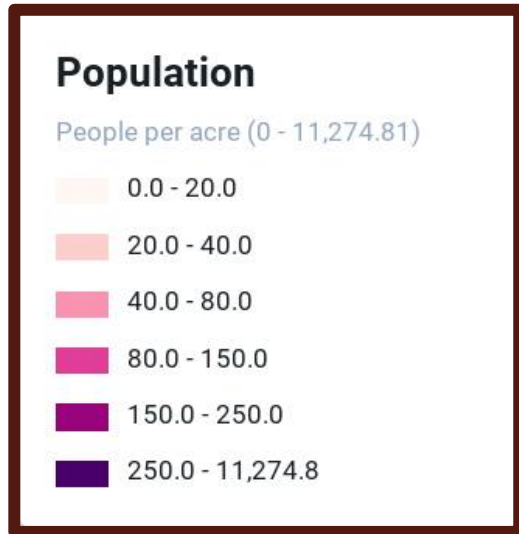


**Figure 8-10: Walking distance to transit**



**Figure 8-11: Parcels Designated Vacant or Providing Commercial Parking**

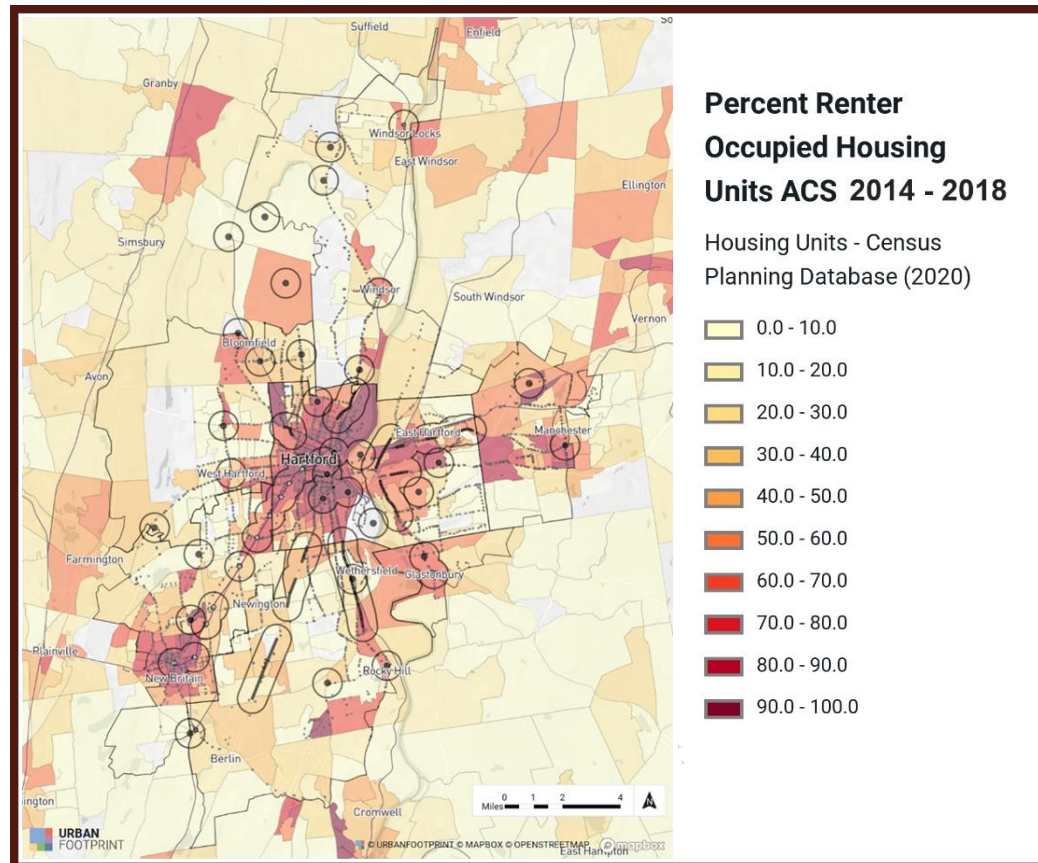
Focus areas for growth and change represent a wide range of existing and potential residential population densities (see **Figure 8-12**). Many focus areas in Hartford and New Britain are among the most densely populated already; others have relatively lower populations. Areas with significant existing density may merit more effort to add transportation mode choice and capacity than less dense areas. Depending on a variety of market, social, and physical / environmental factors, some focus areas may be appropriate places to add significant residential density, while other land use may deserve priority in other areas.



**Figure 8-12: Population Density**

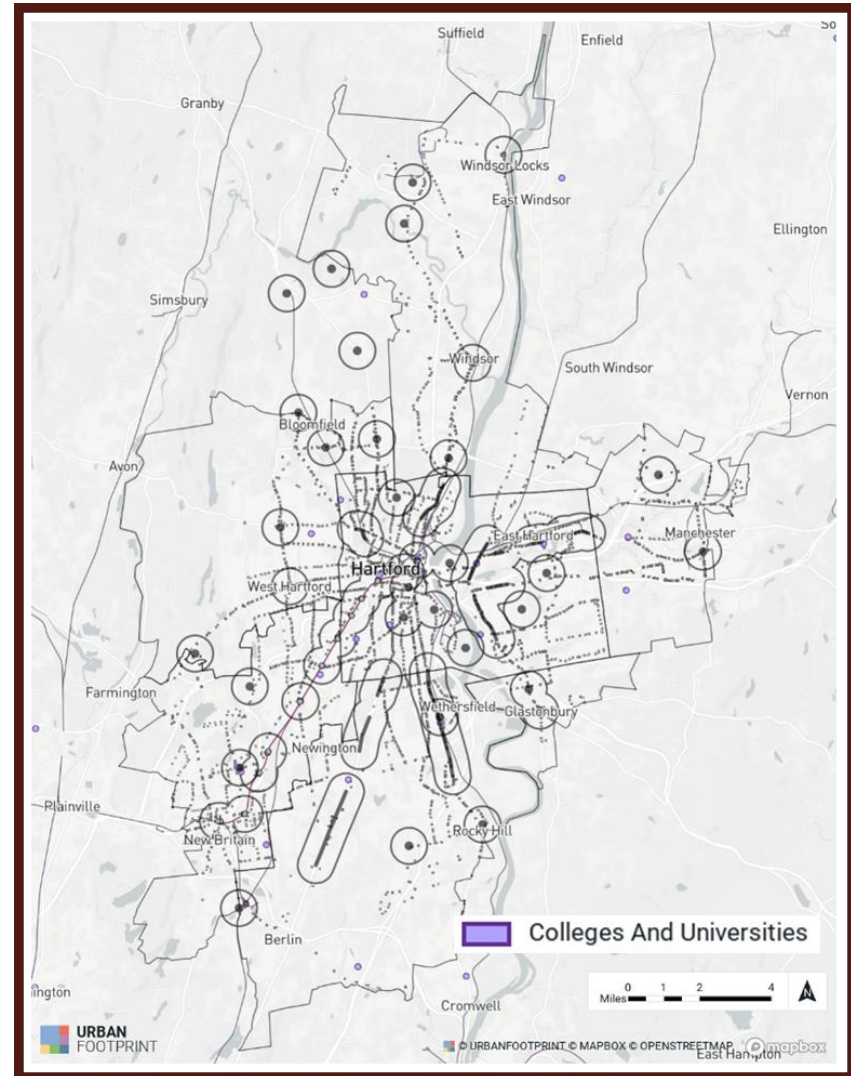
Rental housing stock tends to be concentrated more in older cities with urban development patterns like Hartford, New Britain and Manchester. It is often associated with lower household income and lower car ownership. Therefore, presence of good transit and

walking and biking infrastructure is especially important in areas with significant rental housing. The new growth intentionally targeted to many of these areas should be proactively guided to maximize benefit, and minimize displacement or other harm, to rental households.



**Figure 8-13: Share of Renter-Occupied Housing**

Higher education institutions are important to the region's economy as employers, ladders to economic opportunity for young residents, importers of potential new residents and workforce, and partners to industry in important economic growth areas. Their locations display a wide range of context types and relationships to focus areas. Some like Trinity College and UConn's Hartford campus are in urban neighborhoods that help define campus character and that benefit from campus employment and market opportunities. Others like Manchester Community College and the University of Hartford are more isolated from intensity of use. In any case, higher education campuses are important long-term land use anchors due to their inherent mission-driven longevity.

