CENTRAL MASSACHUSETTS METROPOLITAN PLANNING ORGANIZATION (CMMPO)

Highway Freight Accommodation Assessment Study: West Transportation Planning Subregion

CMMPO
Central Massachusetts
Metropolitan Planning Organization

C M R P C
Central Massachusetts Regional Planning Commission

January 2022

Prepared in cooperation with the Massachusetts Department of Transportation and the U.S. Department of Transportation – Federal Highway Administration and the Federal Transit Administration. The views and opinions of the Central Massachusetts Regional Planning Commission expressed herein do not necessarily reflect those of the Massachusetts Department of Transportation or the U.S. Department of Transportation. A portion of this document was completed using District Local Technical Assistance (DLTA) funds provided to CMRPC.

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Preface

In order to assure that the federal-aid highway system in each of the Central Massachusetts Regional Planning Commission (CMRPC) transportation planning subregions is adequately accommodating existing trucking needs as well as those projected for the future, the Central Massachusetts Metropolitan Planning Organization (CMMPO) Unified Planning Work Program (UPWP) for FFY 2020 initiated a new study series, "Highway Freight Accommodation Assessments" for federal-aid State Numbered Routes. The first installment focused on the North subregion while this second edition concentrates on the West subregion. Based on both field observations and detailed analyses, this document provides a number of suggested roadway improvement options and local trucking policy considerations to assure the continued flow of freight on the region's major highways while mitigating identified local impacts.

Further, as noted in the state's 2018 *Massachusetts Freight Plan*, there is an identified need to improve the Commonwealth's stock of truck parking and servicing areas. The compilation of the *Highway Freight Accommodation Assessment* study series, supported by the Federal Highway Administration (FHWA), is intended to assist in addressing this identified statewide need. Accordingly, in the spirit of Jason's Law, this study examines the potential for wisely located increases in available truck parking at key locations of the region, with a particular focus on rural highway freight movement needs.

*The CMMPO Endorsed UPWP for 2022 includes the next installment in this study series that will focus on the **Southwest** transportation planning subregion.*

1.0 Introduction

The CMMPO's Endorsed 2021 UPWP Freight Planning work activity indicates the compilation of a *Highway Freight Accommodation Assessment Study: Highway Trucking on State Numbered Routes*. This study is the second in a planned series of subregional *Highway Freight Accommodation Assessment* studies. This trucking-centric study focuses on the region's federal-aid highway network in the West transportation planning subregion. The West subregion includes nine (9) host communities: Brookfield, East Brookfield, Hardwick, Leicester, New Braintree, North Brookfield, Spencer, Warren, and West Brookfield. A map of the West subregion can be found in **Figure 1**.

All eligible for federal-aid improvement funding, the following nine (9) State Numbered Routes in the West subregion are the focus of this study effort:

1. Route 9
2. Route 19
3. Route 31
4. Route 32
5. Route 32A
6. Route 49
7. Route 56
8. Route 67
9. Route 148

Major topics addressed in the *Freight Accommodation Assessment Study* include a subregional trucking amenities overview, an inventory of host community bylaws affecting local trucking operations, federal-aid highway network traffic volumes & truck percentages, a range of Management Systems (MS) data & analysis, Performance-Based Planning & Programming (PBPP) considerations, subregional Environmental Consultation maps and local Municipal Vulnerability Preparedness (MVP) Plan findings. In addition, the regional Travel Demand Model, a computerized simulation of the region's multi-modal transportation network, provided future-year volume projections for a range of truck classifications, verifying known highway freight routes as well as identifying "hot spots" of local trucking activity.

Based on this broad range of data, observations and corresponding analysis, a summary of findings table is presented. The *Highway Freight Accommodation Assessment Study* concludes with a series of suggested recommendations for both MassDOT and host community consideration. These include both local policy suggestions as well as options for roadway and bridge improvements. Some identified improvement projects may have the potential to utilize

future-year TIP funding available to the CMMPO to assist state or local implementation. Suggested projects are intended to help assure the continued flow of highway freight throughout the greater planning region while mitigating identified local impacts.

