III-A. REGIONAL HIGHWAY SYSTEM

A. GUIDING PRINCIPLES

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law in August 2005. SAFETEA-LU furthers the spirit of previous legislation that has governed the highway planning activities of the CMMPO since 1991. The new national law refines and continues important planning concepts such as safety, geographic equity, innovative finance, congestion relief, mobility and productivity, efficiency, and environmental quality.

At the state level, the Commonwealth of Massachusetts established the principles of “Fix it First” and “Communities First” in its Statewide Road and Bridge Policy. “Fix it First” stipulates that priority be given to the repair of existing roadways and bridges. “Communities First” insists upon collaboration with communities in order to design context-sensitive roadway and bridge projects. According to the policy statement, context-sensitive projects are expected to “protect and enhance the surrounding community and landscape while addressing mobility for all transportation modes.”

Both the federal and state policies are reflected in the CMMPO 2012 RTP Goals and Objectives, many of which are especially relevant to the regional highway system and are listed below:

Goal I. *Attain a safer more secure & better-maintained transportation system across all modes and for all populations*

> <u>Objective I-A</u>. Define and maintain acceptable conditions and optimal functionality of the region’s transportation assets.
>
> <u>Objective I-B.</u> Identify and improve critical locations of safety concern in order to achieve a reduction in the number of injuries and fatalities occurring as people and freight move throughout our region’s transportation system.
>
> <u>Objective I-C</u>. Utilize the management systems, travel demand model, and other regional data to identify and prioritize areas of need to better inform selection of projects.
>
> <u>Objective I-D</u>. Continue to encourage coordination among transportation security agencies, expand on identified risks to transportation infrastructure, and prepare evacuation analyses for the region under various scenarios.

Goal II. *Promote livable communities and improved air quality through context-sensitive design and reduced traffic congestion*

> <u>Objective II-A</u>. Improve and encourage the use of public transit, ridesharing services, and pedestrian and bicycle facilities so as to achieve a reduction in the percentage of commuter trips utilizing single-occupant vehicles (SOVs), as measured in the 2010 US

Census Journey-to-Work data and American Community Survey annual data. Develop/assess alternative strategies to help reduce greenhouse gases (GHG) and that address issues of climate change.

Objective II-B. In conjunction with the MassDOT-Highway District Offices, assist communities that propose potential TIP projects with utilization of the Massachusetts Project Development and Design Guidebook, which outlines a multi-modal and context-sensitive approach to roadway design.

Objective II-C. Ensure consistency of recommended and implemented transportation improvement projects with local and statewide growth management and economic development plans by reviewing available planning documents and maintaining coordinated communication with community stakeholders throughout the development of major local land use projects and the CMMPO RTP and TIP.

Goal III. Develop an alternative, creative transportation system that integrates multiple travel modes and includes the use of technology

Objective III-A. Monitor the connectivity of the physical regional infrastructure within and across the regional planning boundary so that it can be better incorporated in the prioritization and selection of transportation improvement projects.

Objective III-B. Seek out appropriate uses of technology for improving the management of existing transportation infrastructure. Review all project proposals for appropriate technology consideration. Provide an ongoing forum for communication and coordination between appropriate transportation-related agencies in order to deploy the Central Massachusetts Regional ITS Architecture.

B. HIGHWAY NETWORK DESCRIPTION

B.1 Interstates, US, and State Numbered Routes

The highway network in central Massachusetts connects the region's 40 communities to each other and to major New England cities such as Boston, Providence, Springfield, Hartford and Albany. Interstates 84, 90, 190, 290, 395, and 495, US Route 20, and State Routes 9 and 146 provide the majority of this access. The City of Worcester and the Towns of Auburn, Millbury, and Sturbridge house the major crossroads of these facilities within the region while a string of I-495 interchanges along the eastern edge of the region continue to attract significant traffic from Central Massachusetts. Figure III-1 shows the region's Interstate, US, and State Numbered Highways.

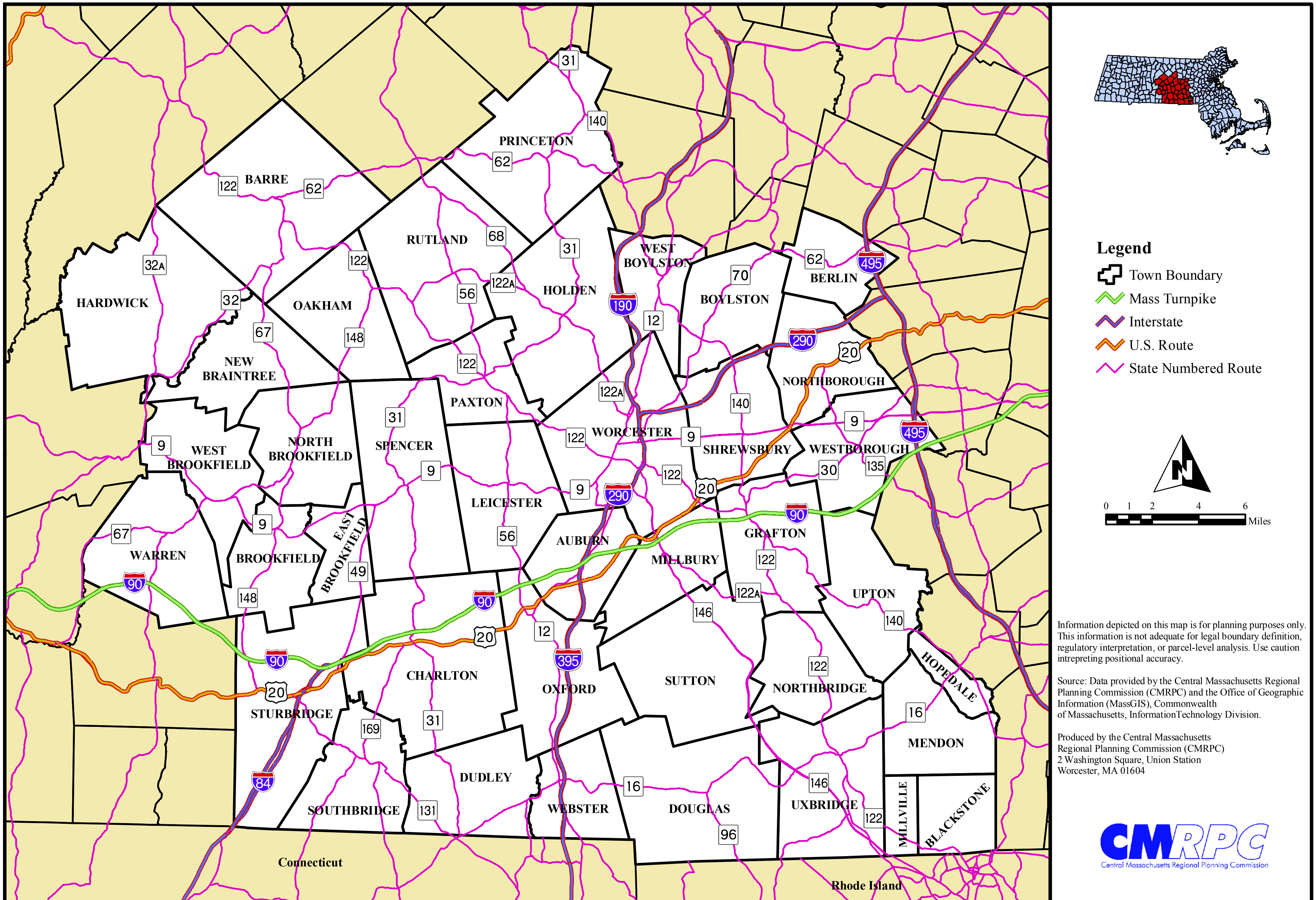


Figure III-1 The Region's Interstate, U.S. and State Numbered Routes

B.2 National Highway System (NHS)

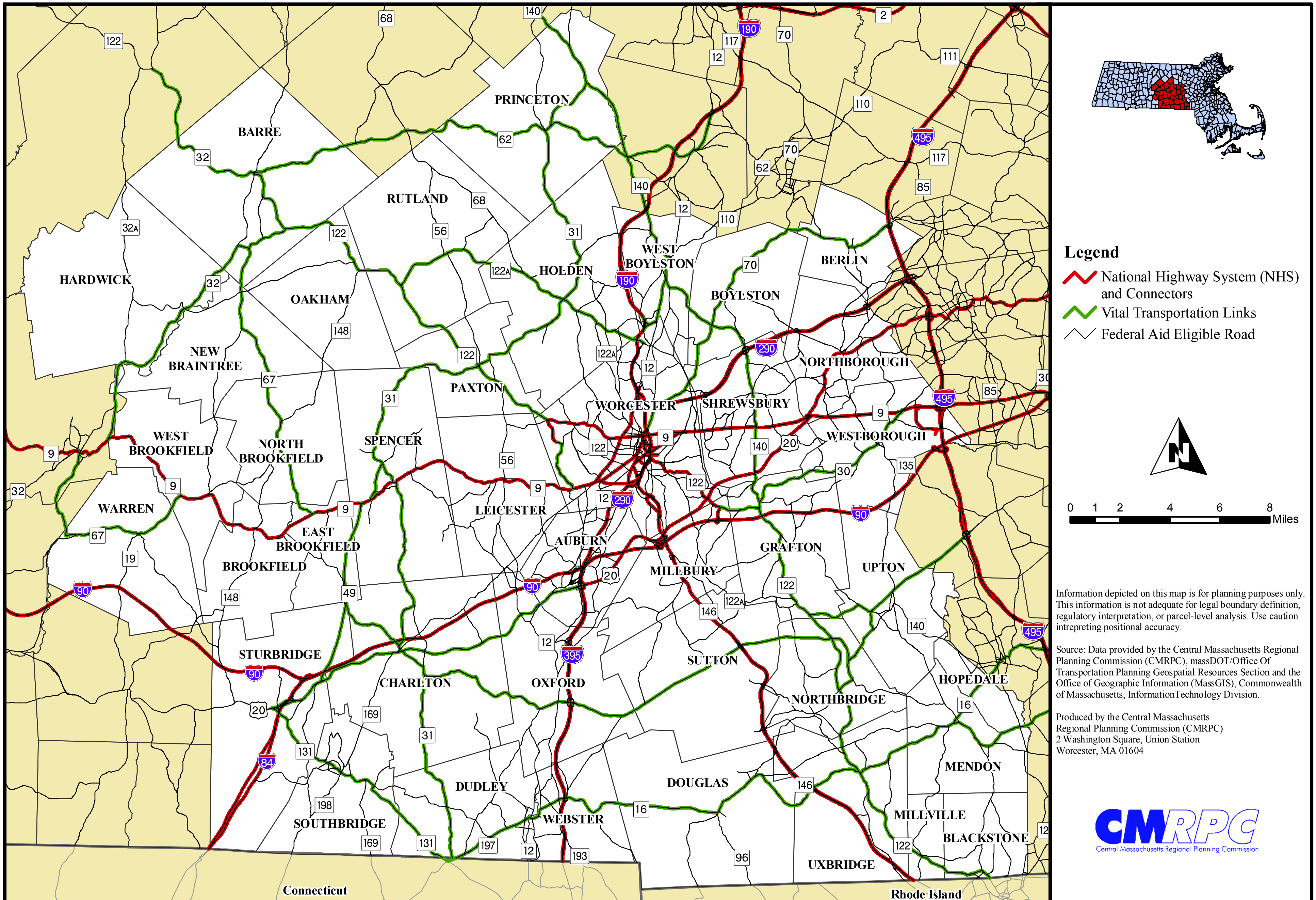
The National Highway System (NHS) is an interconnected network of principal arterial routes that serve major population centers, international border crossings, seaports, airports, public transportation facilities, intermodal freight facilities, and major travel destinations. Established through a cooperative effort between state, regional, and local officials, the NHS also meets national defense requirements and serves interstate and interregional travel. Mandated by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the NHS was officially designated on September 30, 1995.

NHS roadways in the Central Massachusetts region are shown in Figure III-2. As required, all Eisenhower National System of Interstate and Defense Highways, commonly known as the Interstate Highway System, are included in the NHS. In the region these facilities include I-84, I-190, I-290, I-395, and I-495. The Massachusetts Turnpike, I-90, a toll road, is also part of the NHS. U.S. Route 20 through the region is part of the system of United States Numbered Highways, often called U.S. Routes or U.S. Highways. Although the Interstate Highway System has largely replaced the U.S. Highways for through traffic, these facilities continue to serve critical regional connections. As such, U.S. Route 20 between I-395 and I-495 is part of the NHS. Further, State Route 9 and State Route 146, in their entirety, are included in the NHS network. As indicated on the figure, a number of other roadways are also identified as part of the NHS as they provide critical connections to downtown Worcester, various intermodal facilities for both passengers and freight as well as other major travel destinations.

B.2.1 High Priority Corridors on the NHS

From a wider perspective, the CMMPO is also cognizant of the "High Priority Corridors" on the NHS established under SAFETEA-LU. Although none of the High Priority Corridors are in Massachusetts, those identified in the greater New England and New York area have the potential to impact the region in regards to passenger movement, freight flows and evacuation routes. Some of the identified corridors also have the potential to expand into Massachusetts in the future. The High Priority Corridors in the greater area as included in SAFETEA-LU are as follows:

- The **Interstate Route 87** Corridor from New York City to the Quebec border
- The **Interstate Route 95 Corridor** in Connecticut beginning at the New York state line through Connecticut to the Rhode Island state line.
- The **Interstate Route 91 Corridor** from New Haven, CT, through Hartford to the Massachusetts state line.
- The **East-West Corridor** commencing in Watertown, New York, continuing northeast through New York, Vermont, New Hampshire, and Maine, terminating in Calais, Maine.
- The **Providence Beltline Corridor** beginning at Interstate Route 95 in the vicinity of Hope Valley, RI, traversing eastwardly intersecting and merging into Interstate Route 295, continuing northeastwardly along Interstate Route 95, and terminating at the Massachusetts border. This identified corridor also includes the western bypass of Providence, RI, from Interstate Route 295 to the Massachusetts border.



Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), massDOT/Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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Figure III-2 Vital Transportation Links

B.2.2 NHS Connectors

Major intermodal terminals in the region serving freight and passengers have long been identified. Through ongoing freight planning efforts, these facilities, as well as the roadways that provide primary access, continue to be observed and monitored. Recently, the roadways that provide "to the gate" access to the region's identified major intermodal terminals and the greater NHS network were reviewed and assessed, as requested by FHWA. The region's "NHS Connectors" are shown above in Figure III-2. The major intermodal terminals that serve freight and passengers in the region along with brief descriptions of their respective NHS Connectors are summarized below.

Town of Westborough

CSX Transportation Intermodal Yard, rail to truck transfer, Walkup Street: *Yard to Walkup St. to Flanders Rd. to Connector Rd. to Lyon St. to Computer Dr. to Route 9 Westbound & Yard to Walkup St. to Flanders Rd. to Connector Dr. to Research Dr. to Route 9 Eastbound*

City of Worcester

CSX Transportation, TOFC & bulk commodities terminal, rail to truck transfer, Franklin Street: *Yard to Franklin St. to Grafton St. to I-290 interchange*

P&W Railroad Yard/Intransit Container, rail to truck transfer, Southbridge Street: *Yard to Southbridge St. to Cambridge St. & Yard to Southbridge St. to Quinsigamond Ave. to I-290/State Route 146 interchange*

P&W Railroad Yard/Intransit Container, rail to truck transfer, Wiser Avenue: *Yard to Blackstone River Road (formerly Millbury Street) northbound to State Route 146 interchange*

Worcester Regional Airport, passenger & air freight facility, Airport Drive: *Highland Street from the intersection of Park Avenue (Routes 9, 12 and 122A) to Pleasant Street to Airport Drive, terminating at Goddard Memorial Drive*

B.2.3 Other Potential NHS Connectors

As growth and change continue in the Central Massachusetts region, it may be necessary to designate other roadways as NHS Connectors. As such, a number of sites where intermodal operations might eventually meet the established NHS Connector criteria have been identified and are summarized below.

East Brookfield Flats: During the early 1990's, CSX Transportation predecessor Conrail purchased a rather large land parcel in an area of town known as the East Brookfield Flats. Adjacent to both the railroad's Boston Line and State Route 9, it appeared that Conrail had plans for the property. It should be noted, however, that Conrail knowingly purchased the property despite the town of East Brookfield's by-law prohibiting both Container on Flatcar (COFC) and

Trailer on Flatcar (TOFC) terminal operations. In the future, the "Flats" could again face development pressures or, conversely, eventually become dedicated open space.

MassCentral Railroad's Ware River Line: Site development opportunities adjacent to the MassCentral Railroad's Ware River Line may have the potential to attract rail served business and industry. The asset of the rail line that lies in both the CMRPC and PVPC planning regions is owned nearly entirety by MassDOT and is leased to operator MassCentral. The MassCentral's interchange with both CSX and the New England Central Railroad may also result in the future growth of rail to truck intermodal operations in the Ware River Valley.

New England Automotive Gateway: At this major intermodal facility, new vehicles are transloaded from railcars to car carrier trucks for final distribution to retail dealerships. A spur from CSX Transportation's Boston Line provides rail access to the site while a site drive situated on Route 49 south of Route 9 provides highway access. Most loaded car carrier trucks using the facility travel south on Route 49 to the U.S. Route 20, I-84, MassPike (I-90) interchange in Sturbridge.