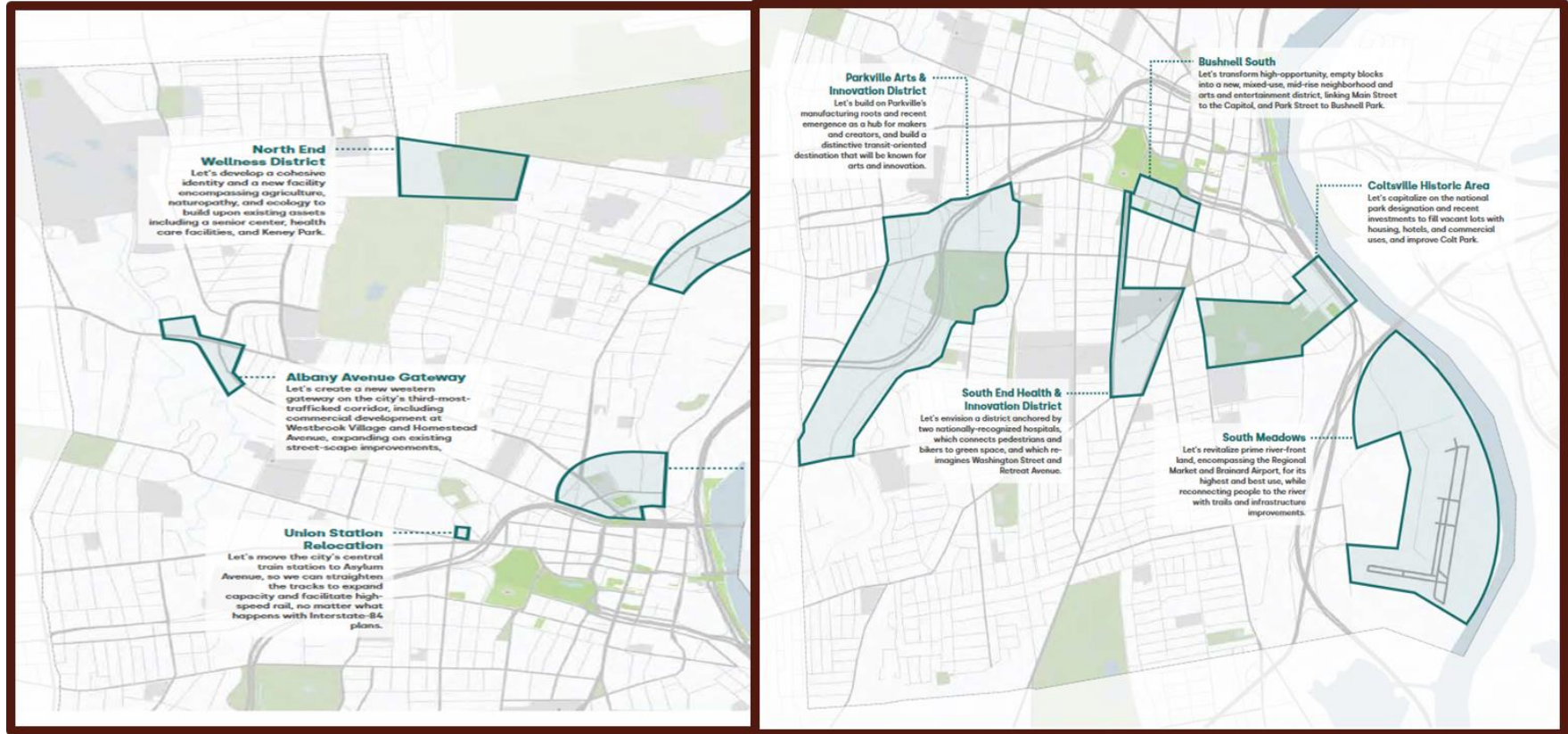


**Figure 8-14: Colleges and Universities**

### 8.5.1 Plans of Community Development for Study Area Municipalities

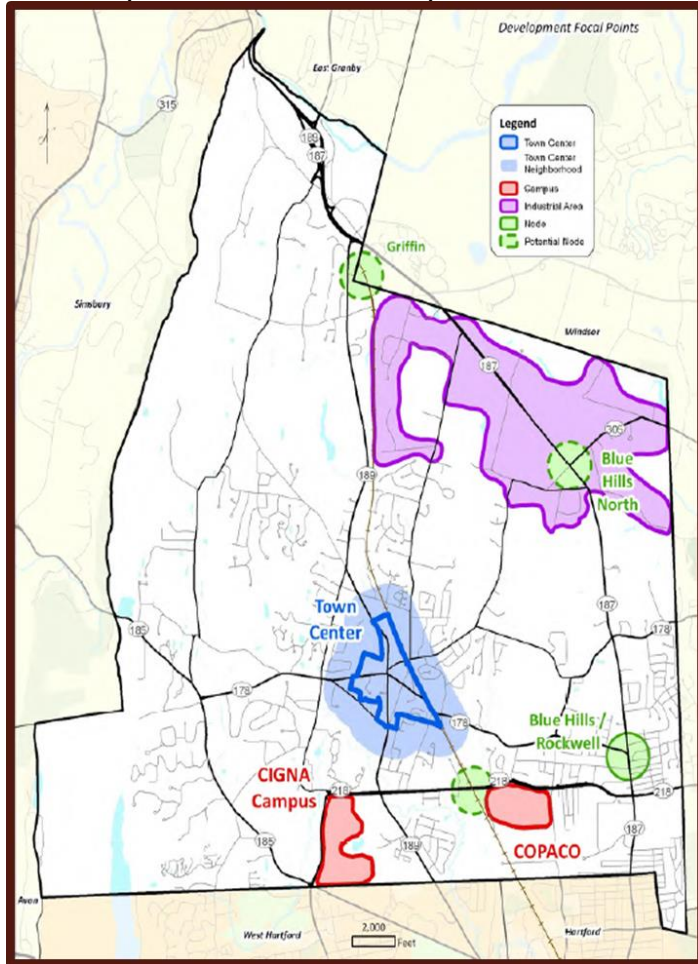
Figures 8-15 through 8-22 provide additional detail on priority development areas as designated by selected municipalities.

Adopted in 2020, **Figure 8-15** identifies ten priority land use initiatives to prepare Hartford for the 400<sup>th</sup> anniversary of its founding in 2035.



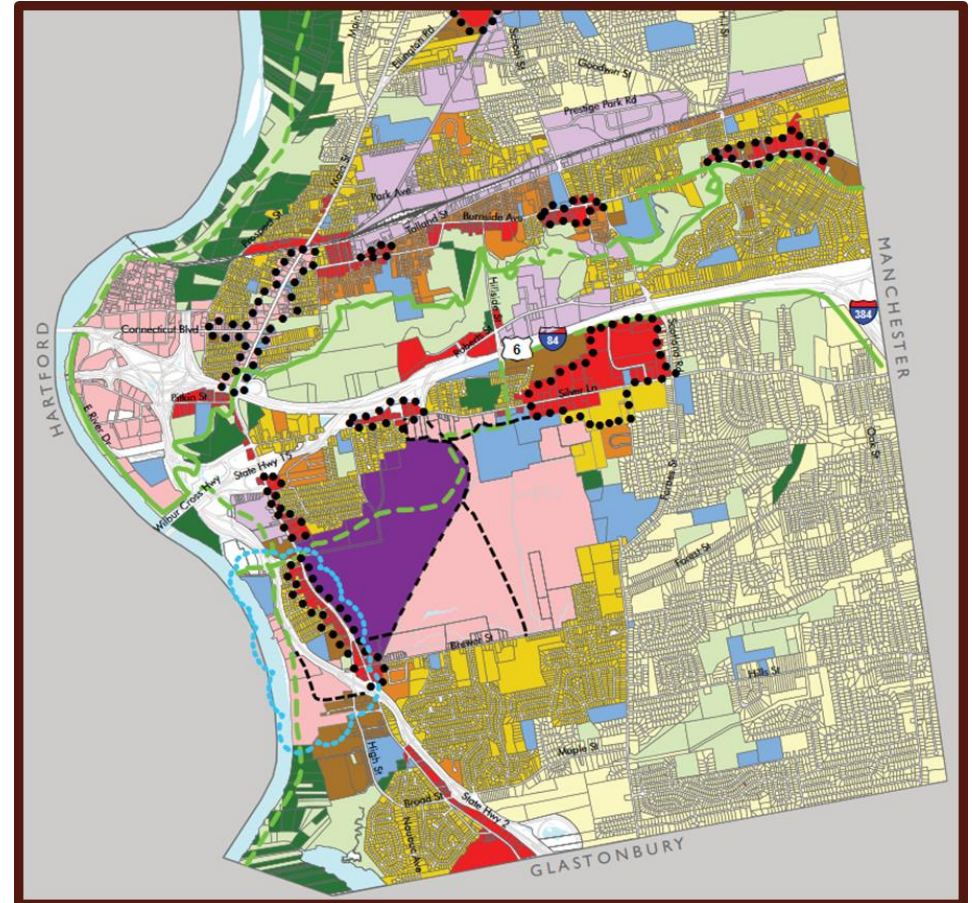
**Figure 8-15: Hartford City Plan 2035**

This 2012 plan concentrates growth in the town core and transitions commercial development to mixed use in key nodes. Some of these nodes are outside the GHMS study area but are closely linked to it.