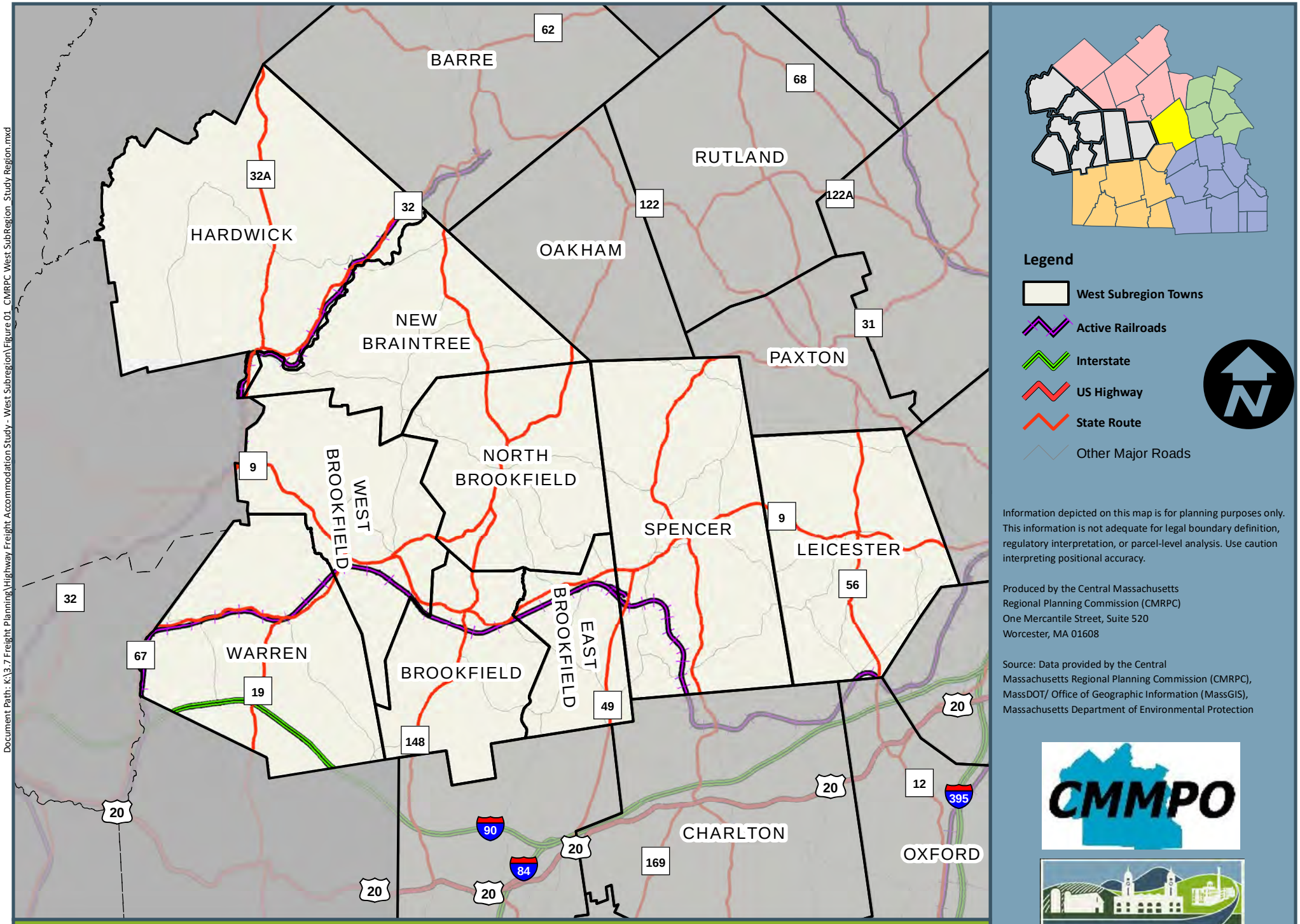

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FIGURE 1 - WEST SUBREGION STUDY REGION HOST COMMUNITIES

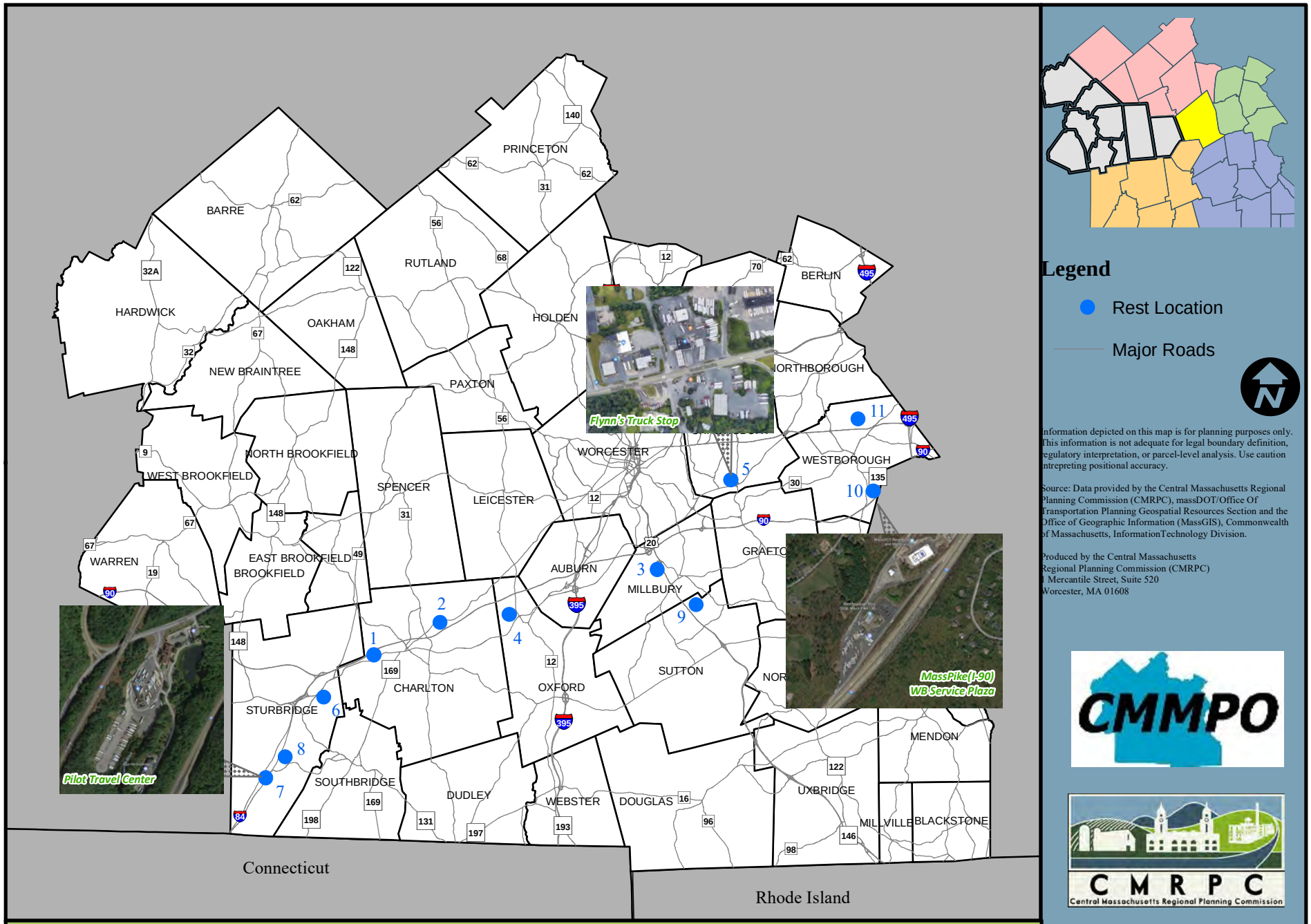
1.1 Area Trucking Amenities

In general, the state's 2018 *Massachusetts Freight Plan* indicates the Commonwealth's deficiency in providing a sufficient number of modern, full-service rest stops catering to trucking. As is widely the case on a national level, the trucking community often lacks adequate facilities to park, rest, bathe, eat, purchase fuel, and make repairs. Earlier findings by the state's Central Transportation Planning Staff (CTPS) indicated that between the greater Worcester area and the northern arch of I-495 corridor there is a formidable lack of adequately sized truck parking facilities with necessary amenities. In addition, the CMMPO is *serious* concerning the implementation of Jason's Law to provide sufficient truck parking and, as such, encourages MassDOT to continue to address this critical area of concern.

This overview of truck parking focuses on those facilities considered "major" as there are numerous small operations serving trucking activities throughout the planning region. Prevalent major sites for long-distance truck parking have previously been identified by the CMMPO. As part of ongoing freight planning efforts, the CMMPO maintains a listing of major truck rest stop locations & amenities summary. These are listed in **Table 1** along with an accompanying map showing respective locations in **Figure 2**. The map includes both public rest stops owned by MassDOT as well as major, privately-owned, commercial facilities serving the trucking industry. (It should also be noted that an industry resource, the "Trucker's Bible", summarizes available amenities at numerous rest stops operated by the private sector nationwide.) Staff periodically updates the major truck stop listing and map on a subregion-by-subregion basis, while also assessing the potential feasibility of additional sites through field work.