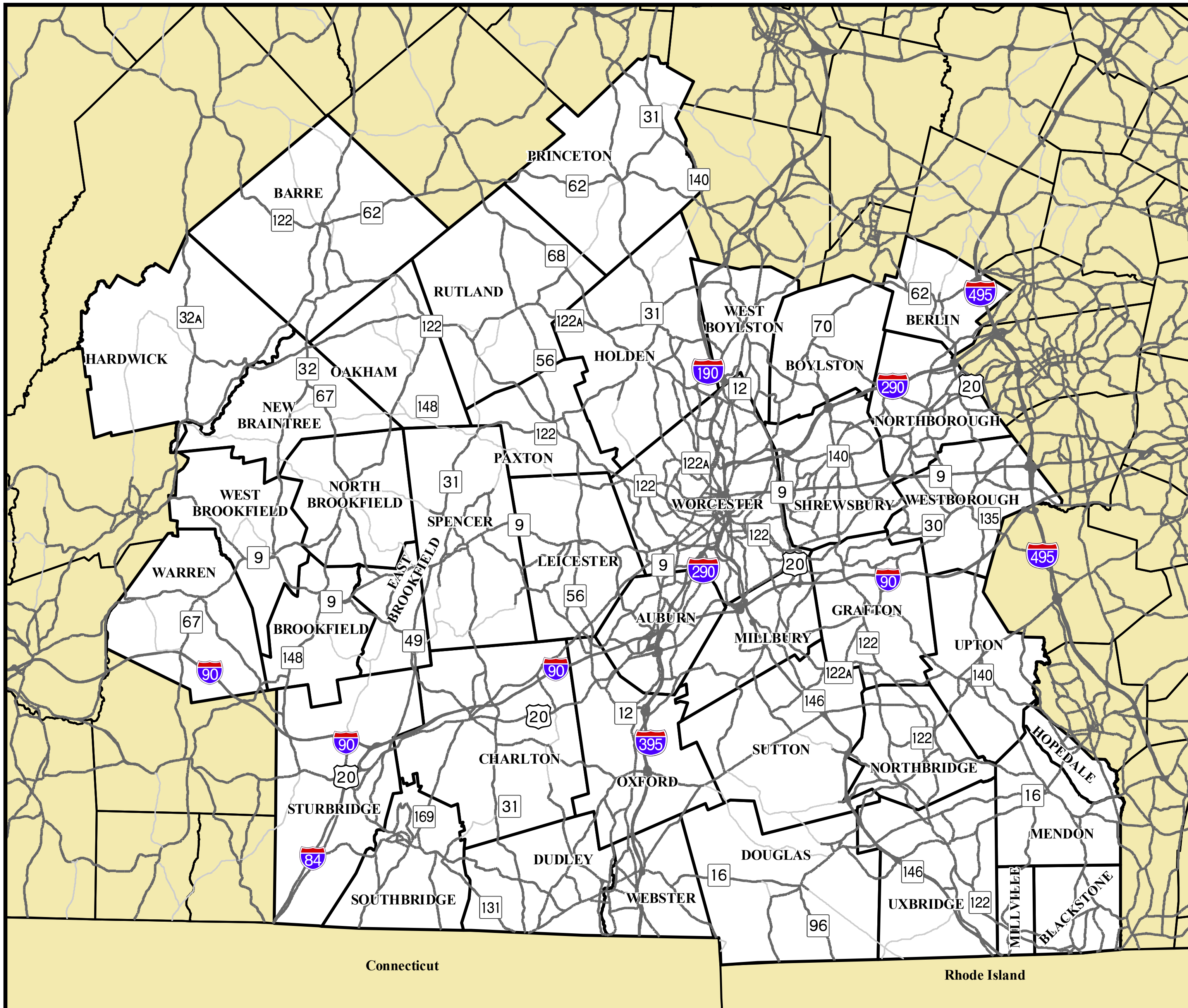
Southbridge Municipal Airport: Beginning in the late 1990's, Southbridge Municipal Airport upgraded access roadways, vehicle parking and various aircraft facilities including tie downs, additional hangar space and aircraft fuel storage/distribution systems. The airport facility has the capacity for increased utilization, perhaps to include cargo operations. Recently opened, a new access road named Commercial Drive runs from Route 169 to just north of the airport grounds at the Casella construction debris recycling center. Notably, at this time, an update of the Airport's master plan is currently underway.

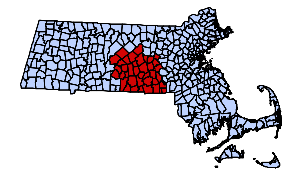
C. THE HIGHWAY IMPROVEMENT PROCESS

C.1 Federal-Aid Eligibility

Federal-aid eligibility is primarily determined by functional classification. Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they provide. The highway network plays a dual service role by providing access to property and facilitating travel mobility. Streets and highways are subdivided into three general classifications: local, collector and arterial. The primary function of local facilities is access to properties, especially housing. In contrast, arterials provide high mobility to serve through movements. Collectors serve as connections between local and arterial facilities. When optimally designed, they provide a balance between property access and through mobility. Roadway sections classified as a major collector or higher in rural areas, minor collector or higher in urban areas, are eligible to receive federal funding for transportation improvements. Figure III-3 shows the federal-aid eligible roadways.

Many federal-aid eligible roadways are designated as part of the National Highway System (NHS). Funding associated with the NHS allows construction of projects on non-NHS highways, as well as the construction of any transit project that is eligible under the Federal Transit Act. However, this eligibility requires the project in question to be located within the corridor of a





Legend

Major Road Network

- Federal-Aid Eligible
- Non Federal-Aid Elligible
- Town Boundary

0 1 2 4 6 Miles

Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), massDOT/Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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CMRPC Central Massachusetts Regional Planning Commission

Figure III-3 Federal-Aid Eligible Roadways

fully access-controlled NHS facility, to improve the level of service of the NHS facility, and to be more cost-effective than an improvement to the NHS facility.

Improvements to non-NHS roadways that are federal-aid eligible are funded through the Surface Transportation Program (STP). SAFETEA-LU allows much flexibility with regard to STP funding as these funds may be used for projects on any federal-aid highway, including the NHS, bridge projects on any public road, and transit capital projects, such as public bus terminals and facilities. SAFETEA-LU expands STP eligibilities to include advanced truck stop electrification systems, high crash/high congestion intersections, and environmental restoration and pollution abatement, such as control of noxious weeds and aquatic noxious weeds and reestablishment of native species. Each state must set aside a portion of their STP funds (10 percent or the amount set aside in 2005, whichever is greater) for transportation enhancements activities. The set-aside of 10 percent previously required for safety construction activities (i.e., hazard elimination and highway-rail crossing improvements) was eliminated in 2006, as these activities are funded separately under the new Highway Safety Improvement Program.

C.2 Funding Projects through the Transportation Improvement Program (TIP)

The region's Transportation Improvement Program, referred to as the "TIP," is a federally required planning document that lists all highway, bridge, transit and intermodal projects in the Central Massachusetts planning region that are programmed to receive federal-aid funding. In the most current TIP, projects are listed for federal fiscal years 2012 through 2015. Projects of regional & statewide significance, such as Interstate Maintenance (IM), as well as projects that improve air quality under the Congestion Mitigation Air Quality (CMAQ) program are examples of the types of projects included. Occasionally, non federal-aid (NFA), or state-funded, projects are also listed for information purposes. Cognizant of limited statewide transportation funding resources, the annual program of projects must demonstrate financial constraint within the federal-aid funding targets established for each of the MPO regions by MassDOT-Planning in cooperation with the Massachusetts Association of Regional Planning Agencies (MARPA).

A historic perspective of the Central Massachusetts region's TIP is shown on Figure III-4. The graphic provides an overview of active TIP projects since 1997 through the 2010 federal fiscal year. As indicated on the legend, three different types of projects are included on the Regional TIP graphic: Advertised, Programmed and Supplemental. Each term is defined as follows:

> ***Advertised* –** Projects that have been "advertised" by MassDOT, inviting competitive bids from the construction (and similar) industries. Through established guidelines, MassDOT will select a contractor to implement a project. Essentially all of these projects have been implemented or will soon be completed.
>
> ***Programmed* –** Projects selected by the MPO to receive a portion of the federal-aid "target" funding allocated to the region by MassDOT.

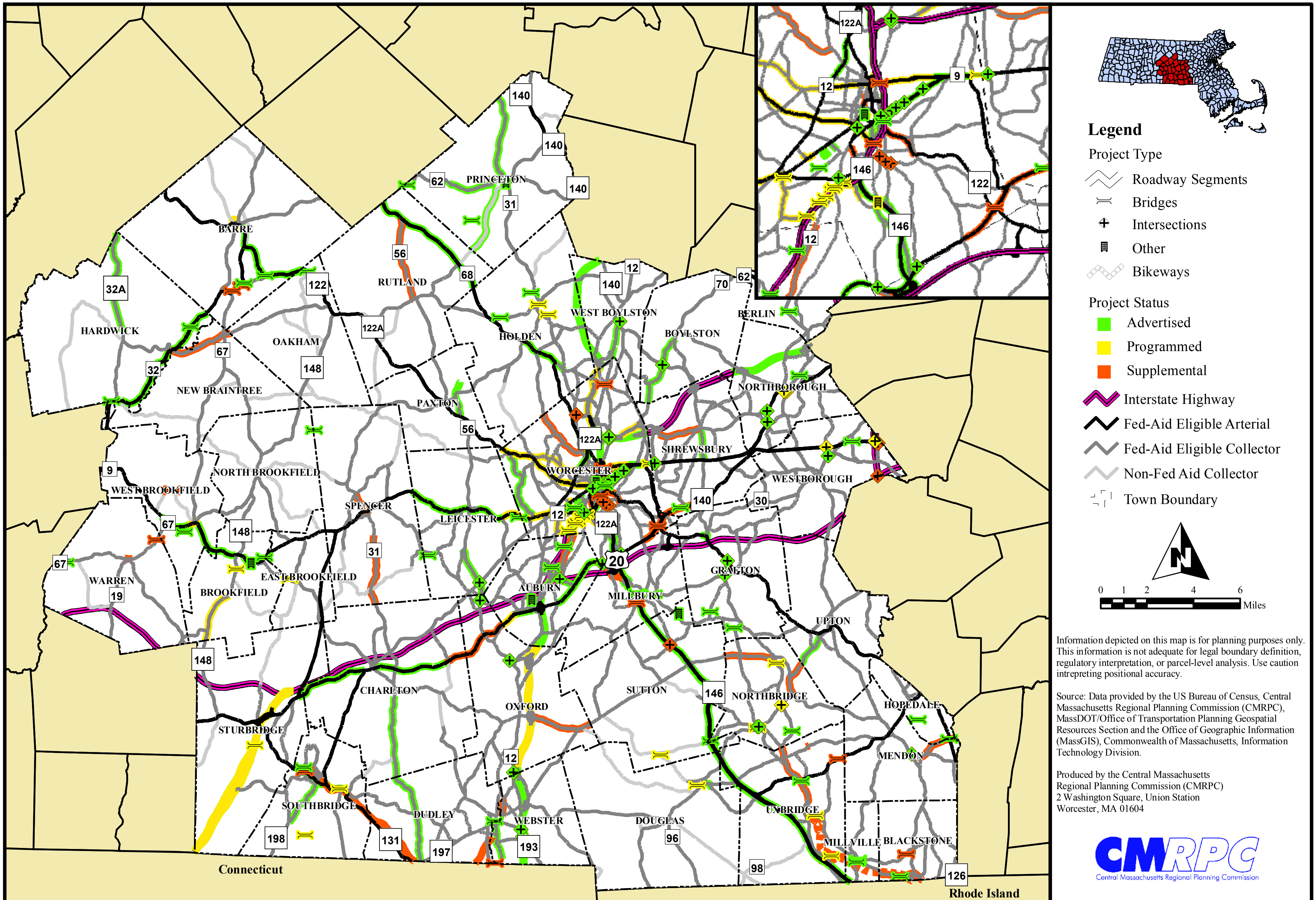


Figure III-4 Central Massachusetts Regional Transportation Improvement Plan Historic Overview

Supplemental **–** Potential improvement projects recognized by the MPO and included for information only. The supplemental project listing is essentially a waiting list of projects eligible for inclusion on the TIP.

The CMRPC transportation staff, working with the membership of the CMMPO, revises the TIP project listing on an annual basis. The annual process has traditionally commenced by a request to the communities to provide updates on any existing projects that have received previous approval as well as any new projects that the host community would like to bring forth for consideration. Often, the host community is responsible for the costs of engineering design and any environmental requirements as well as obtaining any necessary right-of-way to accommodate the project. In order to be considered, project requests must come from the community's highest elected official.

If a given improvement project is seen to have merit, MassDOT requires the host community to complete a Project Need Form (PNF). The PNF is designed to demonstrate a *need* as opposed to describing a proposed improvement project. In most cases, PNFs can be completed by community personnel; consulting services are typically not necessary at this early stage of project development. Each submitted PNF is considered by the MassDOT Project Review Committee (PRC) which meets occasionally. If accepted by the PRC, MassDOT then requires a Project Information Form (PIF) from the host community. Once a project is accepted, the host community is formally notified concerning their ability to seek necessary engineering services through a competitive review and bid process.

Through the CMMPO's formal Public Outreach Program, with full consideration of the principles of Environmental Justice, staff seeks early involvement of local legislators, chief local officials and the general public in the essentially ongoing TIP development process. On a number of occasions over the past few years, outreach efforts have also included periodic *TIP Development Meetings* tailored to a given community or group of communities. At these meetings, an overview of the CMMPO and TIP development process is provided, including a review of host community responsibilities. Specific community projects, proposed for inclusion on the TIP listing, are discussed and, if necessary, prioritized. Community support for a given project or projects is also assessed. Figure III-5 provides a summary of the *TIP Development Meetings* hosted by staff since 2008.

After project proposals are formally submitted by the community's highest elected official, they are screened by the CMMPO and further evaluated by the CMMPO's Advisory Committee, which acts as the technical transportation advisory group to the CMMPO. The prioritization process involves an exchange of project information and evaluation of project importance. An established set of Transportation Evaluation Criteria (TEC) is considered for each eligible project. The CMRPC transportation staff, working with the MassDOT Highway Division District #2 & #3 offices and MassDOT-Planning, accumulates engineering design, right-of-way and environmental status information for each TIP project. If necessary, appropriate community personnel and/or engineering consultants are also contacted to obtain design status updates.

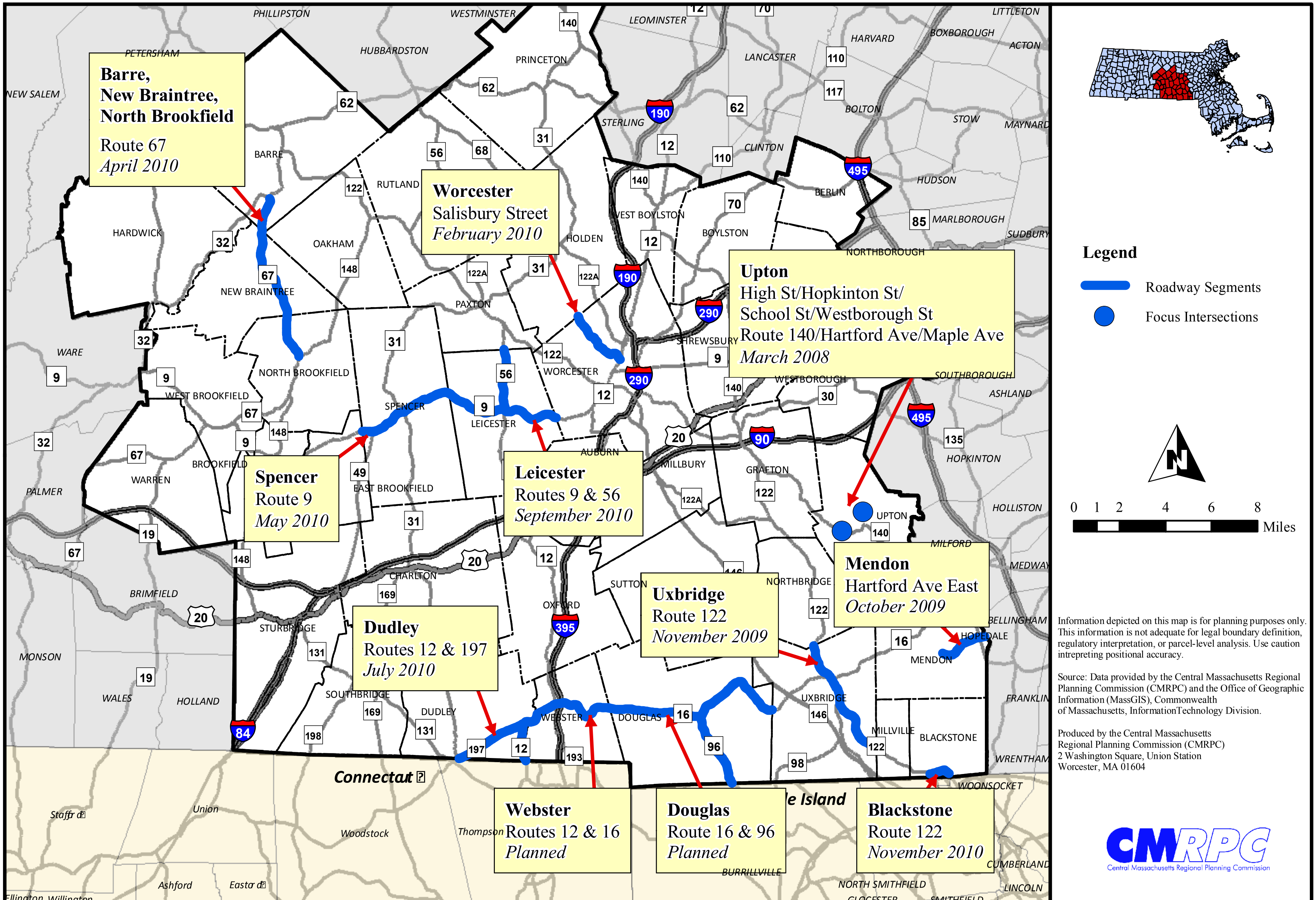


Figure III-5 Recent TIP Development Meetings

Throughout the development of the TIP, the CMMPO oversees an extensive outreach effort that provides ample opportunity for public involvement. Commencing in the spring, the TIP development process typically culminates in August when the CMMPO convenes to consider endorsement of the finalized project listing. At that time, the CMMPO Endorsed TIP is forwarded to MassDOT-Planning where it is combined with the TIPs produced by all of the MPOs throughout the state. The resulting document, referred to as the State Transportation Improvement Program (STIP), is forwarded to the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA) and the Environmental Protection Agency (EPA) for approval. Only after obtaining these approvals are federal-aid transportation funds released to construct the projects included in the CMMPO Endorsed TIP.