**Figure 8-16: Bloomfield Plan of Community Development**

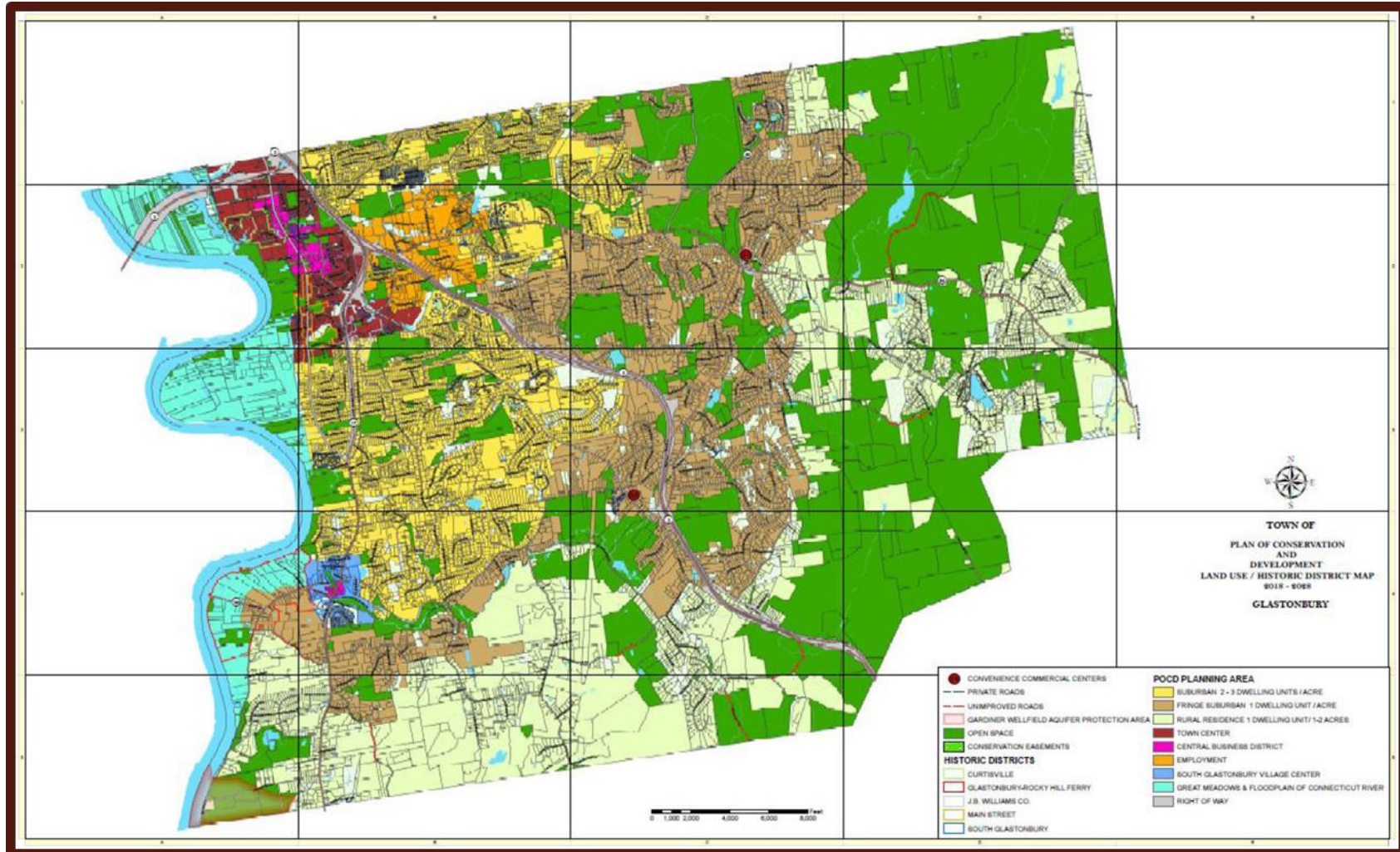
This plan identifies many areas with potential for land use growth or change, including Founders Plaza (pink area along Connecticut River), Rentschler Field (pink area at center), and several commercial corridors outlined in black dots.



**Figure 8-17: East Hartford Plan of Community Development**

Glastonbury includes a wide variety of development conditions from town center to rural. The town intends to focus new development to the northwest, where a mix of concentrated historic and contemporary

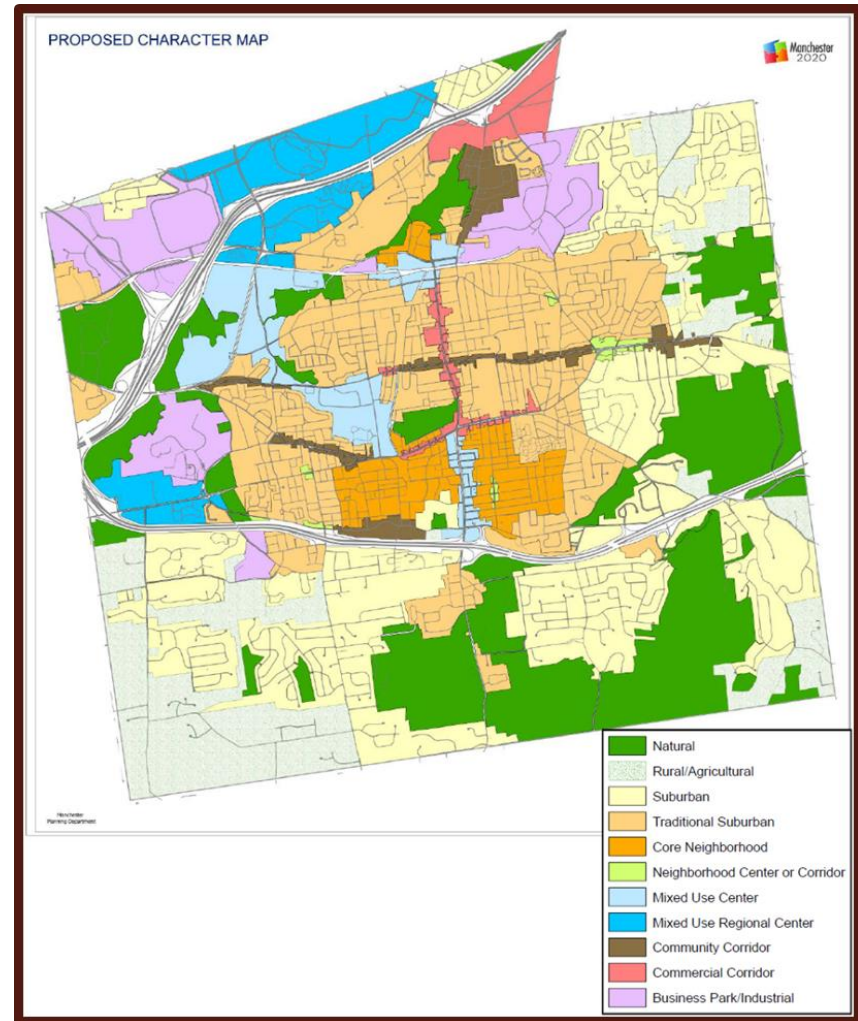
development is present, and where the street grid has potential to support a walkable mixed-use development approach.



**Figure 8-18: Glastonbury Plan of Community Development**



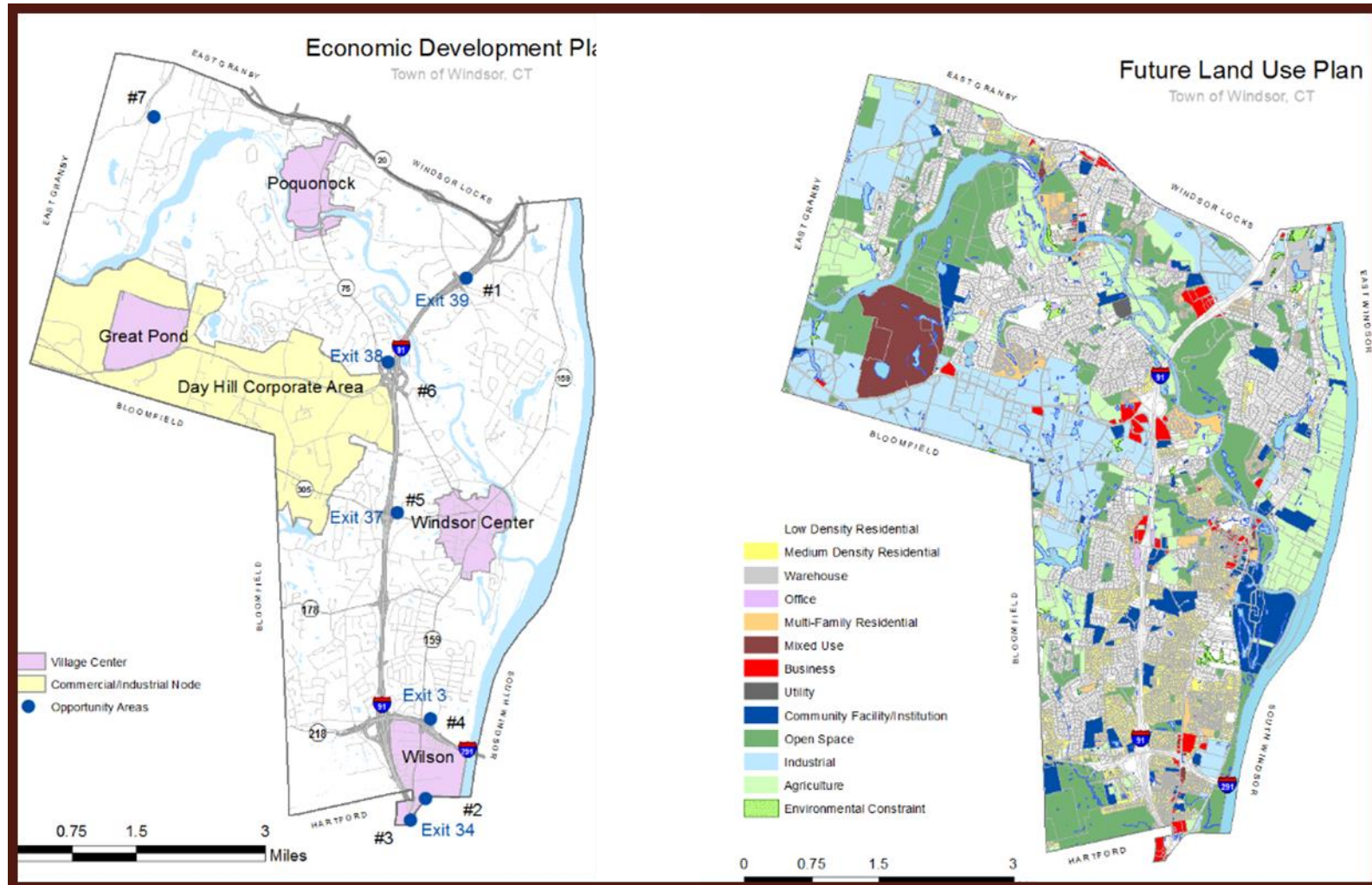
Manchester's 2013 POCD shows how its town center area, at the geographic center of town, includes a combination of Mixed Use, Core Neighborhood, and Commercial Corridor uses. Other Mixed-Use Center and Mixed-Use Regional Center areas are largely commercial and could offer opportunity for more intensive and mixed uses over time.