Table 1
Major Rest Locations for Long-Distance Truck Drivers
In the Central Massachusetts Planning Region

#	Community	Name	Address	Available Services	Diesel Fuel Type	# of Truck Parking Spaces	Phone #
1	Charlton	Massachusetts Turnpike (I-90) Service Plaza	Eastbound Mile Marker 80	Store & Food	Gulf Diesel 24/7 (4 lanes)	8	508-248-4735
2	Charlton	Massachusetts Turnpike (I-90) Service Plaza	Westbound Mile Marker 83	Store & Food	Gulf Diesel 24/7 (4 lanes)	16	508-248-3308
3	Millbury	Xtra Fuels	100 Worcester-Providence Turnpike (Route 146 Southbound)	Store	Xtra Diesel 24/7 (2 lanes)	Minimal	508-581-9676
4	Oxford	Xtra Mart	93 Southbridge Road (US Route 20 west of Route 56)	Store & Food	Mobil Diesel 24/7 (2 lanes)	Minimal	508-987-1431
5	Shrewsbury	Flynn's Truck Stop	307 Hartford Turnpike (Route 20 & Route 140)	Store, Food, Scale, Showers	Flynn's Diesel 24/7 (6 lanes)	300 (in 3 lots)	508-753-9698
6	Sturbridge	New England Truck Stop	201 Charlton Road (Route 20 east of MassPike (I-90)/I-84 Interchange	Store & Heavy Vehicle Repair	NO Diesel Fuel	35	508-347-7363
7	Sturbridge	Pilot Travel Center	400 Haynes Street (Old Route 15, I-84 Exit 1)	Store, Food, Scale, Showers	Pilot Diesel 24/7 (6 lanes)	250	508-347-9104
8	Sturbridge	Sturbridge Mobil	236 Haynes Street (Old Route 15, I-84 Exit 1)	Store & Propane	Mobil Diesel 24/7 (2 lanes)	6	508-347-5792
9	Sutton	Xtra Mart	27 Worcester-Providence Turnpike (Route 146 Northbound)	Store & Food	Xtra Diesel 24/7 (2 lanes)	Minimal	508-865-3084
10	Westborough	Massachusetts Turnpike (I-90) Service Plaza	Westbound Mile Marker 104.4	Store & Food	Gulf Diesel 24/7 (4 lanes)	36	508-366-4841
11	Westborough	Xtra Mart (Mobil)	183 Boston-Worcester Turnpike (Route 9, 3 miles west of I-495)	Store	Global Diesel 24/7 (2 lanes)	Minimal	508-366-1708



Legend

- Rest Location
- Major Roads

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 2 - MAJOR REST LOCATIONS FOR LONG-DISTANCE TRUCK DRIVERS

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Ongoing Efforts Concerning Truck Parking

Looking to the future, efforts to increase the available supply of parking for long-distance trucking in the planning region need to continue. Both nationally and statewide, truck parking will continue to be a challenge and will require FHWA's and MassDOT's concerted, ongoing involvement. This could involve state & local policy changes that mandate addressing these needs, through both revised policy & regulation in addition to improved infrastructure. Jason's Law federally mandates adequate rest periods for long-distance truck drivers. As such, adequate truck parking opportunities *must* be available to serve both the Commonwealth's existing and future projected needs. Accordingly, the findings and recommendations of the forthcoming statewide trucking study that MassDOT commenced in 2020 are welcome. The CMMPO staff has participated in the study in a stakeholder role.

There exists the potential for expanded existing or new additional facilities in the planning region for large truck parking to enable drivers to meet the federally-required rest periods. Parking has the potential to be offered on a guaranteed, reservation-style basis, perhaps with basic amenities. As indicated in the Long-Range Transportation Plan (LRTP) for the region, *Mobility 2040 Update for 2020*, the CMMPO supports the eventual implementation of additional modern, full-service rest stops throughout the greater region serving the trucking industry.

MassDOT Weigh Station Truck Parking Opportunities

It is suggested that both underutilized or dormant MassDOT Weigh Station infrastructure along the region's federal-aid highways could potentially assist long-distance truck drivers in meeting the federally-mandated rest period requirements. These paved and gated, yet often-empty, Weigh Stations could potentially present opportunities for large truck parking. Based on staff's cursory research, not all Weigh Stations are currently in use, as activity levels appear to vary over time. Further, other opportunities for large truck parking may exist on other dormant or surplus MassDOT-owned properties throughout the Commonwealth.