C.3 Maintenance Responsibility

Figure III-6 shows that a significant portion of the federal-aid eligible roadway network is maintained by the region's communities. The interstate highways and a number of major state-numbered routes are maintained by MassDOT or the Massachusetts Turnpike Authority. Maintenance responsibilities include ensuring usable and safe pavement condition, clearing snow and ice, cleaning drainage structures, and repairing sidewalks and shoulders.

While the need for an improvement project may be identified by a number of entities, including the CMMPO, the entity responsible for maintaining the facility is also responsible for designing federally-funded improvement projects along that facility. Along with design, this responsibility also includes acquiring the necessary right-of-way and obtaining all required permits. The ability to address these preliminary tasks varies considerably between communities, with many smaller communities at a disadvantage, resulting in some projects languishing within the TIP process for a number of years.

For bridges, MassDOT is responsible for the reconstruction or replacement of bridges over 20 feet in length. The statewide bridge management program includes inspections on all publicly-owned bridges. For those less than 20 feet in length, reports are provided to the owner of the bridge, often a city or town. More detailed information about the region's bridges is provided later in this chapter in section ***D.4.1 Statewide Bridge Management System (BMS)***.

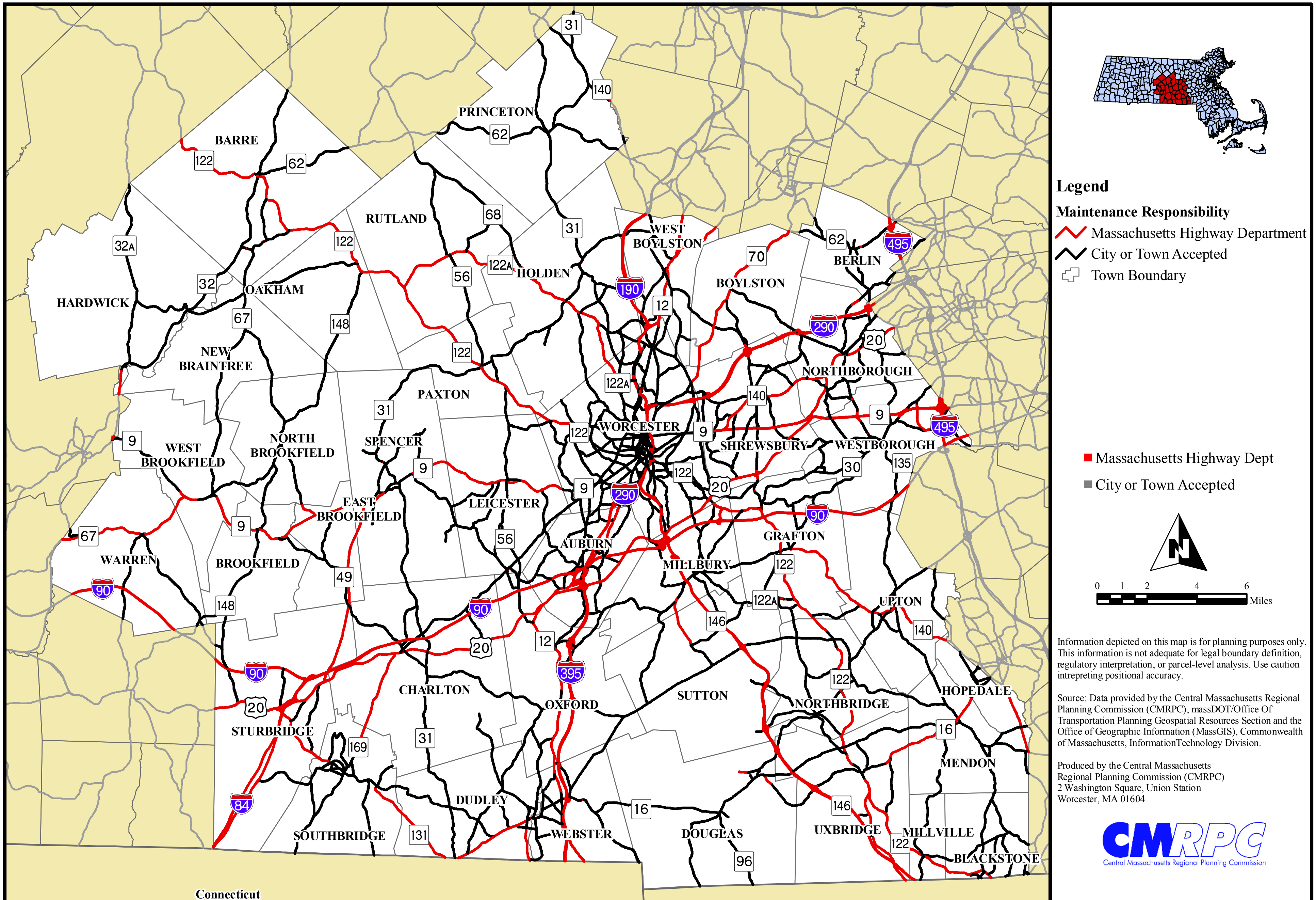


Figure III-6 Maintenance Responsibility of Federal-Aid Eligible Roadway

C.4 Massachusetts Project Development & Design Guide

As part of the implementation of "Communities First," MassDOT developed the Project Development and Design Guide. This document replaces the former Design Guide (Blue Book), incorporates context sensitive solutions, and addresses all travel modes throughout the design process.

The following are the Guiding Principles for the Project Development and Design Guide[1]:

- **Multimodal Consideration —** to ensure that the safety and mobility of all users of the transportation system (pedestrians, bicyclists and drivers) are considered equally through all phases of a project so that even the most vulnerable (e.g., children and the elderly) can feel and be safe within the public right of way. This includes a commitment to full compliance with sate and federal accessibility standards for people with disabilities.
- **Context Sensitive Design —** to incorporate, throughout project planning, design, and construction, the overarching principles of Context Sensitive Design (a collaborative, interdisciplinary approach that involves all constituents to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility for all users).
- **A Clear Project Development Process —** to establish a clear and transparent project development and design process that can be administered consistently throughout the state. The ideal is a process that results in project consensus among constituents which can be expeditiously accomplished within reasonable project cost.

The Project Development and Design Guide went into effect on January 1, 2006 and can be accessed online at *http://www.vhb.com/mhdGuide/mhd_GuideBook.asp*.

[1] MassDOT, *Project Development and Design Guide,* January 2006: I-2.

D. HIGHWAY CONDITION ASSESSMENT

D.1 Transportation Management Systems

Transportation management systems are the focus of a number of ongoing planning efforts within the region. Management systems identify issues through a systematic process of data collection and analysis, develop recommendations to address the issues, and monitor the effectiveness of improvement projects after they are implemented. With the passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the CMMPO began to supplement its traffic monitoring program with a regional Congestion Management System (CMS), Pavement Management System (PMS), and Intermodal Management System (IMS), which later became known as "Freight Planning." In 2008, the Data Integration Program was started to utilize and analyze all Transportation management systems data in a cohesive manner.

The goal of the Data Integration Program is: *to provide timely and comprehensive transportation data in an easily-accessible format to:*

1. *CMRPC Transportation staff for use in its work program in support of the CMMPO transportation planning process;*
2. *All CMRPC staff for use in their work activities in support of the agency's member communities; and*
3. *CMRPC/CMMPO member communities to enhance their local planning efforts.*

This process uses Geographic Information Systems (GIS) technology to maintain, map, and analyze information from the transportation management systems.

GIS will provide the platform for the spatial organization and analysis of the transportation performance measures determined by the CMMPO Congestion Management, Pavement Management, Transportation Safety Planning, and Traffic Monitoring programs. Access to this information through a geographic interface will be used to support the development of CMMPO TIP project listings and Regional Transportation Plans (RTPs) as well as serve as a resource for other planning activities.

The Transportation management system also uses a multimodal approach to map and analyze transit data, bike/ped data, freight information for use in ongoing transportation planning activities and for use in the development and implementation of the Regional Transportation Plan.

Beginning in FY 2007, GIS technology began to be utilized to maintain, map, and analyze information from the transportation management systems. Specific products included:

- A database and associated GIS data layer and maps storing intersection locations and types studied as part of the Transportation Safety Planning Program, the calculated vehicle crash rates, and the relationship to regional average crash rates for similar intersections.
- A database and associated GIS data layer and maps storing encountered delay (in car-minutes per hour) at intersections studied as part of the region's Congestion Management Program (CMP) and their relationship to a regional average delay.

- A database and associated GIS data layer and maps storing travel time growth rates as calculated on roadway segments monitored as part of the region's CMP.

In 2009, WRTA bus-stop and ridership data was mapped and analyzed to help in transit planning activities. Traffic count data has been mapped data as points and segments for use by the planning staff and all communities. Regional pavement condition data has been mapped in a usable format and has been used as part of different studies.

Starting in 2009 and updated in 2010, crash data (2004-2008) obtained from MassDOT was mapped and analyzed to develop crash reports to aid in the HSIP project selection and justification.

In 2010 traffic count database was integrated with the MassDOT Roadway Inventory Files to produce a regional traffic volume map. This map assists in analyzing various datasets such as pavement condition, congestion, crash locations etc.

Mapping and analysis of the various datasets was performed for presentation and to generate discussion during the RTP public outreach meetings and during project identification process.

D.2 Highway Safety

The Central Massachusetts Metropolitan Planning Organization (CMMPO) recognizes the importance of transportation safety planning for all agencies and users of the regional transportation system. The organization's transportation safety plan employs a multi-modal strategy, encompassing roadway, transit, bicycle, pedestrian and rail travel throughout the central Massachusetts region.

D.2 .1 SAFETEA-LU Emphasis on Safety

SAFETEA-LU authorizes a new core federal-aid funding program beginning in FY 2006 to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. It creates a positive agenda for increased safety on our highways by almost doubling the funds for infrastructure safety and requiring strategic highway safety planning, focusing on results. Previous to this legislation, safety programs were typically funded from a set-aside from the Surface Transportation Program.

D.2.2 Massachusetts Statewide Safety Planning Activities

In October 2006, Massachusetts completed its Strategic Highway Safety Plan, one year ahead of the deadline established by SAFETEA-LU. The Plan includes a Memorandum of Understanding between the following state and federal agencies:

- MassDOT
- Executive Office of Transportation, Office of Transportation Planning
- Registry of Motor vehicle
- Governor's Highway Safety Bureau
- Massachusetts State Police
- Department of Public Health
- Massachusetts Chiefs of Police Association

- Joint Committee on Transportation
- Massachusetts Association of Regional Planning Agencies
- Federal Highway Administration
- Federal Motor Carrier Safety Administration
- National Highway Traffic Safety Administration

D.2.3 Highway Safety Improvement Program

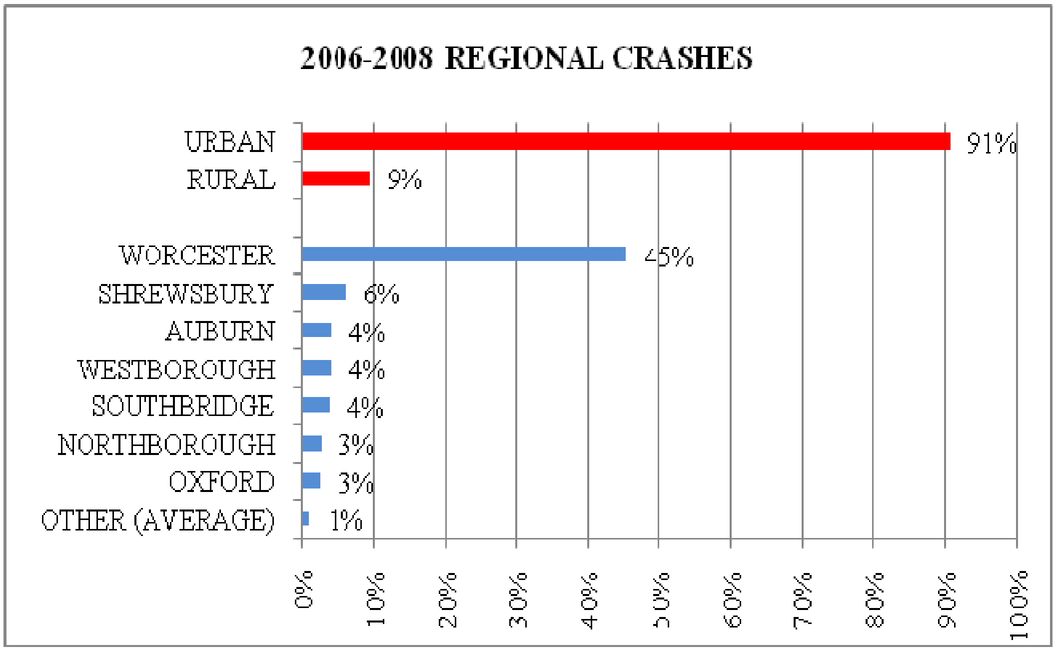
Starting in October 1, 2007, States were required to have a State Highway Safety Program (SHSP) that identified and analyzed safety problems and opportunities in order to use Highway Safety Improvement Program (HSIP) funds for new eligible activities under 23 USC 148. The HSIP is a "core funding" program administered by Federal Highway Administration, which apportions funds to States under Section 104(b) (5) for a range of eligible activities focused primarily on infrastructure-related safety improvements. The purpose of the HSIP is to achieve a significant reduction in traffic fatalities and serious injuries on public roads.

D.2.3.1 HSIP Selection Criteria

a) Projects using Federal HSIP funding are required to be selected by a data driven process. To satisfy this requirement MassDOT obtains crash data from local police reports collected by the RMV Crash Records Section. Then with the assistance of Geonetics, they developed an automated procedure for processing, standardizing, matching and aggregating the crash data by geographical location using Geographic Information System (GIS) tools and procedures resulting in crash clusters, bike clusters and pedestrian clusters. The data used in this report is based on automobiles crashes from 2006 -2008 and pedestrian/bicycle crashes from 2002-2008.
b) The top 5 % of automobile crash clusters are listed in Table V-1. They are derived from all crash clusters identified by MassDOT on local roads (excluding interstate highways).
c) The top 5% of pedestrian and bicycle crash clusters are listed in Table V-2. They are derived from all pedestrian / bicycle crash clusters identified by MassDOT.
d) The top crash corridors are listed in Table V-3. They were identified on road segments where the top 5% of combined automobile pedestrian and bicycle crash clusters occurred.
e) The location of top crash clusters are shown in Figure III-7.

D.2.3.2 The CMRPC Region

The Central Massachusetts Regional Planning Commission consists of 39 towns surrounding the City of Worcester. Major transportation routes include east/west bound traffic served by interstates 90 and 290, while interstates 290,190, 84, 395 and 495 serve north/south bound traffic. From 2006-2008 there were over 30,000 crashes in the region. 45% of all crashes were in the City of Worcester and 91% of all crashes were in the urbanized area.