**Figure 8-19: Manchester Plan of Community Development**

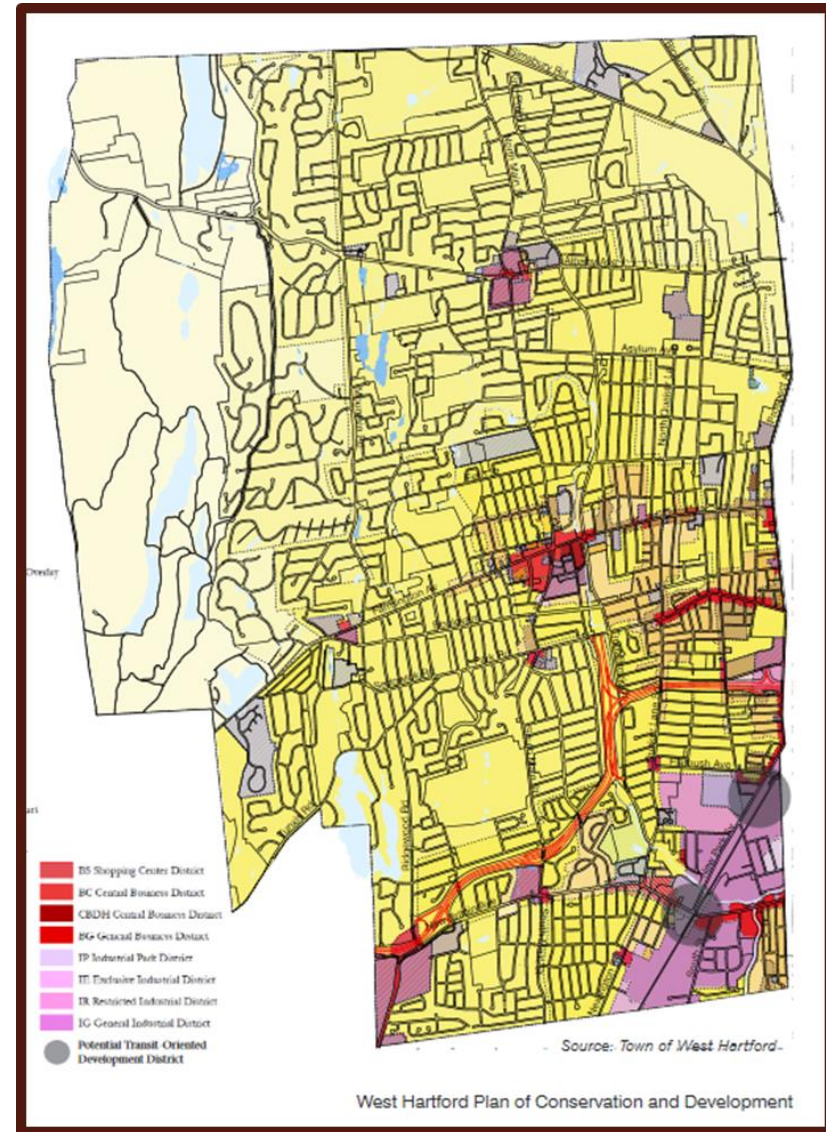
Future Land Use and Economic Development Plans (2014). Windsor has designated four priority “village

center” mixed-use growth areas – one its traditional town center, and the others emerging centers.



**Figure 8-20: Windsor POCD**

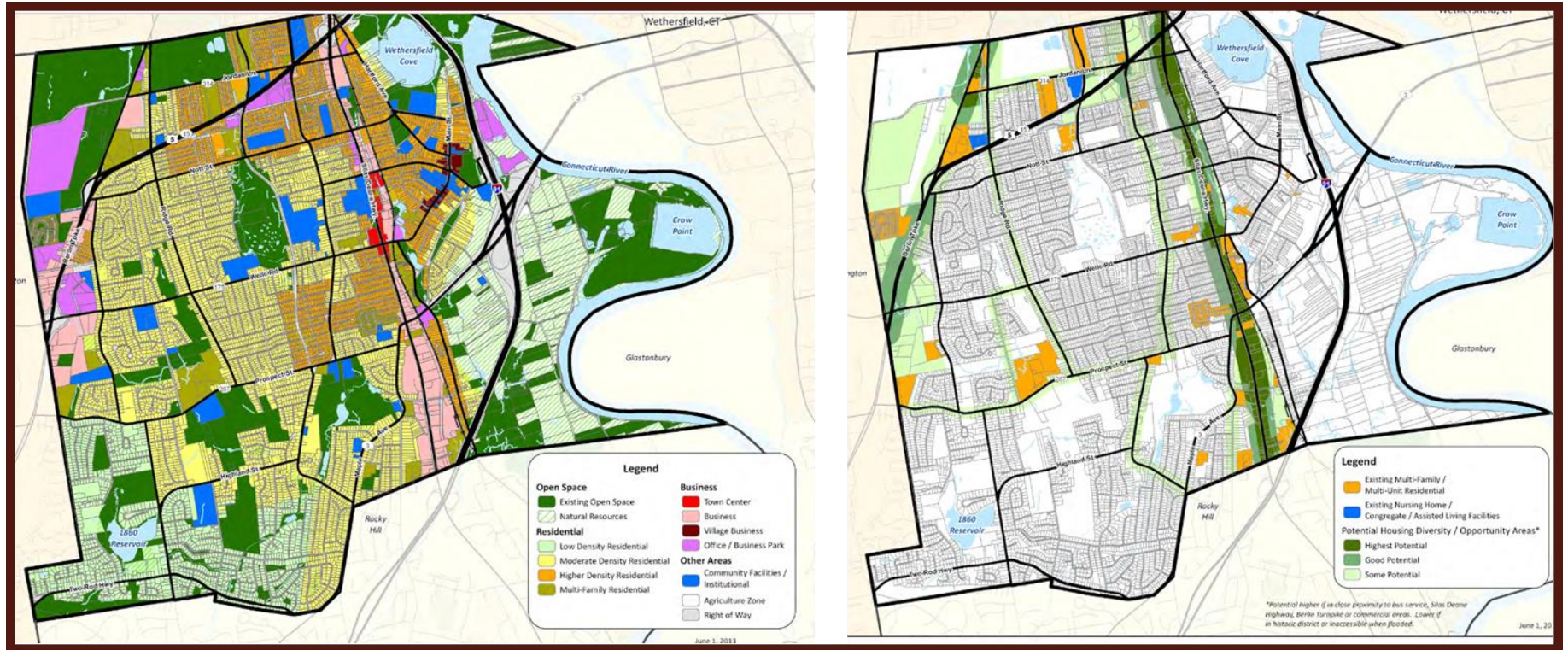
West Hartford's 2019 POCD designates mixed-use centers and transit station areas for priority growth. The town contains two CTfastrak stations.



**Figure 8-21: West Hartford POCD**

With much of its land fully developed, Wethersfield has identified commercial corridors like the Silas

Deane Highway as those most likely and appropriate for changes that intensify land use.



**Figure 8-22: Wethersfield land use plan and target housing areas**

## 8.6 Precedents of Land Use-Transportation Dynamics to Inform Further Study

To inform the scenario development phase, the following planning studies or initiatives may be worthwhile to highlight as case studies. Most of the study areas had prolonged periods without new real estate investment. Most of those have seen significant development take place in the past five years as a result of changes to zoning, multi-modal transportation infrastructure, public-private partnership, and/or other policy development updates. Some have seen little investment due to continued need for transportation investment, brownfields remediation, parcel assembly or other prerequisites. Lessons learned from these examples may suggest locations in the GHMS area most poised for growth and change. They may also suggest land use or transportation strategies that would be effective for overcoming challenges to economic development in other places.

- i. New Haven Hill-to-Downtown Planning Study
- ii. Fairfield TOD Planning Study
- iii. Barnum TOD Planning Study, Bridgeport
- iv. Stamford Glenbrook and Springdale Planning Studies
- v. Warwick Station District, Warwick, RI
- vi. Providence Innovation and Design District, Providence, RI
- vii. Attleboro, MA Station Area Development
- viii. Massachusetts Gateway Cities Report

The Bushnell South master planning process currently under way in Hartford also provides a useful window into development feasibility in dense, transit-served areas. The process seeks to establish a mixed-use neighborhood anchored by the Bushnell Theater on approximately 15 acres of parking lots formerly occupied by state employee parking. State investment in new parking structures, funded in part by the Capitol Region Development Authority (CRDA), has freed the parking lots for redevelopment. While there is a growing market for housing in the adjacent downtown, economic analysis has determined that much of the aspired development will require some form of subsidy from the state, city, and or other sources. Relatively less expensive four-story residential buildings do represent attractive opportunities for developers right now. Mixed-use buildings with concrete or steel first floor (“podium”) construction are inherently more costly to construct and thus would require some level of subsidy. Subsidies can take a variety of formats including city or state property tax abatement, a tax-increment financing district, or below-market land prices.