The following is a list of roadside MassDOT Weigh Stations identified in the greater planning region:

Charlton:	I-90 (MassPike) Eastbound
Lancaster:	Route 2 Eastbound *(currently used for MassDOT construction staging)*
Sturbridge:	I-84 (Wilbur Cross Highway) Eastbound
Sturbridge:	I-84 (Wilbur Cross Highway) Westbound
Uxbridge:	Route 146 Northbound

In addition, based on CMMPO staff research, MassDOT currently maintains six (6) Weigh-in-Motion Stations statewide. The location of the Weigh-in-Motion Stations are as follows:

- **Attleborough**: I-95 north of I-295
- **Hatfield**: I-91 north of Chestnut Street
- **Ludlow/Springfield**: I-90 (MassPike) between exits 6 and 7
- **Methuen**: I-93 north of Routes 110/113
- **Sturbridge**: I-84 Westbound (Wilbur Cross Highway) Connecticut state line
- **Worcester**: I-190 south of West Mountain Street

Truck Parking Opportunities near Trucking Activity Centers

It is considered an ongoing challenge for long-distance truckers to seek and locate modest parking opportunities, especially in the more rural areas of the planning region. The CMMPO staff has considered outputs from the regional Travel Demand Model to assist in identifying trucking "hot spots" in the region, helping to target potential locations for needed future truck parking opportunities. At this time, staff has identified potential truck parking opportunities for federally-required driver rest in the West subregion at the following locations, one in each of the nine (9) host communities encompassed in this study:

- **Brookfield:** Route 148 Corridor, former Route 9 Rest Area
- **East Brookfield:** The Flats, Former Airport Site
- **Hardwick:** Gilbertville Village Area
- **Leicester:** Route 56 (Huntoon Highway) Industrial Area
- **New Braintree:** Route 67 Corridor
- **North Brookfield:** Hannafords Market Parking Lot
- **Spencer:** Big Y Plaza Parking Lot
- **Warren:** West Warren Mills
- **West Brookfield:** Route 9 Corridor
- *OTHERS UNDER REVIEW, To Be Determined*

As an example, staff seeks opportunities for large truck parking 24/7 in underutilized "big box" or shopping plaza parking lots and/or designated loading/maneuvering areas. Staff seeks to suggest local community bylaw refinements/additions to allow for controlled long-distance truck parking when store deliveries meet certain thresholds at various retail & industrial establishments. An example is the Walmart model used elsewhere in the nation: overnight parking welcome, in a supervised/monitored and maintained facility.

Additionally, the needed expansion/addition of available rest stops for long-distance trucking may have the opportunity to be supported through private sector funding or, alternately,

benefit from a "Public-Private Partnership" (PPP) funding scenario, where private funding is used to leverage designated public monies. Future potential PPP arrangements could include the following aspects:

- Rest stop construction & management
- Truck hook-ups for electrical power (vastly reducing idling)
- Diesel & alternate fuel sales
- Light repair facilities
- Dining options & lavatories
- Other locally-customized features

Availability of Diesel Fuel in the West Subregion

Staff has conducted research to identify existing substantive diesel fueling opportunities in the planning region. This information is useful to long-distance trucking as well as for emergency situations that could strike the region. The Massachusetts Department of Environmental Protection (DEP) maintains a database of permitted locations for diesel storage.

This information for the nine (9) host communities in the West transportation planning subregion was extracted from the DEP database and is shown in **Table 2**. Based on the DEP information, at this time there are only six (6) commercial outlets in the West transportation planning subregion providing diesel fuel sales. As can be seen from the table, the only diesel stations are in the communities of Leicester, Spencer, and Warren.

Table 2
Diesel Fuel Locations in the West Subregion

Facility Name	Facility Address	Host Community
Peterson Oil Service	154 Main Street	Leicester
Laney's Sunoco	353 East Main Street	Spencer
Spencer Xtra Mart	94 Main Street	Spencer
Sunoco #80000541-00141077	73 West Main Street	Spencer
Bill's Citgo	961 Main Street	Warren
Warren Xtra Mart	1300 West Main Street	Warren

In addition, it should be mentioned that the railroad industry operating in the greater region has the capability to provide "pop-up" gasoline and diesel outlets from strategically-placed railcars. Freight rail giant CSX & shortline MassCentral Railroad serve the West planning subregion on their Boston Line and Ware River Line, respectively.

1.2 Host Community Bylaws Concerning Trucking

Staff reviewed local community bylaws for the West subregion towns, seeking any pertaining to truck prohibitions, delivery hour restrictions, parking prohibitions or any other locally-defined rules concerning large commercial vehicles, such as local "Jake Brake" use discouragement. *(The phrase "Jake Brake" is slang for engineered safety devices for modern truck tractors that use an engine compression brake that closes the valves in an engine for added slowing ability.)* Based on staff's research, it was determined that *none* of the host communities in the West subregion have local bylaws governing trucking operations.