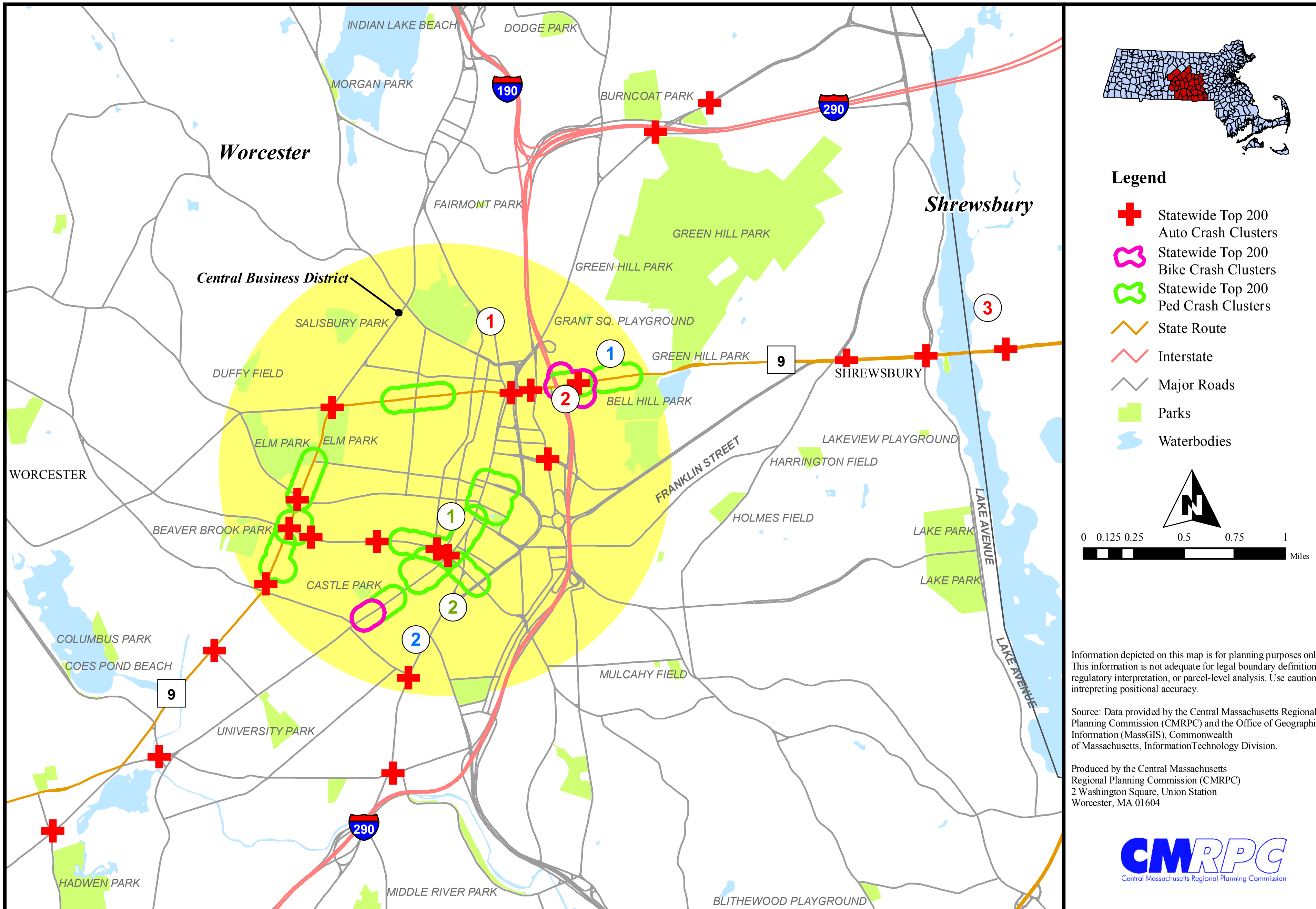
HSIP FUNDED PROJECTS IN THE REGION:

a) City of Worcester - The FY2011 Transportation Improvement Program (TIP) included \$5.1M in HSIP funds for the Belmont Street East resurfacing project[2].

b) City of Worcester – The FY2012 State Transportation Improvement Program (STIP) approved \$1.0 M HSIP funds for intersection & signal design improvements at Lincoln Street, Highland Street, Pleasant Street corridor[3].

[2] CMMPO Minutes of December 2, 2009 Meeting

[3] http://www.eot.state.ma.us/downloads/stip/2009/2012_highway_0210.pdf



Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC) and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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Figure III-7 CMRPC Highest Ranked Crash Clusters

D.2.4 Public Transit Safety

The CMMPO and the Worcester Regional Transit Authority (WRTA) recognize that a safe and efficient public transportation system is an integral component of the urban fabric. In addition to operational efficiency of the bus routes, passenger safety, comfort, and convenience are all considerations in the planning activities that support the fixed-route bus service. The WRTA has established an extensive safety program that is intended to provide a safe environment for its employees and customers and to protect its assets from the threat of loss, damage or abuse.

1. **Policy & Procedures**: Through its fixed route operations the transit authority has instituted a variety of policies and procedures to improve overall safety in the system. To ensure the comprehensiveness of the program, all policies and procedures are covered in the training of newly hired employees and through periodic retraining of all employees. They include:
    - Personnel Selection
    - Accidents and Incidents Procedures
    - Driver Training
    - Maintenance Plan
    - Drug & Alcohol Testing Program
    - Safety Data Acquisition/Analysis
    - Safety Committee

2. **Location of Bus Stops:** A collaborative effort was undertaken between the CMMPO and the WRTA to identify existing bus stops using Geographic Positioning Systems (GPS) technology. The information was then downloaded to a GIS platform to spatially locate the bus stops for improved management. Bus stop data collected in 2007 and 2008 was mapped using GIS software. The database containing WRTA ridership sample data by bus route was also mapped. Using the crash data from MassDOT, the bus-stop locations with highest Bike/Ped crash clusters were identified. This integrated effort identified the need to evaluate safety, security, and accessibility at City of Worcester bus stops as follows.

    a) **Signage at Bus Stops**: The safest location of bus stops for pick-up or discharge of passengers is decided in a collaborative effort between the Worcester City Council, Worcester Department of Public Works (DPW), and the WRTA. Due to periodic changes to the fixed route service, bus stop signage also requires frequently updates. An active list of these locations must be maintained by both the Worcester DPW which is responsible for the signs, and the WRTA which monitors bus service. It is becoming increasingly apparent that maintaining an updated list of all bus stops poses a challenge for both agencies.

    b) **Safety at Bus Stops**: In order to assist the WRTA meet its mission to provide convenient, comfortable, safe, reliable, cost-effective mobility services for the region it is necessary to evaluate the efficacy of designated bus stops. To advance this effort, the FHWA has advocated the use of Road Safety Audits (RSA). Such an audit will be performed by an independent interdisciplinary team of 3-5 persons consisting of community members and professionals to examine the design of designated high frequency bus stops in order to reduce both verified and potential hazards at these locations using the following methodology:

- Generate a checklist of criteria for evaluating safety and accessibility at bus stops
- Classify the designated bus stops consistent with the checklist
- Develop a bus stop rating system to evaluate safety and accessibility
- Utilize bus stop ratings to evaluate and improve safety on public transit routes

D.2.5 Rail Safety

Massachusetts had one of the best rail safety records in the nation from 2008- 2010. Worcester County suffered 40 injuries and 5 fatalities in the same period[4]. As, the U.S. Department of Transportation is advocating substantial increases in passenger, light-rail, and freight over the next three decades, the region is looking to participate in improving rail safety. All levels of government and private stakeholder, are expected to work together to meet these safety challenges. *Operation Lifesaver*, a rail safety education partner is helping to raise awareness to improve public safety at highway-rail grade crossings and tracks through public awareness using education, enforcement and engineering, making communities with tracks and railroad property safer, reducing collision incidents and decreasing the likelihood of injuries and fatalities. The region concurs with *Operation Lifesaver* and advocates the use of safe engineering practices for at-grade railroad crossings where two or more modes of transportation intersect to include the following devices to improve rail safety in the central Massachusetts.

- *Traffic control devices* at highway-rail grade crossings such as signs, signals, pavement markings, or other warning devices designed to help manage traffic flow and reduce risk.
- *Apply established standards* for signage at highway-rail grade crossings.
- *Designate Quiet Zones* with flashing light signals with gates, constant warning time train detection circuitry and power-off indicators visible to the train crew.
- *Gates with channelization* or medians, four-quadrant gates, one-way streets, and crossing closures.
- *Wayside horn* mounted at the crossing and activated simultaneously with flashing lights
- *Emergency Notification Sign (ENS)* posted at highway-rail grade crossing, with telephone number to notify the railroad of device malfunction.
- *Warning signs* informing pedestrians and bicyclists that they are trespassing on private property and could be fined, seriously injured or killed.

D.2.6 Pedestrian and Bicyclists Safety

Within the CMMPO region, there are a total of 107 individual pedestrian crash locations with six (6) of those locations within the Top 5% of all pedestrian crash locations in the region. For bicycles, there were 36 individual bicycle crash locations with two (2) of those locations within the Top 5% of all bicycle crash locations in the region. The Bicycle and Pedestrian plan recommends prioritizing locations with high bike and pedestrian crashes for future improvements.

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[4] *Federal Railroad Administration, Office of Safety Analysis, Annual Casualties By State, Railroad or Type*

D.3 Security Planning

SAFETEA-LU calls for an increase in planning for the security of the transportation system and requires it to be a stand-alone planning factor. The CMMPO has come to regard security for all agencies and users of our transportation system – motorists, cyclists, pedestrians and transit users – as an important component of the Regional Transportation Plan.

Transportation security refers to both personal and homeland security, including attention to the vulnerability to intentional attack and natural disasters, and the associated evacuation procedures. Security is generally defined as freedom from intentional harm or tampering. A targeted terrorist attack is not the only threat to Central Massachusetts infrastructure, as natural disasters, accidents and safety issues may also present security risks. Traditional crimes, fires, system property damage, trespassing, failure of vehicles or equipment, infrastructure deterioration, and vehicular gridlock are constant security risks. Responding to emergencies is often complicated by vehicular congestion, inadequate first responder access, and other factors not directly related to the specific incident.

An overall goal is to increase the security of the transportation system for both motorized and non-motorized users.

The Central Region Homeland Security Advisory Council (CRHSAC) has taken a lead effort in planning for the region's security needs. The CMHSC is taking a regional approach and is exploring ways to better integrate prevention, response, mitigation, and recovery efforts directed toward security incidents, regardless of whether they are natural or manmade. The Council's Transportation voting member is the Administrator of the Worcester Regional Transit Authority, and MassHighway is represented by a non-voting member. The Council has funded one transportation-related project to date; installation of security cameras at the North Leominster Commuter Rail Station.

CMRPC assists the CRHSAC in its security planning and funding efforts. As part of that collaborative effort, CMRPC will prepare an Evacuation Plan beginning Summer 2011.

As part of its current work program, the CMMPO explored its potential role in the field of security planning. The organization recognized the importance of transportation security planning to all agencies and users of the regional transportation system. Over a dozen agencies perform functions crucial to our transportation system. Some are implementing security measures, while others may not be. To ensure that security needs are met promptly and equitably, the CMMPO effort coordinates and cooperates with transportation agencies and stakeholders.

- Transportation stakeholders include the Worcester Regional Transit Authority; MassDOT Office of Transportation Planning and Highway Division; Massachusetts Bay Transportation Authority; Peter Pan, Greyhound and Bonanza bus lines; Amtrak; freight railroad operators; and city and community public works departments.

- Regulatory and advisory stakeholders include the Central Region Homeland Security Advisory Council, U.S. Department of Homeland Security, Federal Highway Administration, Federal Transit Administration, Federal Aviation Administration, Massachusetts Bicycle Coalition, city and town planners, and city and town officials.

- First responders include state and local police and fire departments and emergency medical technicians.

It was identified that security efforts may focus on the following three components and related planning:

Coordination with transportation agencies and stakeholders

- Meet regularly to develop working relationships for information and resource sharing
- Identify existing emergency command/operations facilities and assess role of transportation in emergency procedures
- Assist transportation stakeholders in planning and mitigation efforts, utilizing information available through our planning processes, including management systems

Identification and prioritization of security components of transportation infrastructure enhancements

- Develop an inventory of critical transportation infrastructure and at-risk locations
- Identify levels of prioritization of transportation security components
- Ensure timeliness and equity of projects and funding through the TIP process

Contingency planning for evacuations and other emergencies

- Utilize modeling software to predict effects of potential emergencies such as bridge closure, rail emergency between stations, bus service suspension, and other incidents
- Survey potential hazards and develop transportation emergency response and evacuation plans
- Ensure security drills and related exercises are coordinated with transportation stakeholders, and assist agencies and towns in identifying and coordinating such efforts
- Develop a process to identify and discuss transportation experiences and lessons learned, for prevention efforts and improved incident management

While most of these efforts overlap, the CMMPO recognized that its role as a coordinator was a natural one. The CMMPO can develop stronger relationships and communications through all transportation agencies and coordinate with agencies and stakeholders by meeting regularly for information and resource sharing.

The CMMPO prioritized its effort to "Identify existing emergency command/operations facilities and assess role of transportation in emergency procedures". As part of that effort, the CMMPO has produced the map of critical transportation infrastructure (dams, bridges, high volume roads, flood zones, and transit routes)(see Security Chapter for maps). From this planning exercise, the CMMPO hopes to better understand where flood prone areas exist, highlight the transportation infrastructure that could be most affected, monitor future flooding events, and provide an analysis of the transportation impacts of each event to feed into future planning efforts.

In addition, in conjunction with the CRHSC, an Evacuation Plan will also be produced in the Summer/Fall of 2011. Travel Demand Modeling software will be used to project travel effects of potential emergencies, including bridge closure, WRTA service/system shut down, roadway spill, or commuter/freight rail incident.

The CMMPO is also involving its congestion management planning process to identify existing bottlenecks that can potentially become security issues, particularly in evacuation and incident management situations. As part of a past effort to survey Emergency Medical Technicians to determine roadway locations where first responders' response time is inhibited, as well as the cause of the delay, the CMMPO seeks to plan transportation projects to facilitate first response travel. In part, the region's security relies on the ease and accessibility of first responders throughout the central Massachusetts region.

Consistent with the goals of the CRHSC, the CMMPO will be able to identify and prioritize security components of transportation infrastructure enhancements. The CMMPO will involve itself to the extent permissible in future post-incident planning to identify and discuss transportation experiences and lessons learned for prevention efforts and improved incident management.

D.4 Infrastructure Condition

D.4.1 Statewide Bridge Management System (BMS)

According to the MassDOT bridge listing, there are 659 bridges in the region. Virtually every bridge in the regional listing is maintained by MassDOT or the local municipality. As the list does not include railroad overpasses, it does not include any of the bridges that are maintained by the five railroads operating within the region. MassDOT regularly collects bridge condition data using consistent federal standards in various structural categories including bridge deck, superstructures (the physical condition of the bridge), substructures (condition of the piers, abutments, piles, girders, footings, or other components), retaining walls, deck geometry, and roadway approach alignment. The resulting inventory is used to calculate a condition rating, which is used to classify the bridges as either structurally deficient or functionally obsolete. Bridges that do not fall into one of those categories are ineligible for the Highway Bridge Replacement and Rehabilitation Program funded by the Federal Highway Administration (FHWA).

A structurally deficient bridge is defined as a bridge whose condition has been rated no better than poor in any of these five areas: bridge deck, superstructures, substructures, culverts, and retaining walls. Utilizing information provided by MassDOT in 2010, the region's 53 structurally deficient bridges are depicted in Figure III-8 and listed in Table III-1. Notably, improvement projects on five (5) of these bridges were advertised for replacement in FY 2010. An additional bridge is listed on the CMMPO 2011-2014 TIP to be advertised during FY 2011.

The most notable structurally deficient bridge listed is the Route 9 bridge over Lake Quinsigamond between Worcester and Shrewsbury. Built in 1916 and reconstructed in 1983, the nearly 100-year-old bridge has a fairly low AASHTO rating (34.0) and is key to efficient and secure transportation in the area. This bridge is currently listed on the Central Massachusetts Metropolitan Planning Organization (CMMPO) 2011-2014 Transportation Improvement Plan (TIP) listing as well as being part of the state Accelerated Bridge repair plan. It is in pre-design phase at time of writing, with the overall bridge style and structure type having been selected and presented to the public and design review and oversight groups. Public information meetings on the progress of this effort were held in March of 2009, 2010 and 2011.