### 8.7 Land Use Considerations Key Takeaways

- ❖ While the region has a relatively strong and varied job base, and rates highly in levels of education, young college graduates entering the workforce, and other criteria relative to peer regions, its stagnant population growth is a potential weakness threatening future prosperity.
- ❖ Portions of the northeast with better access to transit service have outperformed the Hartford-Springfield region in economic development. Communities along the Northeast Corridor rail spine, excluding cities of Washington, New York and Boston as outliers, have seen average annual job growth of 1.1% since 1990 compared to 0.6% annual job growth for the Hartford-Springfield region, barely half as much.
- ❖ The Information, Finance, and Professional Services industry sector, a foundation of the GHMS economy and strategic priority for growth, especially gravitates toward places with high transit ridership. Travel associated with this sector in 2019 utilized transit for 29.4% of trips in the Northeast Corridor as a whole, but for only 2.7% of trips in the Hartford-Springfield region. While New York City's high transit use skews the Northeast Corridor figure, even the nationwide average of 7.7% transit trips by the Information, Finance, and Professional Services sector is nearly three times the Hartford region's rate.
- ❖ Real estate and business development should be focused in a relatively limited number of walkable focus areas within the GHMS area to maximize economic and community development (see figure 3). These areas offer the current or potential mix of land uses; relatively high concentrations of population, employment, and development; transportation choices; and amenity that will best support regional population growth and economic development moving forward. These areas also primarily consist of previously developed land, and generally avoid major wetlands and floodplains and other sensitive natural areas identified in Chapter 7. other Clustering new development in these areas will help Greater Hartford compete more successfully with other regions to which it has been losing ground since 1990.
- ❖ Real estate and business development will not inevitably flow to the designated focus areas, even though many have appropriate zoning and land use priorities in place. While some focus areas have recently gained benefit of improved transit services and other assets thanks to proactive regional effort, most areas will require additional proactive efforts to attract market-driven development. Examples include parcel aggregation, brownfields remediation, or investment in additional multi-modal transportation infrastructure.

- ❖ National-scale changes in land use, such as potential reduced office and retail space demand, are already forcing a rethinking of land uses in certain areas. This can present important new opportunities in some focus areas but may require updated approaches to multi-modal transportation, zoning, or other supportive elements, entailing additional study and resources.

## 9 Multimodal Connectivity

### 9.1 Introduction

With the emerging trends of Mobility-as-a-Service (MaaS), travelers have been increasingly relying on using multiple modes to reach their destinations in a seamless and efficient manner. Whether it's a connection between a ride-hailing service connecting to passenger rail or park and ride options to switch from autos to transit services, multimodal connectivity has been playing a significantly important role in efficient mobility solutions. The availability of well-planned first/last mile connection to major transit nodes using active transportation is also an example of how multimodal connectivity can support improved user experience and micro-mobility.

This chapter includes discussion of multimodal connectivity in the GHMS study area focused on major transit nodes that facilitate mode transfers, such as the Hartford Union Station and Bradley Airport.

### 9.2 Connecting Hartford Union Station

Hartford Union Station is a historic transportation terminal originally built in 1889 and has been listed in the National Register of Historic Places since 1975. It acts as a hub of multimodal connectivity in the study area. Hartford Union Station is centrally located along the Hartford line and provides access to significant employment and residential destinations in Hartford and its surrounding communities. The following section reviews existing transit and rail connectivity at Union Station for bus-transit and BRT, bike, and

pedestrian facilities, as well as other emerging services. Two types of primary trips will be addressed in this analysis: first and last-mile connections and regional connections. The former will focus on the multimodal connectivity afforded to those arriving at Hartford Union Station as a final destination within the surrounding two miles or those departing Union Station originating from the surrounding two miles. The latter examines those who are coming from further out and using the station for access to the broader regional rail network (i.e. connections south to the New Haven Line or north towards Vermont).

*The Hartford area remains a significant employment destination in Connecticut with more than 115,430 jobs within two miles of Union Station.*



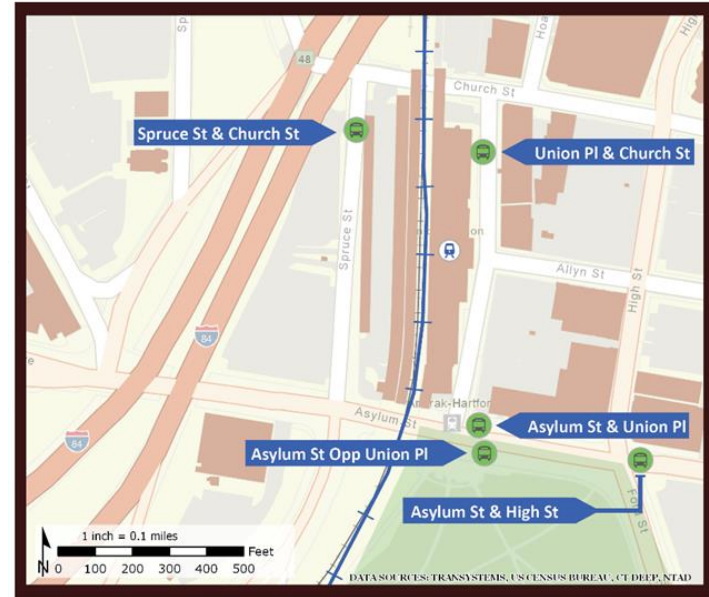
The Hartford area remains a significant employment destination in Connecticut with more than 115,430 jobs within two miles of Union Station and roughly 9,200 originating from existing Hartford Line station communities.<sup>1,2</sup>

### 9.2.1 Fixed Route Bus

Hartford Union Station operates as a transit hub, bringing together Hartford Line rail service with local bus and regional services like CTfastrak. Beyond Union Station itself, there are five (5) bus stops in the immediate vicinity of Union Station (**Figure 9-1**), which are serviced by more than 30 CTtransit bus routes. These routes provide connections between Union Station and most local and regional destinations, including the Greater Hartford area, New Haven, Waterbury, New Britain, and Storrs.

#### 9.2.1.1 Local Service

There is a high density of local fixed-route bus service in Hartford, with 770 stops within a two-mile radius of Union Station serviced by 40 different routes. In addition to local bus service, the Asylum Hill, Columbus Boulevard, and Hartford Dash (currently suspended) shuttles provide free weekday service between Union Station and select areas of downtown Hartford.



**Figure 9-1: Union Station CTtransit Stops**

<sup>1</sup> The employment figures here are from the Census Bureau’s LEHD OnTheMap Tool and present data on “All Jobs” for 2018 (the most recent data year).

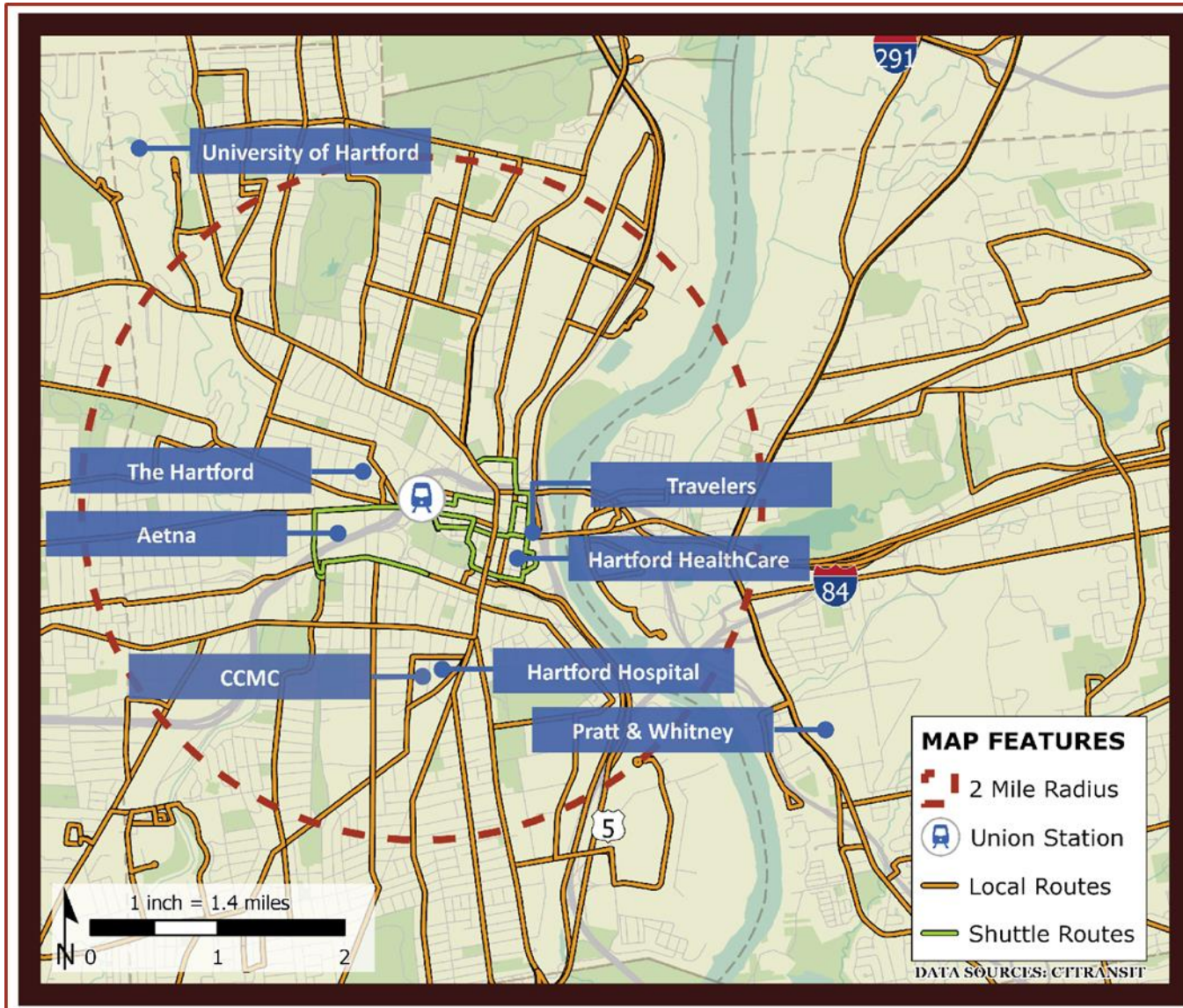
<sup>2</sup> It is important to note that this figure is not arguing that these are trips that are currently made using the Hartford Line, rather it serves to the number of individuals employed in Hartford who have easy access to Hartford Line Stations.