Brookfield – ***None Posted***

East Brookfield – ***None Posted***

Hardwick – ***Unknown***

Leicester – ***None Posted***

New Braintree – ***None Posted***

North Brookfield – ***None Posted***

Spencer – ***None Posted***

Warren – ***None Posted***

West Brookfield - ***Unknown***

The CMRPC Regional Collaboration & Community Planning (RCCP) staff has broad experience in crafting local community bylaws, village bylaws, and other similar documentation for various host communities. When necessary, these bylaws can be customized to account for local trucking activities, deliveries, and parking as well as other related activities. In addition, it should also be mentioned that staff has determined that MassDOT's competitive Complete Streets program has yet to fund a project in the CMRPC planning region associated with trucking operations.

2.0 State Numbered Routes

This section of the *West Subregion Highway Freight Accommodation Study* details the primary focus network of State Numbered Routes owned and maintained by either MassDOT or the host communities. These highways are eligible for federal-aid improvement funding through the CMMPO's Transportation Improvement Program (TIP). Currently programmed TIP projects in the West subregion are also listed. Further, the CMMPO's previously-designated Critical Freight Corridors are summarized. Lastly, field-observed traffic volumes and associated truck percentages are presented.

2.1 Analysis Network

As previously stated, all State Numbered Routes eligible for federal-aid improvement funding in the West subregion are the primary focus of the study effort. Other federal-aid town-owned & maintained highway segments have also been also included in the study scope, often serving as connectors between the State Numbered Routes. Again, the following nine (9) State Numbered Routes in the West subregion are the focus of this analysis: Route 9, Route 19, Route 31, Route 32, Route 32A, Route 49, Route 56, Route 67, and Route 148. Segments of these highways that were previously designated by the CMMPO as Critical Freight Corridors are also identified.

Federal-Aid Eligible Road Classifications & Highway Ownership

Figure 3 shows the federal-aid eligible highways in the West subregion. Funds are allocated from the FHWA to MassDOT to be distributed to the state's MPO's for roadway improvement projects through the regional TIPs. A combination of functional classification and urban/rural designation determines if a roadway qualifies for the use of these federal funds. Eligibility includes all Interstates, urban/rural arterials, urban collectors, and rural major collectors. Rural minor collectors and local roads are excluded from this group and thus ineligible for federal-aid highway funding.