Table III-1
Structurally Deficient Bridges in Central Massachusetts

Town	Roadway Name	Over/Under	Owner	AASHTO Rating
Barre	Route 32 (Main Street)	Ware Canal	Town	41.3
Barre	Route 32 (S Barre Road)	Ware River	MassDOT	2.0
Barre	Rte 32 (New Braintree Road)	Ware Canal	MassDOT	55.9
Barre	Worcester Road	Prince River	MassDOT	75.2
Charlton	Glenmere Road	Little River	Town	47.2
Douglas	Mechanic Street	Mumford River	Town	41.3
Dudley	Peter Street	French River	Town	36.0

Town	Roadway Name	Over/Under	Owner	AASHTO Rating
Dudley	Perryville Road	French River	Town	23.2
Dudley	West Dudley Road	Quinebaug River	Town	2.0
East Brookfield	Shore Road	East Brookfield River	Town	7.0
Grafton	Route 122A (Main Street)	Blackstone River	MassDOT	69.1
Hardwick	Access Gate 43	Quabbin Res S BAF DAM	Other State Agency	30.3
Hardwick	Bridge Street	Ware River	Town	14.6
Holden	River Street	Quinapoxet River	Town	28.4
Holden	Route 31 (Wachusett St)	Quinapoxet River	MassDOT	33.6
Hopedale	Mill Street	Mill Brook	Town	38.8
Leicester	McCarthy Avenue	Kettle Brook	Town	40.9
Leicester	Parker Street	Bartons Brook	Town	2.0
Millbury	Route 146	W Main Street	MassDOT	30.2
Millbury	Greenwood Street	Diversion Channel	Town	59.3
Millbury	I-90 Ramps	I-90	MassDOT	78.0
North Brookfield	Hines Bridge Road	Five Mile River	Town	46.5
Northborough	Allen Street	Assabet River	Town	67.6
Northbridge	Douglas Road	Mumford River	Town	31.0
Northbridge	Rte 122 (Providence Rd)	Blackstone River	MassDOT	59.1
Northbridge	Linwood Avenue	Linwood Pond	Town	45.0
Oxford	Comins Road	French River	Town	70.7
Rutland	Intervale Road	Ware River	Town	58.2
Shrewsbury	Route 9 (Belmont Street)	Lake Quinsigamond	MassDOT	34.0
Southbridge	Alpine Drive	Lebanon Brook	Town	24.5
Southbridge	Route 131 (Sandersdale Rd)	Sandersdale Canal	Town	47.2
Southbridge	Route 169 (N Woodstock Rd)	P&W Railroad (Abandoned)	MassDOT	28.8
Spencer	Brooks Pond Road	Five Mile River	Town	24.3
Sturbridge	Haynes Street	Quinebaug River	MassDOT	49.6
Sutton	Blackstone Street	Blackstone River	Town	48.7
Sutton	Main Street	Mumford River	MassDOT	20.9
Sutton	Depot Street	Blackstone River	Town	60.5
Uxbridge	River Road	Ironstone Brook	Town	24.0
Uxbridge	Route 122 (Main Street)	Blackstone River	MassDOT	40.2
Uxbridge	Route 16 (Mendon Street)	Blackstone River	MassDOT	38.0
Warren	Old Boston Post Road	Naultaug Brook	MassDOT	41.0
West Brookfield	Long Hill Road	CSX Railroad	MassDOT	32.8
West Brookfield	Wickaboag Valley Road	Sucker Brook	Town	48.9

Town	Roadway Name	Over/Under	Owner	AASHTO Rating
Westborough	I-90 EB	CSX Railroad	MassDOT	39.0
Westborough	I-90 WB	CSX Railroad	MassDOT	39.0
Westborough	I-495 SB	Route 9	MassDOT	38.2
Westborough	I-90 EB	Flanders Road	MassDOT	48.0
Worcester	I-290 EB	McKeon Road	MassDOT	56.8
Worcester	I-190 NB	Route 12	MassDOT	65.0
Worcester	I-190 SB	Route 12	MassDOT	47.0
Worcester	Route 12 (Webster Street)	Middle River	MassDOT	64.9
Worcester	Route 122 (Grafton St)	US Route 20 (Southwest Cutoff)	MassDOT	46.7
Worcester	Route 9 (Belmont Street)	I-290	MassDOT	34.0

Source: MassDOT, September 2010

A functionally obsolete bridge is defined as a bridge that is considered in serious condition in any of these three categories: deck geometry, underclearances, or approach roadway alignment. Additionally, if the structural condition or waterway adequacy is in serious condition (but better than that for a structurally deficient bridge), the bridge would be identified as being functionally obsolete. Essentially, a functionally obsolete bridge is one that is not built in accordance with currently accepted design standards. The region's 174 functionally obsolete bridges are also depicted in Figure III-8. A tabular listing of these bridges has been provided in the Technical Appendix.

Posted bridges are bridges that have weight restrictions. There are 71 such bridges within the region, 21 of which are also structurally deficient and 25 of which are functionally obsolete. The region's posted bridges are depicted in Figure III-8 and listed in Table III-2.

Table III-2
Posted Bridges in Central Massachusetts

Town	Over	Under	Owner	AASHTO Rating	Deficiency
Auburn	Oxford Street	Kettle Brook	Town	72.7	FO
Barre	Route 32 (Main Street)	Ware Canal	Town	41.3	SD
Barre	Rte 32 (New Braintree Road)	Ware Canal	MassDOT	55.9	SD
Berlin	Bridge Road	Assabet River	Town	48.8	FO
Berlin	Linden Street	North Brook	Town	65.5	
Berlin	Pleasant Street	North Brook	Town	66.8	
Berlin	South Street	North Brook	Town	61.0	FO
Blackstone	Route 122 (Main Street)	Blackstone River	MassDOT	32.8	FO

Town	Over	Under	Owner	AASHTO Rating	Deficiency
Blackstone	St. Paul Street	Blackstone River	Town	37.9	FO
Brookfield	Fiskdale Road	Quaboag River	Town	42.1	FO
Douglas	Hemlock St	Tinkerville Brook	Town		
Douglas	NW Main Street	Whitin Reservoir	Town		
Douglas	Mechanic Street	Mumford River	Town	58.4	FO
Douglas	Potter Road	Mumford River	Town	63.6	
Dudley	Brandon Road	Mill Race (Dry)	Town	60.0	FO
Dudley	Carpenter Road	P&W Railroad	MassDOT	27.6	FO
Dudley	Tracy Court	French River	Town	58.5	FO
East Brookfield	Shore Road	East Brookfield River	Town	7.0	SD
East Brookfield	South Pond Road	South Pond Inlet	Town	79.3	
East Brookfield	Main Street	E Brookfield River	Town		
East Brookfield	Podunk Street	Great Brook	Town		
Grafton	Millbury Street	Quinsigamond River	Town	55.4	FO
Grafton	Route 140 (Shrewsbury St)	CSX Railroad	MassDOT	55.7	FO
Hardwick	Barre Road	Moose Brook	Town	91.5	
Hardwick	Creamery Road	Ware River	Town	38.1	FO
Hardwick	Taylor Hill Road	Moose Brook	Town	64.4	FO
New Braintree	Barr Road	Meadow Brook	Town	57.4	
New Braintree	Hardwick Road	Winimussett Brook	Town	74.4	
No. Brookfield	Hines Bridge Road	Five Mile River	Town	46.5	SD
Northbridge	Douglas Road	Mumford River	Town	31.0	SD
Northbridge	Linwood Avenue	Linwood Pond	Town	45.0	SD
Oxford	Comins Road	French River	Town	70.7	SD
Oxford	Dudley Road	French River	Town	67.3	FO
Oxford	Harwood Street	French River	Town	50.4	FO
Princeton	Old Colony Road	Ware River	Town	70.6	
Princeton	Main Street	Keyes Brook	Town		
Princeton	Clement Hill Road	S Wachusett Brook	Town		
Princeton	E Princeton Road	E Wachusett Brook	Town		
Rutland	Whitehall Road	Long Meadow Brook	MassDOT	92.4	
Shrewsbury	Boylston Street	I-290	MassDOT	77.6	SD
Southbridge	Main Street	Quinebaug River	MassDOT	50.9	SD
Southbridge	Mill Street	Quinebaug River	Town	70.5	FO
Southbridge	Ashland Avenue	Lebanon Brook	Town		

Town	Over	Under	Owner	AASHTO Rating	Deficiency
Southbridge	Central Street	Quinebaug River	Town	74.9	FO
Southbridge	Rte 169 (N Woodstock Rd)	P&W Railroad (Abandoned)	MassDOT	28.8	SD
Spencer	Brooks Pond Road	Five Mile River	Town	24.3	SD
Spencer	North Spencer Road	Seven Mile River	MassDOT	53.2	
Sturbridge	Champeaux Road	Water Long Pond	Town	59.0	
Sturbridge	Holland Road	Quinebaug River	Town	50.9	FO
Sturbridge	Stallion Hill	Quinebaug River	Town	59.5	
Sutton	Depot Street	Blackstone River	Town	60.5	SD
Sutton	Blackstone Street	Blackstone River	Town	48.7	SD
Upton	Glen Avenue	West River	Town	75.6	
Upton	Pleasant Street	West River	Town	39.4	FO
Uxbridge	Main Street	Blackstone River	MassDOT	40.2	SD
Uxbridge	Hartford Avenue	Mumford River	Town	50.1	FO
Uxbridge	River Road	Ironstone Brook	Town	24.0	SD
Uxbridge	Route 122 (N. Main Street)	Mumford River	MassDOT	53.4	FO
Warren	Old Boston Post Road	Naultaug Brook	MassDOT	41.0	SD
Warren	Main Street	Quaboag River	MassDOT	53.0	
Warren	Gilbert Road	Quaboag River	Town	75.7	
Warren	Old West Brookfield Road	Quaboag River	Town	71.3	
W. Brookfield	Shea Road	Mill Brook	Town		
W. Brookfield	Foster Hill Road	Coys Brook	Town	45.4	
W. Brookfield	Long Hill Road	CSX Railroad	MassDOT	32.8	SD
W. Brookfield	Wickaboag Valley Road	Sucker Brook	Town	48.9	SD
Worcester	Webster Street	Middle River	MassDOT	64.9	SD
Worcester	James Street	CSX	MassDOT	67.4	SD
Worcester	Laurel Street	I-290	MassDOT	51.7	FO
Worcester	May Street	Beaver Brook/Sewer	City	62.9	FO
Worcester	Route 9 (Belmont Street)	I-290	MassDOT	34.0	SD

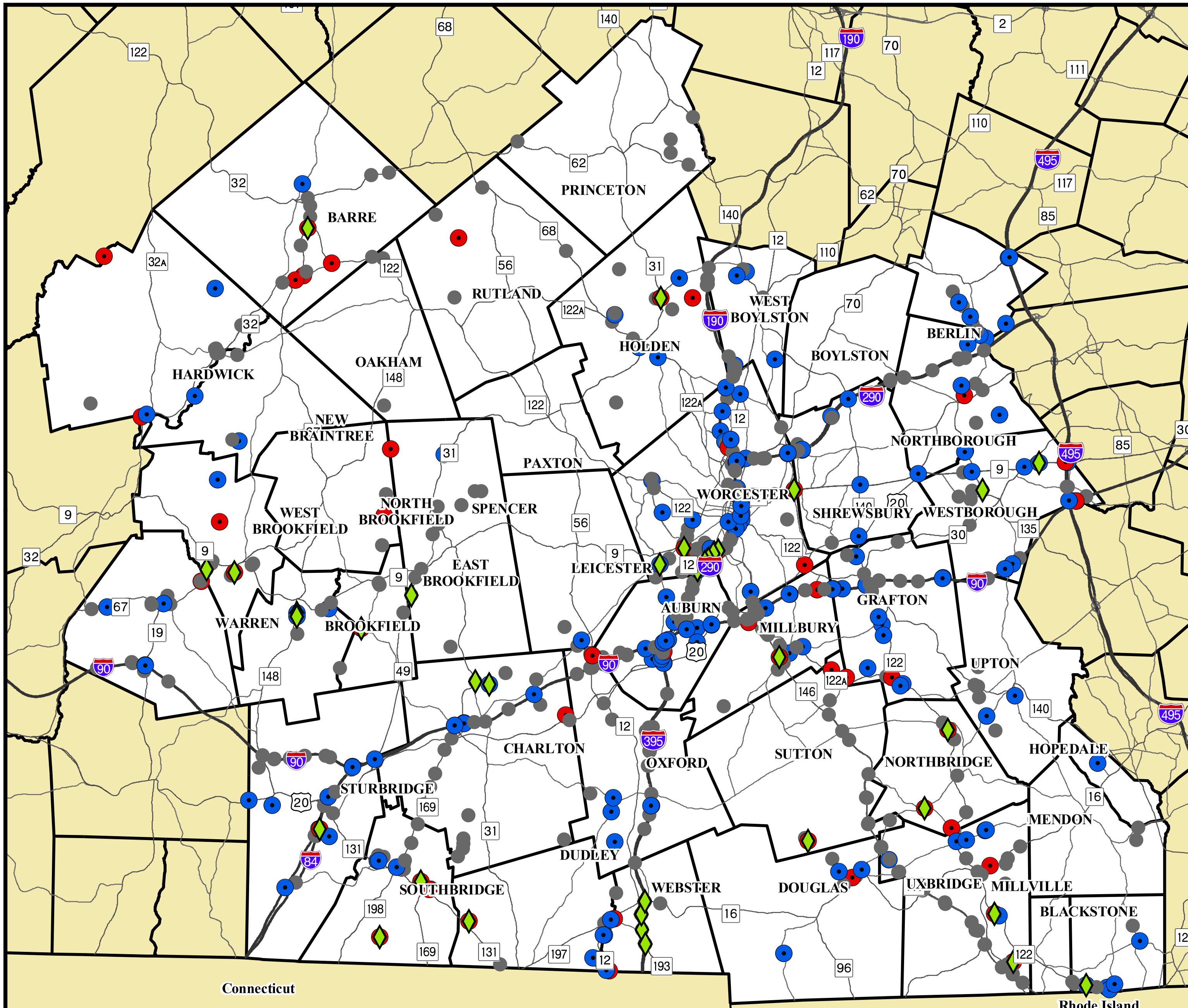
Source: MassDOT, May 2011

The Accelerated Bridge Program (ABP) was developed primarily to address the state's structurally deficient bridge inventory. With investments made to date and the continued support of MassDOT's statewide Road and Bridge Program, the number of former MassHighway and DCR structurally deficient bridges has declined at a steady pace. Regional ABP bridge projects that are completed, under construction or in their design phase are listed in Table III-3 and show as green diamonds in Figure III-8.

Table III-3
Accelerated Bridge Program Bridges in Central Massachusetts

Town	Over	Under	Owner	AASHTO Rating	Status
Westborough	Lyons Street	Route 9	MassDOT	49.8	Complete
Grafton	Pleasant Street	Blackstone River	Town	28.3	Complete
Sturbridge	Haynes Street	Quinebaug River	MassDOT	49.6	Construction
Southbridge	Alpine Drive	Lebanon Brook	Town	24.5	Construction
Sutton	Main Street	Mumford River	MassDOT	20.9	Construction
Brookfield	Fiskdale Road	CSX	MassDOT	72.7	Construction
Charlton	Jones Road	CSX	MassDOT	74.7	Construction
Charlton	New Spencer Road	CSX	MassDOT	86.0	Construction
Spencer	Podunk Boulevard	CSX	MassDOT	91.4	Construction
WBrookfield	Routes 19 & 67	CSX	MassDOT	83.2	Construction
Westborough	Milk Street	CSX	MassDOT	84.9	Construction
Worcester	James Street	CSX	MassDOT	67.4	Construction
W Brookfield	Long Hill Road	CSX	MassDOT	32.8	Construction
Northbridge	Providence road	Blackstone River	MassDOT	59.1	Construction
Uxbridge	Main Street	Blackstone River	MassDOT	40.2	Construction
Uxbridge	River Road	Ironstone Brook	Town	24.0	Construction
Webster	I-395	Thompson Road	MassDOT	94.8	Construction
Webster	Birch Island Road	I-395	MassDOT	82.8	Construction
Webster	I-395	Memorial Beach Road	MassDOT	92.2	Construction
Webster	I-395	Memorial Beach Road	MassDOT	92.2	Construction
WBrookfield	Shore Road	E Brookfield River	Town	7.0	Design
Holden	Wachusett Street	Quinapoxet River	MassDOT	33.6	Design
Dudley	W Dudley Road	Quinebaug River	Town	2.0	Design
Northbridge	Douglas Road	Mumford River	Town	31.0	Design
Worcester	Webster Street	Middle River	MassDOT	64.9	Design
Shrewsbury	Route 9	Lake Quinsigamond	MassDOT	34.0	Design
Barre	Worcester Road	Prince River	MassDOT	75.2	Design
Southbridge	N Woodstock Road	PW	MassDOT	28.8	Design
Millbury	Route 146	West Main Street	MassDOT	30.2	Design
Brookfield	Fiskdale Road	Quaboag River	Town	42.1	Pending
Blackstone	Main Street	Blackstone River	MassDOT	32.8	Pending

Source: MassDOT, November 2010



Legend

Bridge Condition

- Meeting Standards
- Functionally Obsolete
- Structurally Deficient
- Accelerated Bridge Program (ABP)

0 1 2 4 6 Miles

Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), massDOT/Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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Figure III-8 Central Massachusetts Region Bridge Conditions and ABP Inclusion Status

D.4.2 Pavement Management System

Central Massachusetts Regional Planning Commission (CMRPC) transportation staff implemented a pavement management program to assist decision makers in determining the most cost effective strategies to address the regions deteriorating roadway conditions. In general, a successful program defines a roadway network, identifies the condition of each segment within the network, develops a list of needed improvements, and balances those needs with the available resources of the party responsible for maintaining the defined roadway network.

Using the calculated pavement rating, the Average Daily Traffic (ADT) volume, and the unit cost and estimated life of the repair option chosen, recommended improvement projects can be organized in a prioritized order. The key to an efficient pavement management program lies in the project prioritization process. All roadways are in a constant state of deterioration because of time, weather, and traffic load. Since the ultimate goal of the state and town highway departments is to maintain a roadway network at an acceptable level of performance, roadways needing preventive or routine maintenance should receive sufficiently high priority. A “maintenance first” strategy is far more efficient than the typical “worst first” approach. In a limited funding environment with the poorest performing roadways receiving highest priority, many maintenance projects are postponed, and, as that trend continues, a roadway once needing routine, inexpensive maintenance now needs a far more expensive improvement option. The “worst-first” roadway network typically remains at the same poor level of overall condition, while properly prioritized maintenance and repair can improve the overall condition of a network in time using the same level of resources.