There are local bus connections from Union Station to most major employers in the Greater Hartford area. These include Travelers, Aetna, Hartford Healthcare, and The Hartford, which can be reached with direct bus service from Union Station in approximately 10 minutes. Transfer between local buses is necessary to reach employment destinations such as the University of Hartford, Cigna, Hartford Hospital, Connecticut Children’s Medical Center (CCMC), and Pratt & Whitney. These destinations are not serviced with direct routes from Union Station, therefore, the travel time from Union Station is longer, averaging 30 minutes by bus. Regardless, the system provides for strong connectivity between Union Station and surrounding major employers (see **Figure 9-2**).

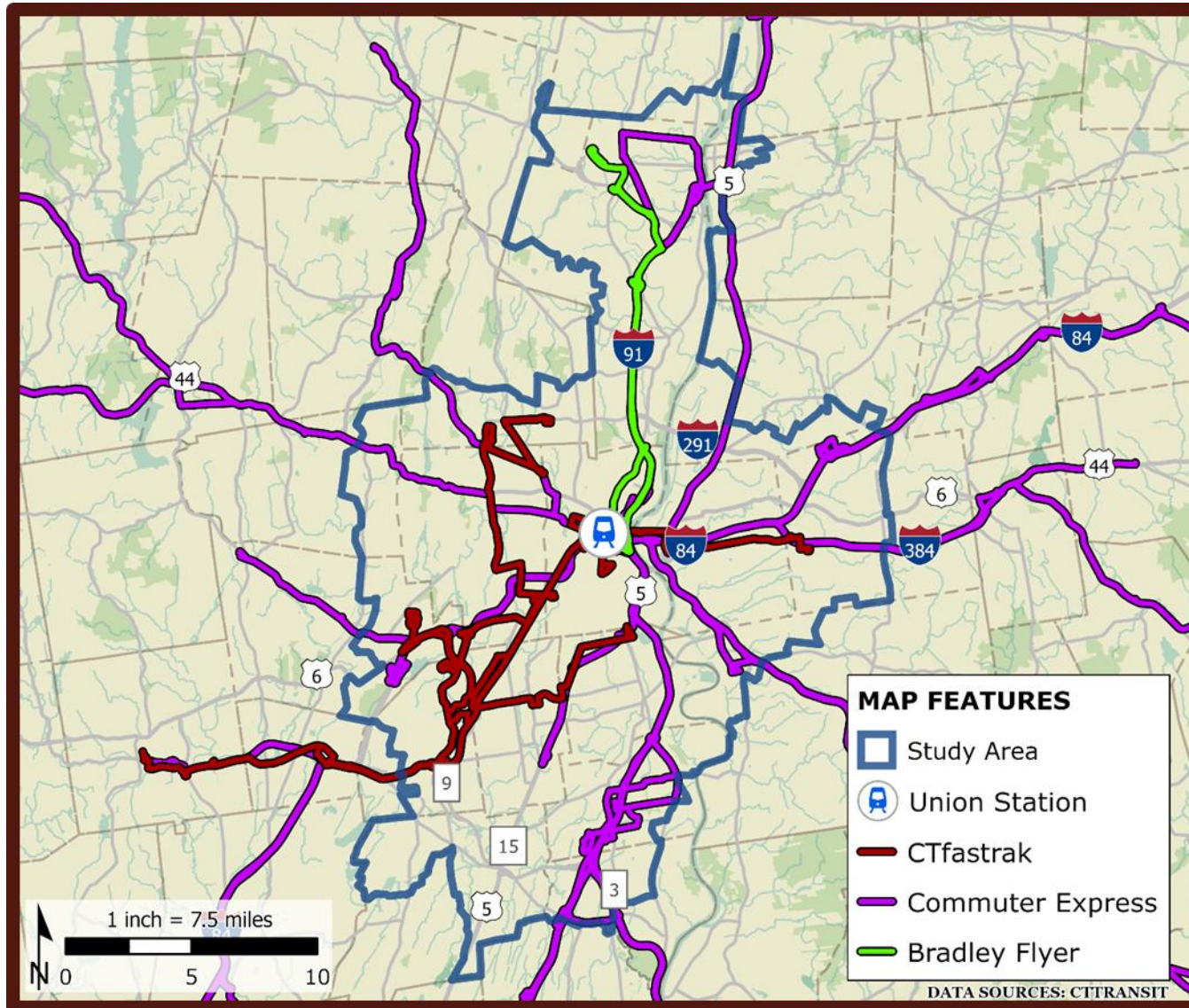
#### *9.2.1.2 Regional Service*

Union Station also serves as the terminus for regional services, including *CTtransit* express bus, *CTfastrak*, and the Bradley Flyer. There are 25 express bus routes providing connectivity to destinations around Connecticut, including Torrington, Old Saybrook, Middletown, Windsor Locks, Willimantic, and more. *CTfastrak* has 8 routes that use bus-only roadways for all or part of the trip, connecting Hartford Union Station and New Britain. The Bradley Flyer provides hourly service from Union Station and the Connecticut Convention Center to Bradley International Airport, seven days a week. See **Figure 9-3**.

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**Figure 9-2: Hartford Union Station – Local Bus Service and Major Employers**



**Figure 9-3: Hartford Union Station – Regional Bus Service Connection**

### 9.2.1.3 Fixed Route Ridership

As part of the assessment of fixed route services directly accessible to Hartford Union Station, transit ridership to and from the five stops directly adjacent to the station was reviewed.<sup>3</sup> From these five stops 29 routes are directly accessible including the three downtown shuttles.

Three of 29 routes are part of the CTfastrak system, which services the corridor between Hartford and New Britain. Combined, the three CTfastrak routes (101, 102, and 128) receive the highest number of passengers across the five stops with more than 5,000 monthly boardings and 7,000 alightings.

DASH, one of the downtown shuttle services (currently suspended due to the COVID-19 pandemic), attract the most ridership of the shuttle services from this location. (See **Table 9-1** here & **Figure 9-2** earlier). The majority of daily ridership on the DASH come from boardings which is indicative of transfers from Hartford Line rail services to access other locations in downtown. Whether the dash has historically garnered ridership from the Hartford Line, the free downtown shuttle represents an ideal last mile commute.

**Table 9-1: CTtransit Ridership from Union Station**

| <i>Route</i>       | <i>Monthly Boardings</i> | <i>Monthly Alightings</i> |
|--------------------|--------------------------|---------------------------|
| 101                | 3,702                    | 5,281                     |
| 60-66              | 1,900                    | 1,956                     |
| 913                | 1,227                    | 2,132                     |
| 128                | 953                      | 1,220                     |
| 82-84              | 1,248                    | 845                       |
| 30                 | 1,302                    | 619                       |
| 83                 | 927                      | 734                       |
| <b>DASH</b>        | <b>777</b>               | <b>607</b>                |
| 76                 | 523                      | 735                       |
| 102                | 542                      | 505                       |
| 72                 | 488                      | 344                       |
| 74                 | 324                      | 350                       |
| 905                | 309                      | 63                        |
| AHS                | 62                       | 236                       |
| 903                | 164                      | 107                       |
| <i>All Others</i>  | 543                      | 288                       |
| <b>Grand Total</b> | <b>14,991</b>            | <b>16,022</b>             |

<sup>3</sup> The five stops are: Asylum St opposite Union Pl, Asylum St and Union Pl, Union Place and Church St, Spruce St and Church St, and Asylum St and High St.

### 9.2.2 Active Transportation

Active transportation options continue to become a more viable, affordable means of transportation and is especially relevant as a first- or last-mile option. Active transportation extends the easily accessible range well beyond a comfortable walking distance. This section looks at various types of active transportation access including bicycling and bike share, scooters, and pedestrian (discussed below) infrastructure that are present in the Hartford Union Station vicinity.

**Bikes on Buses and Trains:** Ease of bringing a bicycle onto transit vehicles into Hartford and the level of infrastructure available once users arrive is a critical issue. *CTrail*-operated Hartford Line trains permit bikes on all trains (pending space availability), while Amtrak-operated Hartford Line trains limit bikes on board and require that tickets be purchased through Amtrak and a bike reservation be added to that ticket.