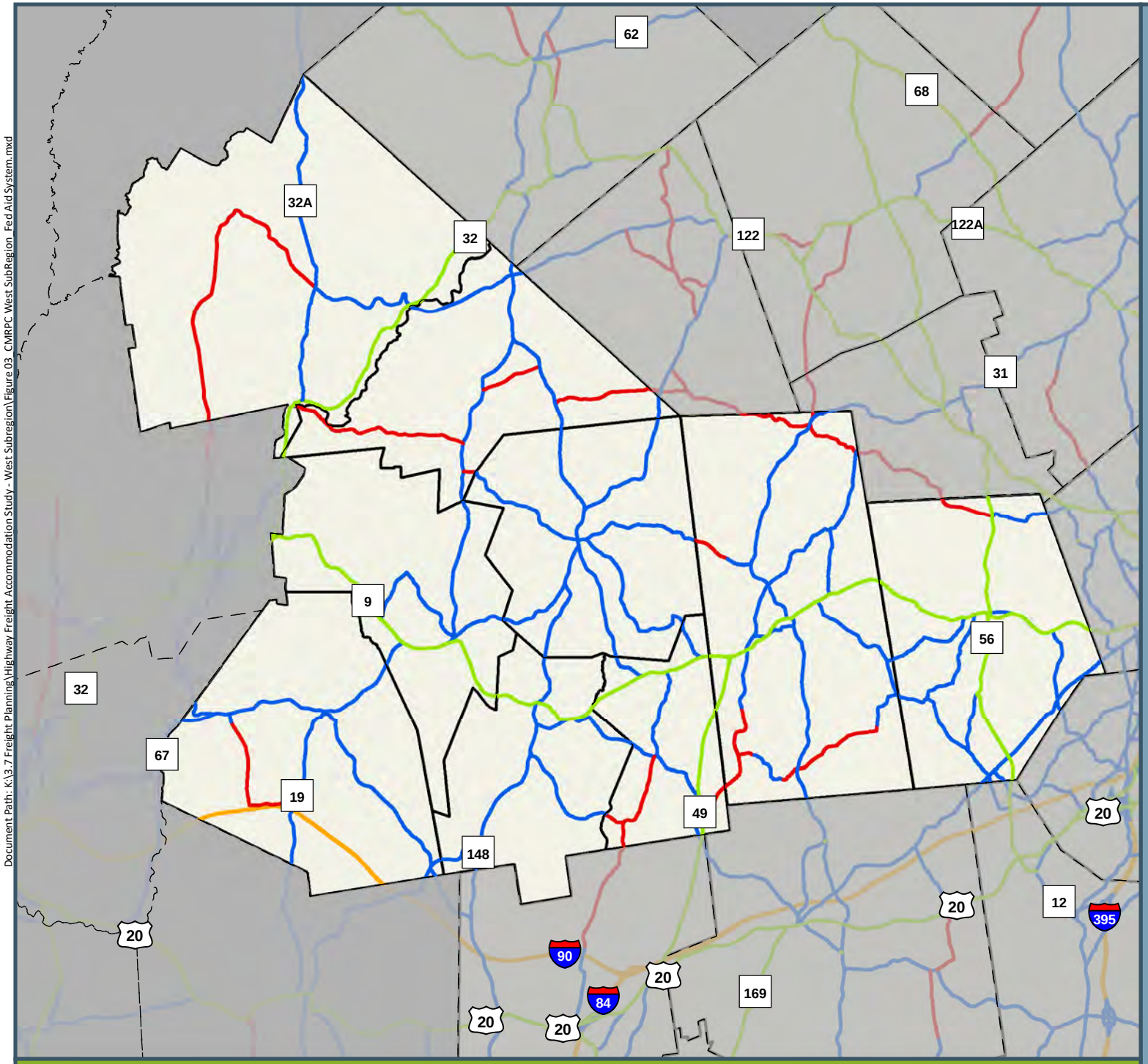
As shown on the map there are four categories of federal-aid eligible roads. There are two (2) National Highway System (NHS) categories and two (2) Surface Transportation Program (STP) categories. The NHS-funded highway network represents all Interstate roadways and principal arterials throughout Massachusetts. In addition, roadways connecting the NHS roadways with military bases are also considered part of the NHS network. Also, NHS passenger & freight terminals are connected to the NHS network by roadways called "NHS Connectors".

The STP-funded highway network is comprised of any functionally classified roadway. STP-funded roadways include all urban arterials, urban collectors, and rural arterials. According to prior national transportation legislation, rural collectors are also STP eligible, but have a

limitation on the amount of STP funding allocated to the states that can be used. These types of roads are classified in what is called the "C15" category.

Only one Interstate NHS roadway is within the West transportation planning subregion, Interstate 90, the Massachusetts Turnpike, which is located in Warren. However, being a MassDOT-operated toll road, I-90 in Massachusetts is ineligible for federal-aid. Roadways in the West subregion eligible for NHS funding include Routes 9, 32, 49 and 56. The remaining State Numbered Routes included in this Accommodation Assessment Study are STP-eligible and include Routes 19, 31, 32A, 67, and 148. Other major roadways within the West subregion shown on the figure are classified as either STP-eligible or STP – C15.

In addition, **Figure 4** shows the highway ownership for the State Numbered Routes and other major roadways in the West subregion. As can been seen in the figure, the majority of the highways are owned, and thus maintained, by the nine (9) host communities. The entirety of Interstate 90 (Massachusetts Turnpike), Route 49 as well as portions of Route 9 and Route 67 are the major highways in the West subregion owned and maintained by MassDOT.



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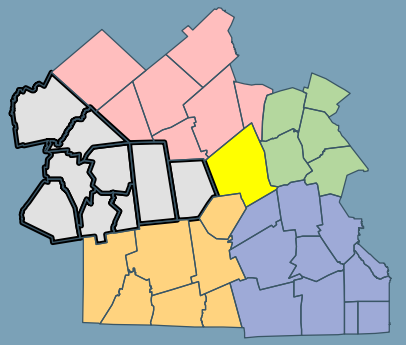

Legend

- West Subregion Towns
- Interstate - NHS
- Other Road - NHS
- STP Eligible
- STP Road - C15

N

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Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/ Office of Geographic Information (MassGIS), Massachusetts Department of Environmental Protection