D.4.2.1 Data Collection Process

Staff collected pavement distress information on the federal-aid eligible roadways within the central Massachusetts region, including the city of Worcester and the 39 surrounding communities, excluding the interstate highways (I-84, I-90, I-190, I-290, I-395, & I-495). A team of two technicians collected the information in the field by conducting a “windshield survey.” This team drove along each predetermined segment of the defined roadway network and took note of the severity and extent of the following pavement distresses:

- potholes
- distortions
- alligator cracking
- transverse and longitudinal cracking
- corrugations, shoving and slippage
- block cracking
- rutting
- bleeding/polished aggregate
- surface wear and raveling

Staff completed the region-wide pavement condition data inventory over the course of four summers from 2006 until 2009. Technicians began this cycle again in the summer of 2010 in order to maintain a current database.

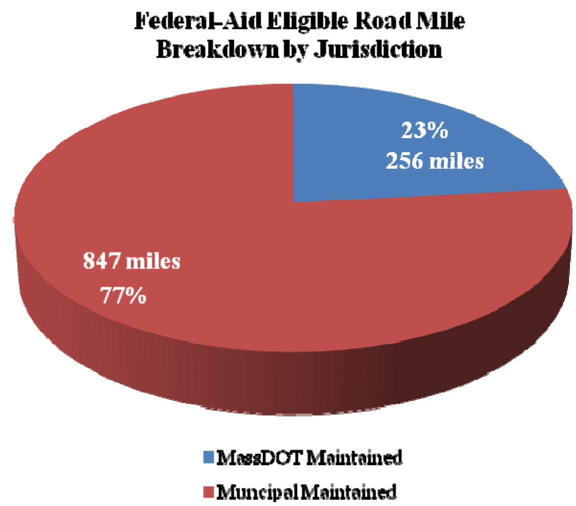
Staff entered the data collected in the field into *Cartegraph*, an asset management software package developed and supported by Cartegraph Systems Incorporated, used to inventory, quantifiably rate and analyze pavement distress information. Using *Cartegraph*, staff determined an Overall Condition Index (OCI) for each segment based upon the pavement ratings and nature of the distresses. The OCI is a score used to rate each segment inspected on a scale from 100 to 0. An OCI of 100 indicates optimal pavement conditions, while an OCI of 0 indicates that a road is in very poor condition and in need of extreme repair measures. The score is calculated by subtracting a series of deduct values associated with the severity and extent of the various pavement distresses described above. *Cartegraph's* deduct values are determined through a series of deduct curves, which were developed by pavement engineers using years of research on pavement performance. The resulting OCI is a quantified rating of pavement condition.

Table III-4 below shows that the OCI scores are separated into five categories ranging from "excellent" to "very poor." Each category is associated with a general maintenance or repair strategy recommended for pavement segments scored in that range. These recommended actions are used in budget scenarios to create maintenance and rehabilitation plans.

Table III-4
Overall Condition Index Rating Ranges & Recommended Action

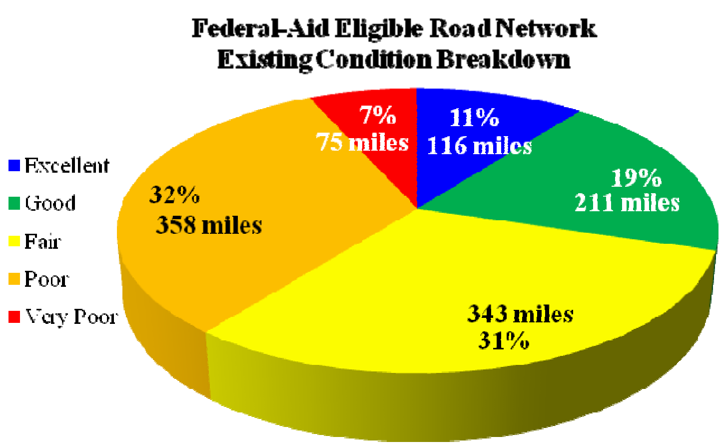
OCI Range	Pavement Condition	Recommended Action
0 - 24	**Very Poor**	**Base Rehabilitation –** represents roads that exhibit weakened pavement foundation base layers. Complete reconstruction and full depth reclamation fall in this category
25 - 47	**Poor**	**Structural Improvement –** when the pavement deteriorates beyond the need for surface maintenance applications, but the road base appears to be sound. These include structural overlays, shim and overlay, cold planeing and overlay, and hot in-place recycling.
48 - 67	**Fair**	**Preventive Maintenance -** slightly greater response to more pronounced signs of age and wear. This includes crack sealing, full-depth patching, and minor leveling, as well as surface treatments such as chip seals, micro-surfacing, and thin overlays.
68 - 87	**Good**	**Routine Maintenance -** used on roads in reasonably good condition to prevent deterioration from the normal effects of traffic and pavement age. This treatment category would include either crack sealing or local repair (pot hole, depression, poorly constructed utility patch, etc.), or minor localized leveling.
88 - 100	**Excellent**	**Do Nothing -** used when a road is in relatively perfect condition and prescribes no maintenance.

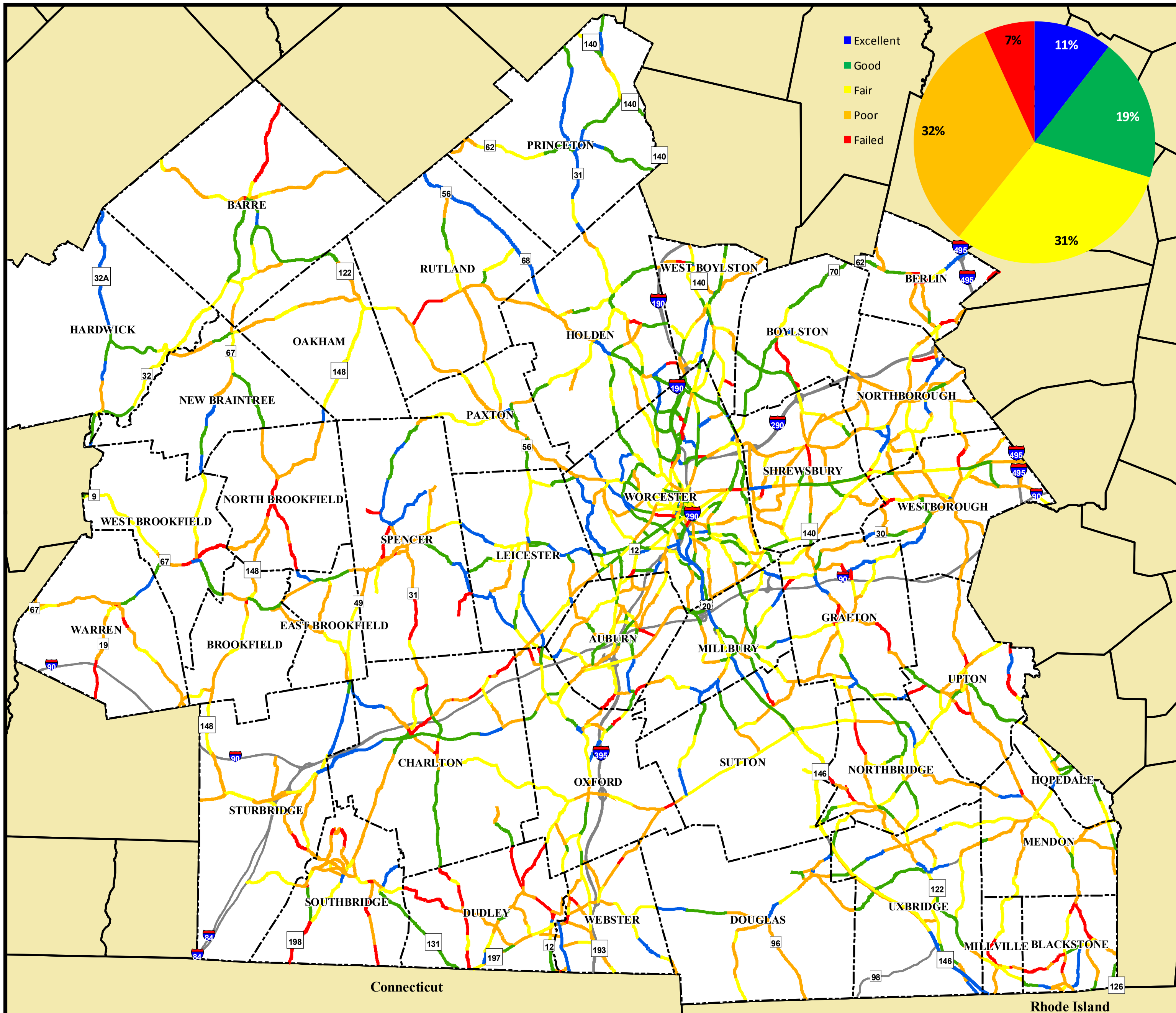
D.4.2.2 Existing Condition



According to CMRPC records, there are approximately 1,100 federal-aid eligible road miles in the CMRPC region. The Massachusetts Department of Transportation (MassDOT) maintains roughly ¼ of these roadways, while the 40 municipalities within the region maintain the remaining total. The mileage is comprised of 182 miles of arterials and 74 miles of collector under MassDOT jurisdiction, and 74 miles of arterials and 773 miles of collectors under town jurisdiction.

CMRPC staff determined that about 116 miles of the region's 1,103 mile federal-aid eligible road network are in "excellent" condition, 211 miles are in "good" condition, 343 miles are in "fair" condition, 358 miles are in "poor" condition, and 75 miles are in "very poor" condition. The map in Figure III-9, Table III-5, and the graph below each provide a visual depiction of this breakdown. If categories "excellent" and "good" are combined and categories "fair" and "poor" are combined, than we can see that the network is currently split in thirds: 1/3 is in "good" condition, 1/3 is in "fair" condition, and 1/3 is in "poor" condition. The network OCI (a weighted average of all the OCIs in the regional network) is approximately 60.1, placing it in the middle of the Preventive Maintenance treatment band (OCI ranging from 48 – 67). As shown above, this OCI average generally represents a roadway in "fair" condition. By definition, a road network condition in this treatment band means that considerable resources are needed to sustain network wide road conditions. It is likely that while any proposed pavement management spending plan will strive to maximize the benefit of each dollar invested. However, without an aggressive investment in the federal-aid eligible road network, the system will undoubtedly continue to lose roads from the routine and preventive maintenance treatment bands into the structural improvement and base rehabilitation bands because of time, weather, and traffic load. This very costly loss will present a challenge for the region to retain its roads in "fair" condition.





Legend

Fed-Aid Eligible

OCI Recommended Action

- Excellent (Do Nothing)
- Good (Routine Maintenance)
- Fair (Preventive Maintenance)
- Poor (Structural Improvement)
- Failed (Base Rehabilitation)

0 2 4 6 Miles

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Source: Data provided by the US Bureau of Census, Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/Office of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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Figure III-9 CMRPC Regional Pavment Condition - 2010

Table III-5
Pavement Condition Miles & Percentage by Jurisdiction & Functional Class

Condition	MassDOT Maint. Arterials		Municipal Maint. Arterials		MassDOT Maint. Collectors		Municipal Maint. Collectors	
Excellent	29	16%	6	8%	7	9%	74	10%
Good	39	21%	18	24%	27	37%	127	16%
Fair	51	28%	26	35%	20	27%	246	32%
Poor	61	34%	16	22%	18	24%	262	34%
Very Poor	2	1%	8	9%	2	3%	64	8%
Total Miles	182		74		74		773	

D.4.2.3 Subregional Analysis

As mentioned above, the central Massachusetts planning region network OCI is 60.1. The central subregion network OCI is 68.1. The northeast subregion network OCI is 50.2. The southeast subregion network OCI is 62.2. The southwest network OCI is 56.8. The west subregion network OCI is 58.8. The north subregion network OCI is 60.8. While most subregional network OCIs linger around the regional OCI of 60.1, the central subregion is 8 points higher and the northeast subregion is almost 10 points lower. Table III-6 summarizes the subregional analysis.

Table III-6
Pavement Condition Miles & Percentage by Subregion

Condition	Central Subregion Net. OCI 68.1		Northeast Subregion Net. OCI 50.2		Southeast Subregion Net. OCI 62.2		Southwest Subregion Net. OCI 56.8		West Subregion Net. OCI 58.8		North Subregion Net. OCI 60.8	
Excellent	20.8	11%	9.4	7%	29.4	11%	18.7	9%	25.6	17%	13.4	9%
Good	49	27%	22.9	16%	50.5	19%	29.9	14%	24.4	16%	34.5	22%
Fair	80.7	44%	37.5	26%	84.1	32%	56.5	27%	38.2	26%	46.2	30%
Poor	29.9	16%	64	45%	84.1	32%	79.7	38%	48.2	32%	49	32%
Very Poor	3.7	2%	8.3	6%	15.3	6%	25	12%	13.9	9%	10.2	7%
Total Miles	184.1		142.1		263.4		209.8		150.3		153.3	

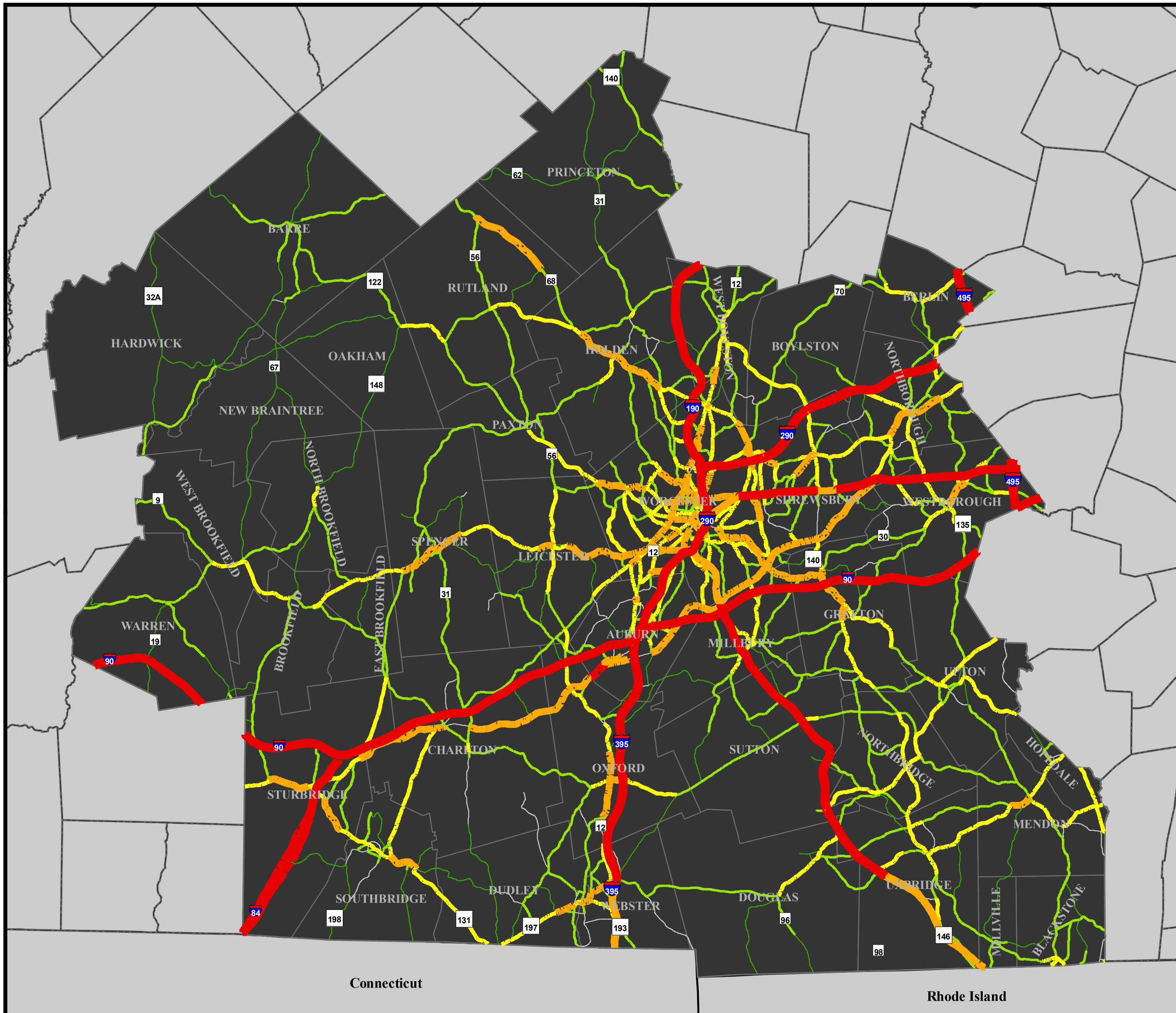
D.5 Mobility

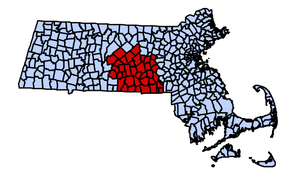
D.5.1 Traffic Monitoring

CMRPC began conducting traffic volume counts in 1982 and has been developing a comprehensive Traffic Counting Program since 1984. Traffic volume counts are most common, but also included in the comprehensive program are a limited number of axle classification counts. The data is used by staff in its ongoing transportation planning program, including the regional travel demand forecast model, the various Management Systems and Freight Planning. Figure III-10 shows traffic volume for the federal aid eligible roadways in the region. This map was compiled using CMRPC's extensive database of traffic volumes. Also, MassDOT's data was used for roadways that CMRPC could not count.