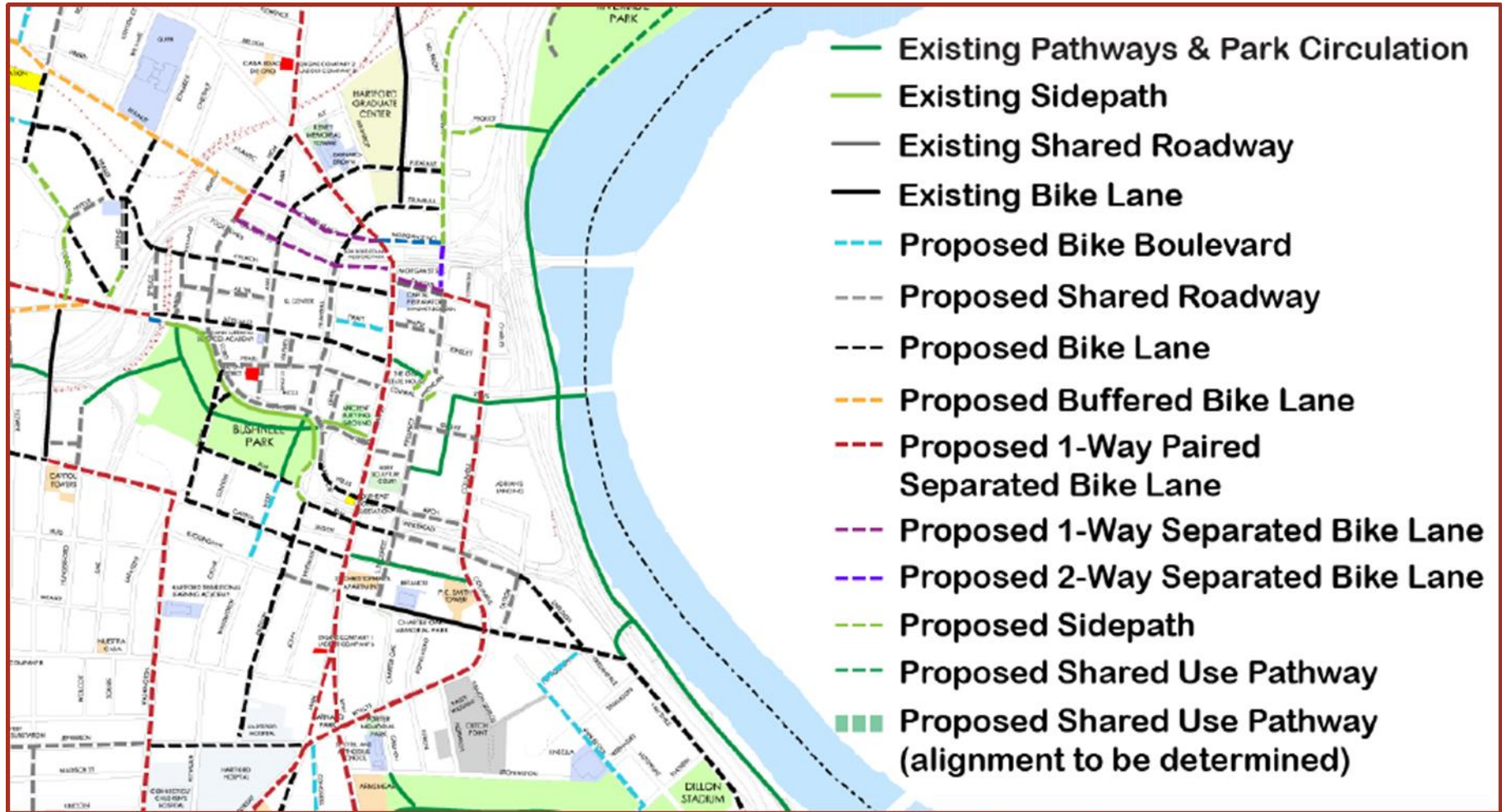
For bus connections into and out of Union Station, all *CTtransit* buses are equipped with bike racks that allow for up to two bikes per bus. While *CTfastrak* buses are not equipped with external bike racks, passengers are permitted to bring bikes on board and use an internal rack system.

**Union Station Area Bike Amenities:** Hartford Union Station has provided two bike lockers located in the Spruce Street Lot; however, the limited capacity hurts the reliability of securing a space. While there are also

traditional bike racks located at the bus terminal and near the front entrance of Union Station, they are significantly less secure and not protected from the weather.

**On-road Facilities:** The road network in and around Hartford Union station provides no dedicated bike facilities and users are required to ride with traffic. While this may not pose a barrier for more advanced users, the lack of dedicated amenities limits the viability of cycling as a first/last-mile connection. In Hartford's 2019 Bicycle Plan the deployment of bike lanes and other dedicated infrastructure was highlighted as a priority, with bike lanes (in multiple forms) being proposed across downtown (**Figure 9-4**). The deployment of the infrastructure outlined within the plan would go a long way towards improving user experience and safety.

**Bikeshare and Scootershare:** Bike- and scooter-share services can lower barriers to access and make it easier for commuters to use a bike as a first or last-mile option. Bikeshare is not currently available in Hartford, requiring bike users to bring a bike with them for a trip to Union Station or from it to their final destination. The Capital Region Council of Governments (CROG) recently signed a contract with Zagster that will allow the rollout of bikeshare and scooter share as early as spring 2021. The initial agreement will allow for rollout in Hartford, East Hartford, West Hartford, Newington, New Britain, and Manchester.



**Figure 9-4: Hartford Bike Master Plan Proposed Bike Infrastructure**

### 9.2.3 Pedestrian

The area in and around Hartford Union Station has a high degree of walkability due to the higher density of development and a contiguous network of sidewalks and crosswalks. Based on the Environmental Protection Agency (EPA) national walkability index, the areas just to the east of Union Station (towards downtown) have the highest degree of walkability, while areas to the west of the station are considered to be significantly less walkable. The lower walkability to the west of the station can be attributed to I-84 crossing through the zone and creating a less pedestrian friendly atmosphere. However, it is still possible for pedestrians to safely reach these areas.

### 9.3 Windsor Locks Station and Bradley Airport Connection

Bradley International Airport provides convenient access to and from Connecticut for those traveling nationally and abroad. It also provides connecting flights to major hubs throughout the United States, tying it to the regional market. Additionally, it is the second largest commercial airport in New England, servicing 6.75 million passengers in 2019. The airport is centrally located between the New York and Boston metropolitan areas and is interconnected with existing transit connections. Bradley International Airport has the capacity to expand services in the future as other major regional airports reach capacity and become increasingly vulnerable to sea level rise and flooding from severe storms.

### 9.3.1 Existing Conditions

Bradley International Airport is accessible across modes, including public transit, private automobile, and transportation network companies (TNCs). With future plans looking to further expand accessibility through either direct rail link or autonomous shuttle.

The most direct connection between Bradley and Hartford is the Bradley Flyer bus service, which provides hourly (20 trips total), semi-express service to all airport terminals in approximately 40 minutes from Hartford Union Station. This interconnection at Union station offers broad accessibility across modes including the Hartford Line, local fixed route bus, regional routes, and *CTfastrak*.

The following section summarizes proposals currently being considered for a direct rail connection from the Hartford Line, as well as additional transit connections from Windsor and Windsor Locks stations.

### 9.3.2 Potential Rail Connections and Future proposals

A 2014 study funded by the Bradley Development League (BDL) evaluated alternatives to determine the viability of a rail connection between Bradley Airport and the Windsor Locks rail station. The BDL is a consortium of four towns (East Granby, Suffield, Windsor, and Windsor Locks) surrounding Bradley International Airport that markets the airport and region for economic development purposes. The study into rail alternatives had three primary goals:

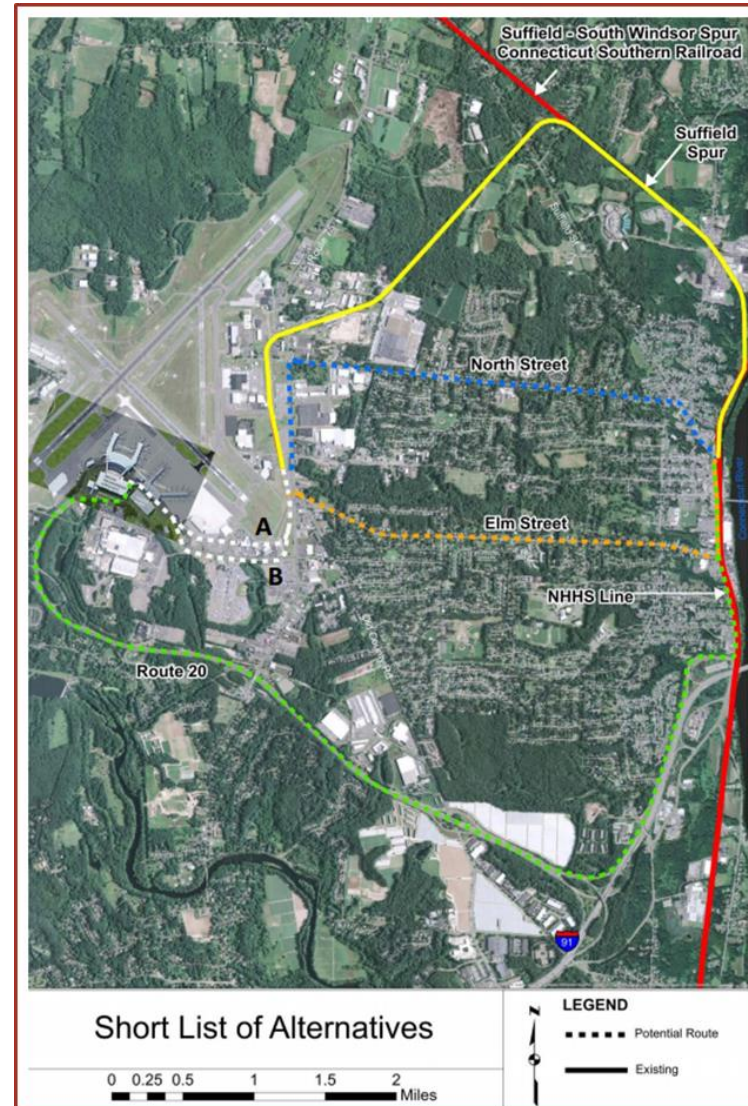


- Improve public transportation connectivity and accessibility between Bradley International Airport and the New Haven-Hartford-Springfield rail line;
- Provide cost-effective and efficient land transportation service to and from Bradley International Airport; and
- Support sustainable local and regional economic development.

Screening by the BDL Steering Committee identified a shortlist of four alternatives for further consideration (**Figure 9-5**):

- Alternative 1: Suffield Spur provides a potential rail connection to Bradley Airport utilizing the existing Connecticut Central Suffield Spur off of the Amtrak mainline. This alternative could use LHRC or DMU vehicles;
- Alternative 2: North Street provides a connection to Bradley Airport from Windsor Locks station via North Street and Route 75 using streetcar equipment;
- Alternative 3: Elm Street provides a connection to Bradley Airport from Windsor Locks station via Elm Street and Route 75 using streetcar equipment; and

Alternative 4: Route 20 provides a connection to Bradley Airport from Windsor Locks station via Route 159, Interstate 91, and Route 20 using LRT or DMU technology.



**Figure 9-5: Rail Alternatives to Bradley International Airport**

### *9.3.2.1 Suffield Spur Alternative Details*

This alternative would utilize the existing Connecticut Central Railroad Suffield Spur from the Hartford Line to the airport via the Bradley Spur. This alternative could deploy diesel locomotive/commuter coaches, or Dual Mode Units (DMUs). The Windsor Locks station would be configured with a separate track for the Bradley Connector, and a two-sided platform to allow a cross-platform connection with Hartford line service.

This route follows the Suffield Spur as it leaves the Hartford line roughly 2,500 feet north of the Windsor Locks Station, and curves to the north-west, servicing several industrial/commercial properties. As seen on the map on the previous page (**Figure 9-5**) the existing alignment terminates adjacent to the “cell-phone” parking lot approximately 2,500 feet north of Schoephoester Road.

The existing line is currently maintained strictly for low-speed freight use only and would require significant upgrading for passenger service, including improvements to grade crossings and likely development of a signal system/PTC. All existing crossings (except Route 75) are protected only by static signage, and the Army National Guard property must be entered and exited by manually unlocking and re-locking gates. The Route 75 crossing is an unusual signalized crossing, using standard vehicular signals instead of crossing signals or gates. The crossing is actuated by a key-by, and it does not appear that track circuits are in place for automatic actuation.

Two routes have been identified for extending the line to the Ground Transportation Center (GTC). Both extend the existing track alignment to the south. This would impact the “cell phone” waiting lot and require some reconfiguration of that lot, or for that use to be shifted to some other location.

The **Table 9-2** on the following page shows the two alignments along the Suffield Spur and a brief overview of the alignment length, the length of new construction or track renovation, the number of existing and proposed at-grade crossings, and the number of existing and proposed traffic signals.

**Table 9-2: Suffield Spur Rail Alternative Options**

|                           | <b>Suffield Spur A</b> | <b>Suffield Spur B</b> |
|---------------------------|------------------------|------------------------|
| <b>Corridor Length</b>    | 6.24 miles             | 6.40 miles             |
| <b>New Construction</b>   |                        |                        |
| <b>At-Grade</b>           | 0.78 miles             | 0.91 miles             |
| <b>Embedded</b>           | n/a                    | n/a                    |
| <b>Elevated</b>           | 0.57 miles             | 0.60 miles             |
| <b>Tunnel</b>             | n/a                    | n/a                    |
| <b>Track Renovations</b>  |                        |                        |
| <b>At-Grade Crossings</b> |                        |                        |
| <b>Existing</b>           | 12                     | 12                     |
| <b>New</b>                | 1                      | 2                      |
| <b>Traffic Signals</b>    |                        |                        |
| <b>Existing</b>           | 1                      | 2                      |
| <b>New</b>                | 0                      | 0                      |

Source: Bradley Airport Light Rail Feasibility Study, 2016

*9.3.2.2 Windsor Locks Autonomous Bus Connection and Connecticut CAV Policy*

On June 27, 2017, the Connecticut legislature enacted Public Act No. 17-69, establishing a pilot program for four municipalities to allow autonomous vehicle testers to operate fully autonomous vehicles on the highways of the municipalities. Windsor Locks applied to be one of the four communities to host an autonomous vehicle pilot program.

During a May 1, 2018 meeting, the Windsor Locks Board of Selectmen discussed a proposal for a Fully Autonomous Vehicle (FAV) Testing Pilot Program that was established by the State of Connecticut Office of Policy and Management (OPM). The goal for the pilot program is to allow a variety of FAV testing to occur in four municipalities throughout the state, bringing

Connecticut to the forefront of the innovative and burgeoning autonomous vehicle industry. Following an application and written agreement, OPM will select four municipalities to participate in the pilot program. The autonomous vehicles would be fully tested on the highways of the chosen municipalities. Town officials agreed that the autonomous vehicles may be a useful and cost-effective alternative to a shuttle bus for transporting travelers between the new Windsor Locks Hartford Line Commuter Rail Station and the Bradley Airport Passenger Terminal. The selection of pilot communities is currently delayed.



**Windsor Locks Station Area Build-Out Illustrative Plan.**  
Portion of an illustrative plan outlining the potential full build-out of the future Windsor Locks station area, including private redevelopment and infrastructure improvements.

Source: Hartford Line TOD Action Plan Part 2, 2019

In March, 2021, CTDOT announced its first-ever, statewide Strategic Plan for Connected and Automated Vehicles (CAV) to support emerging transportation technology and mobility trends. Specifically, the plan outlines strategies for advancing multimodal CAV-related services and infrastructure to address both current and evolving transportation needs. The strategic plan explores the ways CAV technologies could become a powerful tool in helping meet key CTDOT goals for improved safety; enhanced mobility, accessibility, and reliability; reduce congestion; support infrastructure state of good repair; provide efficiencies; reduce vehicle emissions; and support economic growth. Near-term (2021-2025) actions will include deploying pilot projects, early policy coordination and development, assessments of workforce and infrastructure readiness, and other activities.

According to the CTDOT webpage, “until sufficient national CAV standards are set, or a clearer consensus around the usage of CAV technologies, the CTDOT will focus its CAV technology and research investments towards conducting and supporting limited CAV field-testing and small pilot projects in Connecticut.” These pilot programs and demonstration projects will allow the state and participating communities gather valuable insight as to the direction of the industry and the role that CAV can play in the states’ transportation network. Additionally, participation in these programs will position state to become a leader in best practices

and more proactively work to inform policy and regulatory decisions at the federal level.

The Plan identifies two near-term pilot programs: pilot testing CAV full size transit on the CTfastrak and pilot testing Vehicle-to-Infrastructure (V2I) and other emerging traffic signal technologies along a segment of the Berlin Turnpike. The Plan also notes that the CTDOT will also consider exploring additional options and ideas for advancing other types of CAV pilot tests and limited deployments in Connecticut as needs arise and as available funding/resources permit.

Among the components of the Plan that may be relevant to a Windsor Locks Pilot program are:

1. In the future, CAV technologies will likely provide increased mobility options for public transportation users. While fixed route bus and rail services are likely to remain the norm in highly populated urban areas, CAV may offer a better transportation solution for suburban and rural communities. CAV may also help to solve the last mile problem for public transportation. The need for CAV to be integrated at transit hubs should be a priority going forward; and
2. Addressing safety concerns will most likely be achieved via CAV pilot projects that are highly visible with positive community impacts. Providing the public with ways to experience CAVs, potentially via CAV public transit or low-speed shuttles, would clearly demonstrate that non-human driven vehicles are safe and efficient. It is

essential for the public to be able to experience the capabilities and limitations of the technology first-hand, so they can develop an informed perspective.

### 9.3.2.3 Expanded Bradley Airport Express

The latest (2019) Capital Region Council of Governments (CRCOG) Metropolitan Transportation Plan (MTP) provides a 25-year overview of the anticipated major transportation improvements and investments in the Capitol Region. The plan outlines recommendations for an expanded Bradley Flyer service.

Given the very limited transit service to the airport today, bus service improvements are needed. The Bradley Flyer is the only bus service between the airport and downtown Hartford, and it was designed to serve employees at the airport, not air travelers. For instance, the Bradley flyer does not provide dedicated luggage compartments or storage for passengers with large bags. The route's schedule and frequency should be adjusted to become more attractive to travelers. CRCOG's Hartford Comprehensive Transit Service Analysis recommends extending the Bradley Flyer to New Britain along the CTfastrak guideway but recognizes the concern of limited parking availability at the CTfastrak stations. Solutions to help alleviate these concerns could include encouraging long-term airport parking at the underutilized Szczesny Garage in New Britain, charging for parking at CTfastrak stations, and increasing parking capacity at CTfastrak stations.

The MTP includes the following specific recommendations:

1. Support the establishment of a transit connection between the airport and the CTrail Hartford Line, work with CTtransit to provide a connection to the CTrail Hartford Line service by instituting a direct shuttle service from the airport to the Windsor Locks rail station.
2. Support adjustments to Bradley Flyer Service to improve bus service to Hartford from Bradley; the route should operate more frequently and be re-routed to serve the Ground Transportation Center when completed. Extending the Bradley Flyer to New Britain along CTfastrak and rebranding the route could attract more choice riders coming from other stations.
3. Marketing and branding the Bradley Flyer Improved branding, user-friendly schedules, and better signage at the airport could help bolster ridership.
4. Support Bradley Master Plan's calls for improved designs for roadways surrounding the airport.

*9.3.2.4 2021 CTDOT Transit SAFE Analysis*

In accordance with Title VI of the Civil Rights Act of 1964 and Federal Transit Administration (FTA) Title VI Circular 4702.1B, Connecticut Department of Transportation (CTDOT) conducts a Service and Fare Equity (SAFE) Analysis any time fare changes or major service changes are proposed to ensure that changes do not unfairly impact minority and low-income populations. The onset of the COVID-19 pandemic initiated an extended emergency declaration and subsequent service modifications to bus and rail service.

The document also addresses proposed services changes to CTtransit bus service, minor fare changes on two CTtransit Express bus routes, and a proposal to eliminate the Metro-North Railroad Mail and Ride Program. Among the proposed service changes includes a new route that connects Windsor and Windsor Locks stations to Bradley International Airport. The proposed service improves upon existing transit connections to the airport by providing a direct connection to/from the Hartford Line.

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