The highest traffic volumes are on the interstate highways, especially Interstate 90, Interstate 290, and Interstate 495. Currently, approximately 90,000 vehicles per day use the Massachusetts Turnpike between Sturbridge (Interchange 9) and region's east boundary in Westborough, the heaviest being between Sturbridge (Interchange 9) and Auburn (Interchange 10). Lower volumes are observed on other segments west of Sturbridge. Daily volume surpasses 110,000 vehicles a day on sections of Interstate 290 in Worcester. Volumes on Interstate 495 in Berlin and Westborough approach 90,000 vehicles per day. In contrast, volumes on other interstate highways in the region are much lower. Interstate 84 near the Connecticut state line carries only approximately 40,000 vehicles. Interstate 190 carries over 70,000 vehicles per day north of Interstate 290, but by the time it leaves the region in West Boylston at the Sterling town line, a volume of only about 32,000 is observed. Interstate 395 also carries a relatively low volume by the time it leaves the region. Though over 45,000 vehicles use this highway in Auburn, fewer than 22,000 vehicles per day currently utilize the highway as it enters the State of Connecticut in the town of Webster. MassDOT is the agency that collected the data on the interstate highways.

The diverse nature of the development in the region has resulted in widely varying traffic volume patterns. Route 9 between Lake Avenue in Worcester and I-495 in Westborough carries a volume of little over 50,000 vehicles per day. There are several locations along Route 20, throughout the region, where volumes approach or exceed 20,000. Over 20,000 vehicles per day use a section of Route 122A in Holden. Worcester, the center of the region, is also the center of traffic in the region. Several roadways, including Belmont Street (Route 9), Cambridge Street, Grafton Street (Route 122), Highland Street (Route 9), Main Street (Route 9), and Park Avenue (Route 9, 12, and 122A), carry volumes in the 15,000 – 25,000 range. In contrast, several municipalities, especially in the northwest, have no roadways with over 10,000 vehicles per day.





Legend

Traffic Volume

- Not Counted
- < 2500
- 2500 - 7499
- 7500 - 14999
- 15000 - 30000
- > 30000

0 1 2 4 6 Miles

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Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC) and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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Figure III-10 Regional Traffic Flows

D.5.2 Congestion Management Process (CMP)

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required urban areas across the country to assess traffic congestion using a management system approach. On behalf of the CMMPO, staff at CMRPC began developing the region's Congestion Management System in 1994.

The first step was to identify "focus segments," roadways where the traffic volume on the roadway was exceeding the operational capacity. A roadway's capacity is defined as "the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic and control conditions."[5] Utilizing the TransCAD travel demand model for base year 2010 and 2035, a number of road segments across the region were identified as "congested" or "projected" to be congested by 2035. Once identified, CMRPC staff proceeded to verify and monitor the congested conditions in the field by conducting a series of travel-time-and-delay studies along roadways and turning movement counts at intersections. Figures III-11 and III-12 depict the findings of the travel-time-and-delay studies for A.M. and P.M peak hours.

Utilizing the analysis of this data in conjunction with information provided by communities and MassDOT, strategies to mitigate observed congestion can then be developed. Recommendations have included signal timing optimization and coordination; signal equipment upgrades; geometric modifications, such as installation of intersection turn lanes; and deployment of ITS solutions, such as advanced warning systems and traffic control preemptive device technology for emergency responders.

Occasionally, following the implementation of improvement projects, the same surveys described above are used for monitoring purposes and to assist in determining project effectiveness. It should be noted that the region's CMP data collection schedule has the flexibility to accommodate roadways added to the focus network either through refinements to the regional model, ongoing public participation activities, or requests from the MassDOT District offices.

Progress Reports for the region were compiled in 1995, 1997, and annually since 2000. Since 1998, Level-of-Service (LOS) analyses have been conducted at critical intersection locations and improvement options have been suggested for consideration. Beginning in 2000, signal warrants analyses have also been conducted under the region's CMS program. Also notable, the Progress Reports have been utilized by the MassDOT District #3 office for project development purposes since 1996.

[5] Highway Capacity Manual

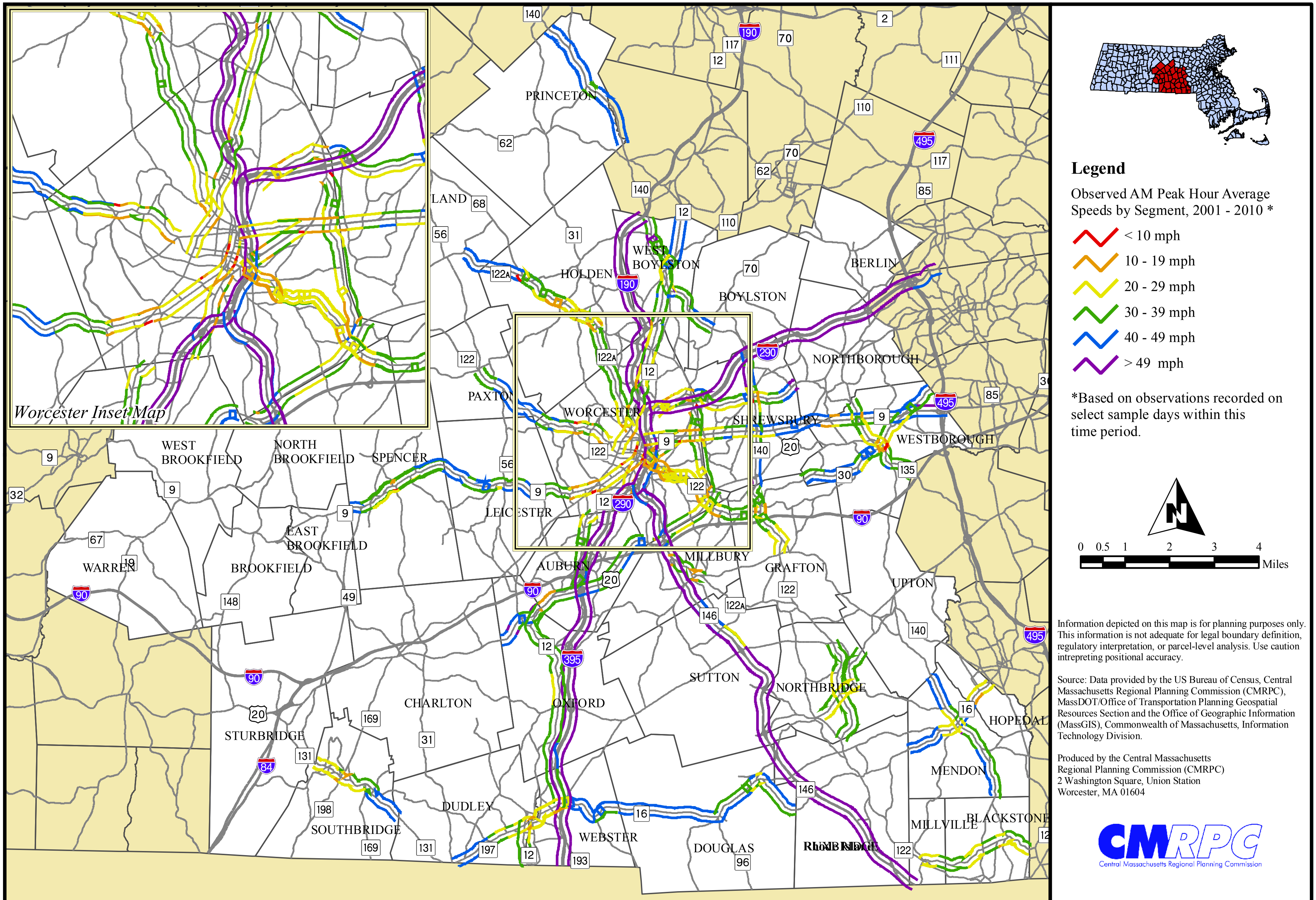
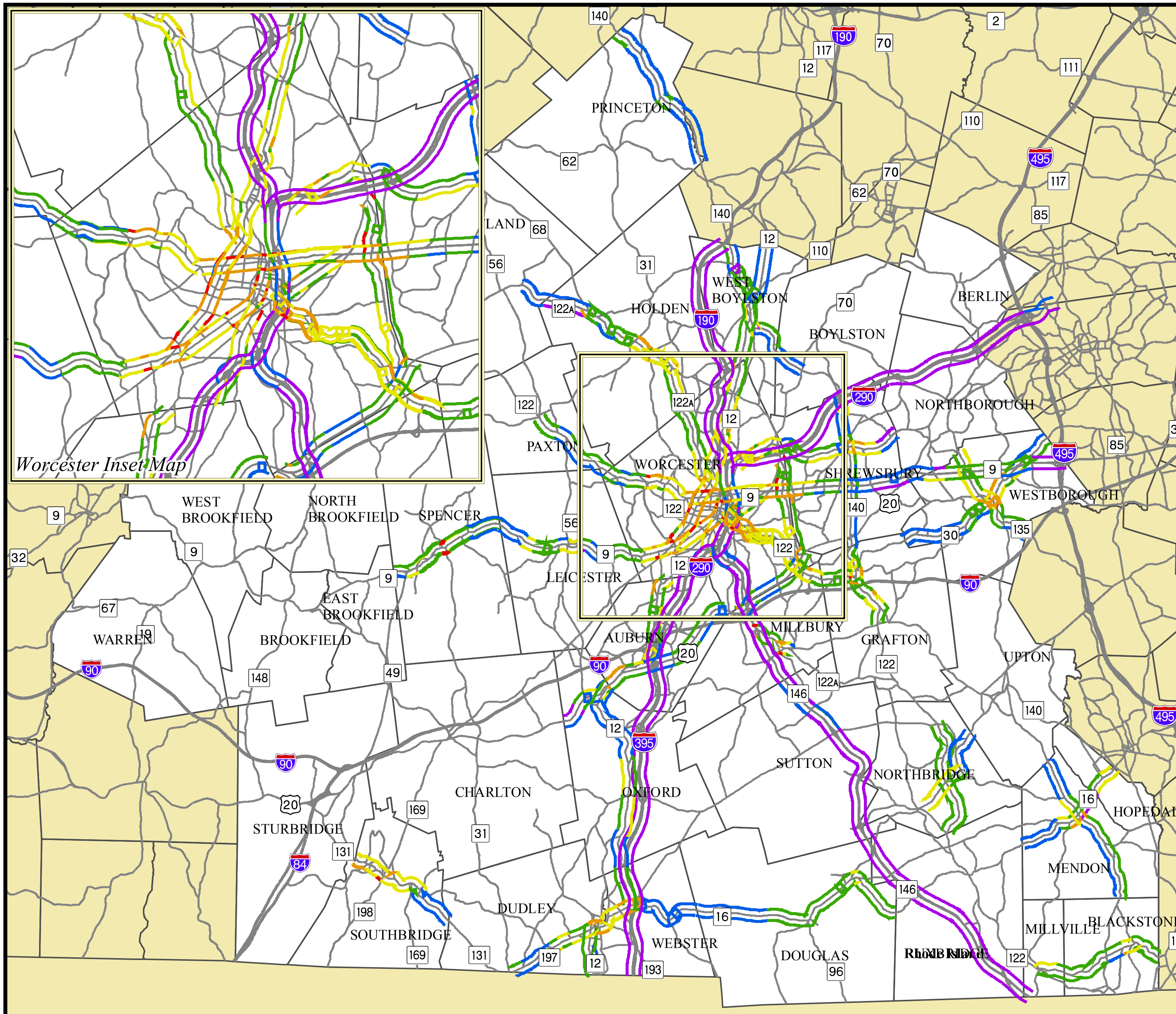


Figure III-11 Observed AM Peak Hour Travel Speeds



Legend

Observed PM Peak Hour Average Speeds by Segment, 2001 - 2010 *

- < 10 mph
- 10 - 19 mph
- 20 - 29 mph
- 30 - 39 mph
- 40 - 49 mph
- > 49 mph

*Based on observations recorded on select sample days within this time period.

0 0.5 1 2 3 4 Miles

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Source: Data provided by the US Bureau of Census, Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/Office of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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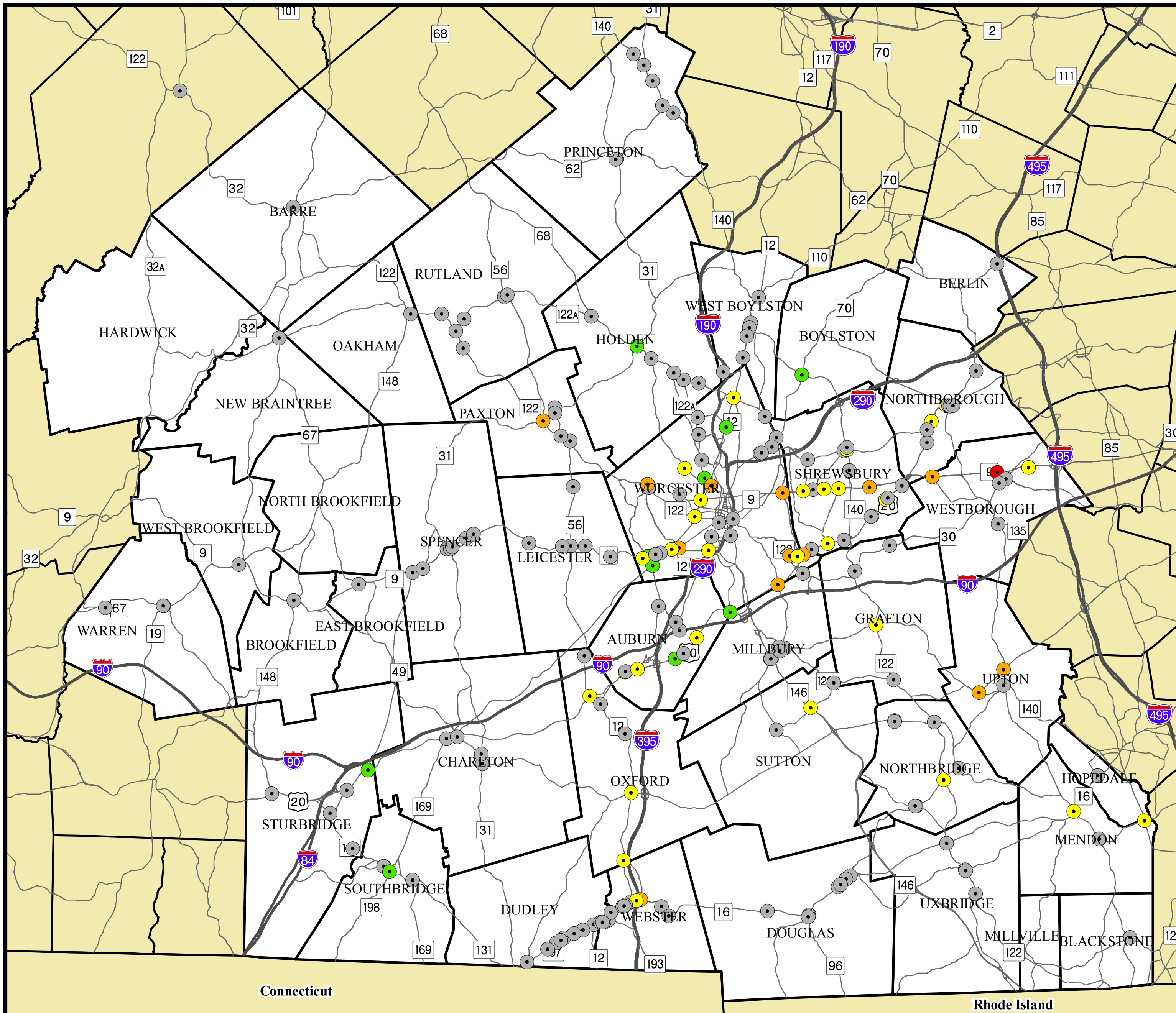
Figure III-12 Observed PM Peak Hour Travel Speeds

D.5.2.1 Trends in Delay Encountered

For all intersections where turning movement counts are obtained, it is possible to analyze the total delay encountered during the examined peak hour periods. A byproduct of the process that results in intersection LOS ratings is the "average delay encountered for entering vehicles." When multiplied by the number of vehicles to which the particular delay pertains, we can arrive at a total amount of waiting time in "car-minutes." A car-minute is one car waiting for one minute, presumably idling and producing emissions as well as adding to total social and economic costs. Five cars waiting for a minute each, or one car waiting for a total of five minutes, results in the same theoretical total waiting time cost and would be measured and quantified by a total net delay of five car-minutes.

Signalized intersections have delays of varying levels in all directions, and this is accounted for. Stop sign controlled intersections have delay counted only for those vehicles arriving on the minor approaches that are required to stop as well as those vehicles on the major approaches that often times need to wait in order to make a left turn. Generally speaking, signalized intersections have more total delay, but a busy stop-controlled location that may not presently meet the warrants for signalization can have substantial delays if volumes on the minor approaches seek to cross the major approaches. Signals establish orderly traffic flows and increase safety by providing the opportunity for traffic to proceed on both the major and minor intersection approaches, thus balancing encountered vehicle delay. When two heavily traveled streets cross at a major signalized intersection, significant delays are often generated due to the high traffic volumes that need to be accommodated. Only after signal operations are optimized are geometric improvements considered, such as the construction of additional travel lanes.

Encountered peak hour delay at critical intersections studied is depicted in Figure III-13.



Legend

Intersection Delay*

- 4 -1,786
- 1,786 - 2,500
- 2,500 - 7,500
- 7,500 - 13,000
- > 13,000

* In car-minutes per hour: The total number of minutes that drivers as a group wait at the intersection during the AM+PM hours. 1,786 minutes is the average peak hour delay of the intersections studied.

Data collected by CMRPC transportation staff as part of the 1996-2010 Congestion Management Program (CMP) program.

0 1 2 4 6 Miles

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Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), massDOT/Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, InformationTechnology Division.

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Figure III-13 Encountered Peak Hour Delay at Critical Intersections Studied (1996 - 2010)

D.5.2.2 Park-and-Ride Facilities within the Region

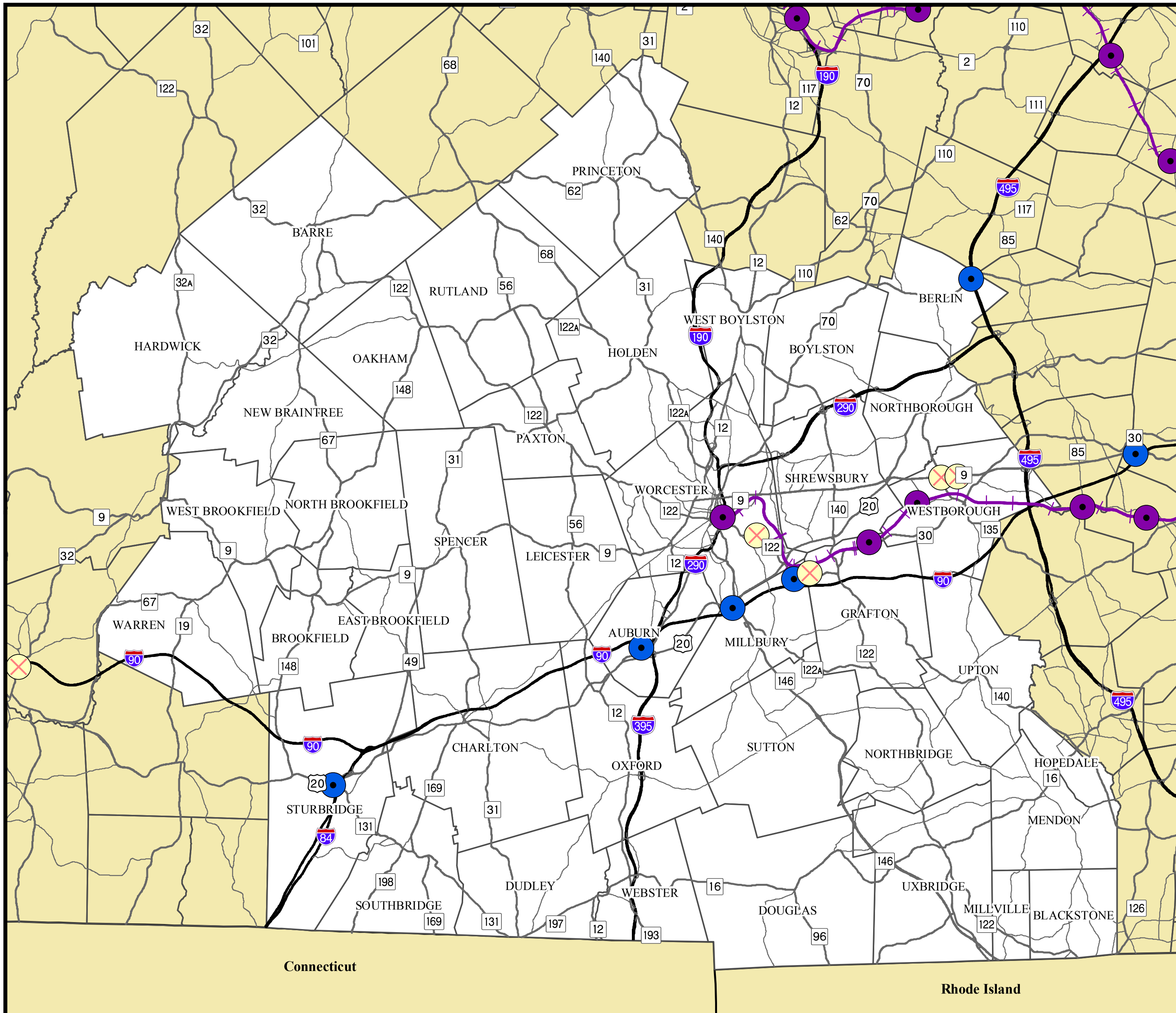
MassDOT supports the development of Park-and-Ride facilities as an integral part of the multimodal transportation system throughout the Commonwealth. These facilities enhance the mobility of the traveling public by providing transfer points for automobiles, bicycles, pedestrians, and other feeder transportation services needing access to and from car and vanpools, rapid transit, bus, passenger rail, ferry boat, and other transportation services. As this system is further developed, it will lead to improved transportation while reducing congestion and improving air quality.

Within the CMRPC region, the study surveyed the MassDOT lot in Berlin as well as the Massachusetts Turnpike lots in Auburn, Grafton, Millbury, Sturbridge, Westborough, and Worcester. These lots and their ulitization are illustrated in Figure III-14. Table III-7 below shows the utilization of the parking lots in the region. Four of the nine lots in the region are currently closed due to low utilization.

Table III-7
MassDOT Maintained Park-and-Ride Lots in the CMRPC Region

#	Community	Location/Address	Capacity	Status*	Comment
1	Berlin	Rte 62 at I-495, Exit #26	45	Open	
2	Auburn	Mid State Drive Adjacent to I-90, Exit #10	135	Open	
3	Grafton	Rte 122 (Worcester Street) at Wyman Gordon Co.	500	Closed	Low Utilization
4	Millbury/Worcester	Rte 20 at I-90, Exit #10A	446	Open	
5	Millbury	Rte 122 at I-90, Exit #11	140	Open	
6	Sturbridge	Rte 131 at I-84, Exit #3 (Bethlehem Lutheran Church Lot)	50	Open	
7	Westborough (1)	222 Turnpike Road	42	Closed	Low Utilization
8	Westborough (2)	Rte 9	58	Closed	Low Utilization
9	Worcester	Rte 122 (725 Grafton St) at Douglas Drug	90	Closed	Low Utilization

**February 2011*



Legend

- Town Boundary
- MBTA Commuter Rail Line
- MBTA Commuter Rail Facility
- Mass DOT
- Currently Closed

0 1 2 4 6 Miles

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Figure III-14 Regional Park-and-Ride Facilities

D.6 Intelligent Transportation Systems (ITS) & Operations

Technology has found its way into nearly every aspect of our lives, and so it should come as no surprise that it is now being used extensively in ways that improve everyday mobility. From traffic signals to toll collectors to transit fare payment systems, technology is spreading quickly in ways that increase the efficiency of the transportation system. Intelligent Transportation Systems, or ITS, is the use of electronics, communications, or information processing to improve the efficiency or safety of transportation systems.

Because ITS transportation solutions are real-time solutions, they are a natural fit for improving the management and operations of transportation systems. Management and operations encompass daily roadway actions, such as reconstruction and maintenance, snow plowing and salting, providing real time traveler information, and traffic signalization. It also encompasses special circumstances like preparing and responding to accident-related congestion, planned special events, and unplanned security concerns.

By focusing on the evolving technology of ITS and the day-to-day activities of management and operations, transportation planners have a greater opportunity of providing more efficient and effective solutions to the region's transportation problems.

While computer-based technology improvements are happening daily within the sphere of the central Massachusetts transportation system, most are not yet real-time, nor are they multi-agency. One of the fastest growing technology improvements is computer-actuated signalization using sensors in the pavement or cameras on the signal equipment, such as those used within the City of Worcester. While it is not typically responsive to changing levels of congestion, it can help to keep traffic at optimum levels under most predictable circumstances. Cameras that are used to monitor traffic congestion levels have been installed at intersections in other regions. When congestion becomes an issue, the signals at these intersections are adjusted remotely to improve traffic flows.

Pre-emptive devices on traffic signals that allow for emergency vehicles to proceed quickly through intersections are very common, especially within the urban core. In the past, there were issues with technology incompatibility between different products, but the 2006 Emergency Medical Technician (EMT) Survey showed that most mobile devices are currently adaptive to the various fixed devices used on traffic signals poles.

With the unification of MassDOT in 2009, came the opportunity to merge the former MassPike Operations Center with the MassHighway Traffic Control Center. Previously they were unable to share data or work as a seamless integrated system due to the use of multiple protocols , incompatible software and the lack of transparency among these agencies. Unification allowed the incident management team to share data, promote compatible software, improve response time, reduce delay and operate
seamlessly to increase safety and ultimately benefit the public. The new single facility is known as the Highway Operations Center - HOC.

While the HOC is primarily a roadway maintenance agency, its mission is to:

- increase safety through better incident management,
- improve detection and emergency response,
- gather and share real-time traveler information,

- manage traffic congestion,
- improve traffic operations and highway maintenance, and
- respond to event specific congestion.

For incident management at special event venues such as sporting events and concerts, portable video cameras with wireless capabilities are used to monitor transportation links. Typically, when an incident is detected on video or other source the control center transmits information using XXML; a protocol which converts data to a common format, to instantly relay it to state and local agencies and private-public partners such as the media and 511 which provide real-time transportation information. MassDOT does not disseminate directly to the public but distributes it through private-public partnerships to groups like Sendza which operates the 511 system in Massachusetts. Conversely, local police inform the HOC about incidents on state roads so that information about the incident can be quickly disseminated to emergency response teams in the area. Incident managers are expected to clear tunnel incidents within 200 minutes and above ground incidents within 2 hours. Variable message signs are activated by the HOC to keep motorists informed and offer alternate routing to reduce delay.

The HOC facility in South Boston is staffed 24 hours a day. It detects incidents using video cameras with pan, tilt and zoom (PTZ) capabilities and communicates with local incident management teams such as police, fire, hazmat and ambulance services to clear incidents in a timely manner. Video data is continuously transmitted using high speed broadband fiber optic cable to instantly transmit video, voice and digital data. Access to high speed communications systems is a critical part of the infrastructure required to transmit video data. From this single location at the HOC, operators of the state's bridges, tunnels and surface roadway systems share video, data and information to communicate directly with emergency first responders regarding incidents occurring on all state owned facilities.

Although the facility is expected to be a hub for statewide operations and safety related communications, the HOOC primarily serves metro Boston at the present time. The facility operates over 600 hundred video cameras located primarily along tunnels, interstate highways and state routes in metro Boston with only two cameras located on I-90 in Central Massachusetts, and no cameras on I-290, even though peak period congestion is a daily occurrence, and incident-related congestion along I-90 is becoming more regular. Video detection has begun to expand greatly to western Massachusetts. A shared resource conduit with high speed fiber optic link is being installed on 55 miles of I-91 from Connecticut to Vermont to transmit data from more than 300 additional video cameras and more than a dozen variable message signs in the region. A new facility for highway operations for MassDOT-District 2 will be located in the Town of Northampton to be linked to the HOC in Boston through the I-90 high speed fiber optic link.

In addition to the two video cameras in the region, there are two variable message signs (VMS) on I-290 controlled by the HOC. These VMS were installed in the mid-2000s, but have only operated on occasion. The location of the signs is insufficient to provide advance driver warning of congestion, since congestion is typically already occurring at those location.

A state owned fiber optic communications backbone is located on I-90 & I-495, consisting of conduit laid on the right-of-way with fiber optic cable used for statewide transmission of video and data. This communications backbone can be described as analogous to traffic on an interstate highway. Communities adjoining I-90 & I-495 can transmit local video and data using the state communications backbone by connecting the last mile using routers to Wide Area Networks (WAN)) which are like arterial roads. Similarly, Local Area Networks (LAN) are like collector streets can be connected to the WAN, facilitating rapid data transmission useful for local traffic management. Secondary benefits to the local communities include access to high speed internet and cable which can be a significant factor for expanding economic development opportunities.

Although there is no indication that the state is planning to expand the communications backbone to I-290, it would clearly benefit the City of Worcester and surrounding communities. The HOC uses central radio command, GPS tracking of snowplows, tracking and management of the roving motorist assistance and Cares Van patrols managed through private--public partnerships. The HOC currently relies on local police to relay information to them before alerting incident response teams in the area to clear the incident then activate variable message signs to inform motorists, illustrating how the current protocol slows down response time and increases delay. Installing video detection at key ramps and intersections on I-290, Route 146, I-395, I-190, Route 9 and Route 20 could significantly reduce response time while giving the region more responsibility in incident management. Coordinating the decision-making with the central Massachusetts region could improve safety and benefit the public. Improving the communications backbone could also allow for consideration of technology-aided methods of managing demand on I-290, since the recently completed Worcester Regional Mobility Study noted that the ability to expand capacity is not presently feasible.

While using electronics to improve efficiency or safety is not a totally new idea, what is new is the level of planning and coordination to ensure that different ITS projects can “talk” to each other and “work” together. Section 5206(e) of the 1997 Transportation Equity Act for the 21st Century (TEA-21) required all ITS projects funded through the Highway Trust Fund to be in conformance with the National ITS Architecture and applicable standards. The National ITS Architecture is a common, established framework for developing integrated transportation systems and is maintained by the United States Department of Transportation (USDOT). The US Department of Transportation required a compliant Regional ITS Architecture to be in place by April 8, 2005 in regions that are deploying ITS projects.

In 2004, the Executive Office of Transportation-Office of Transportation Planning (now MassDOT) led the effort to develop a Central Massachusetts Regional ITS Architecture. This effort was updated in 2010. CMRPC coordinated by building local involvement and support for the effort. During the needs analysis step of the Regional Architecture development process, the Guidance Committee identified key regional needs and major themes for the Regional ITS Architecture. These findings helped shape the architecture to the unique circumstances of central Massachusetts. The four regional needs, unchanged since 2004, were: **congestion management; transit efficiency; efficient use of existing infrastructure; and economic development**. The three major themes expressed by participants in 2004 were: **transit demand and revenue; traffic congestion and traveler information**. In 2010 the **use of ITS data** was added as a major theme. From these expressed regional needs and major themes came four statewide Near-Term Multi-Agency Initiatives that were recommended by the Guidance Committee for Central Massachusetts. They are:

- **Event Reporting System:** Internet-based tool that serves as a centralized repository for information on events affecting the transportation network.

- **Expansion of the Massachusetts Interagency Video Integration System (MIVIS):** Expansion of video sharing and distribution system to allow sharing of real-time video feeds among a larger group of agencies.
- **511 Travel Information System:** Public travel information system, covering the roadways and transit services in the region.
- **Planning Data Archive:** System for coordinating the planning data archives for the transportation agencies in the region.

These statewide initiatives are largely dependent on MassDOT implementation, and when eventually implemented, will require an expansive effort to involve regional agencies beyond MassDOT to become effective and have a significant effect on regional conditions.

D.7 Access Management

SAFETEA-LU, the federal authorizing legislation for transportation, calls for an increase in planning for accessibility, mobility, safety, and security of people, across modes, for both motorized and non-motorized users. Since FY 2008, CMRPC has begun to develop access management and land use planning strategies that would assist communities in managing land adjacent to roadways in order to provide for safe and efficient internal and external access for motorists, transit users, bicycle riders, and pedestrians.

The Federal Highway Administration defines access management as “the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding system in terms of safety, capacity, and speed.” In practical terms, it means managing the number of driveways that a vehicle may encounter without hampering reasonable access to a property and removing slower, turning vehicles from the arterial as efficiently as possible.

The Commonwealth of Massachusetts has been heavily promoting Sustainable Development, Smart Growth and Transit Oriented Development (TOD) design principles in an effort to reduce vehicle travel, improve quality of life, and improve air quality. CMRPC believes that developments have an opportunity to utilize these alternative principles in their design. The traditional “suburban sprawl” style of major commercial development is not conducive to transit service. The walking distances between the buildings are often considerable and do not invite pedestrian activity, thereby not accommodating to bus riders who may want to visit or work at more than one business on site. Also, some general design principles that promote the use of transit and deserve consideration include enhanced pedestrian connectivity between buildings and a more clustered layout with vehicle parking (potentially reduced) located behind the buildings.

Three corridor development scenarios were identified in the 2007 Regional Transportation Plan along “vital links” within the region:

a) near build-out conditions of primarily commercial/retail development (Rte 9 Westborough)
b) rural low-to-medium-density development with primarily residential land uses, (Rte 122A Holden) and
c) under-utilized developable land identified as a future growth area (Rte 140 Boylston)

Beginning in 2009, for each of three scenarios, working with community officials to verify the future land use along each the corridors and reviewed the following existing conditions along the corridor:

- Existing and newly approved driveway locations
- Historic crash data analysis along each corridor
- Peak hour traffic volumes along each corridor
- Land uses of lots of record along and in the immediate vicinity of each corridor
- Zoning boundaries – existing and future changes, if known
- Any existing site design guidelines for managing access