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FIGURE 3 - WEST SUBREGION FEDERAL-AID ELIGIBLE ROAD CLASSIFICATIONS

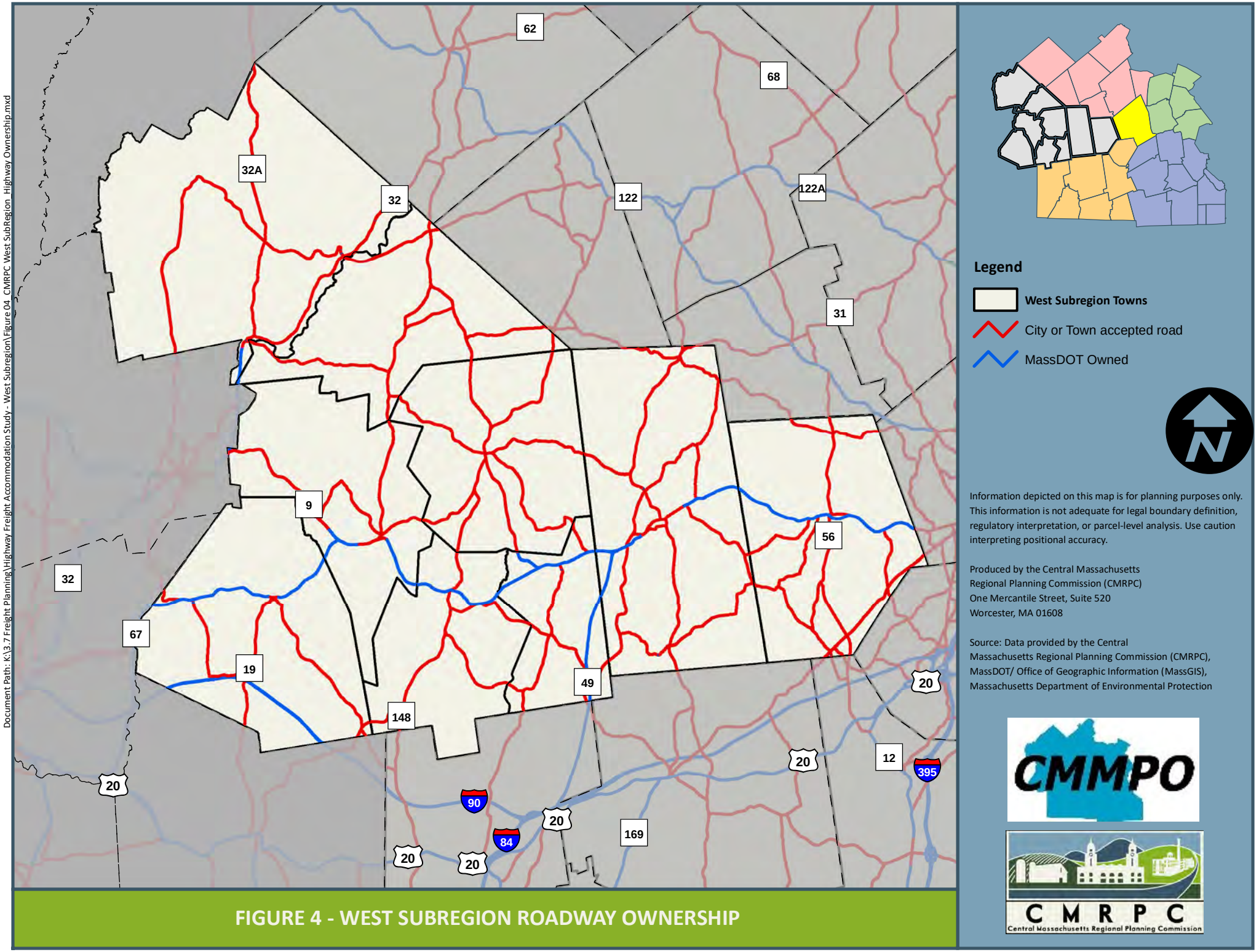


FIGURE 4 - WEST SUBREGION ROADWAY OWNERSHIP

Environmental Justice & Vulnerable Populations

Environmental Justice was first noted on the Executive Order 12898 (1994) which mandated all federal agencies to ensure that their programs do not disproportionately cause high and adverse effects on minority and low-income populations and to ensure that all potentially affected populations have the opportunity to full and fair participation in the transportation decision-making process. Moreover, the US Department Of Transportation (DOT) Order 5610.2(a) presents DOT policy to consider Environmental Justice in all programs, policies, and activities with the US DOT. The guiding principles in DOT's national policy are:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision--making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

To carry out the intent of the federal guidance, it was necessary to identify low income and minority communities or neighborhoods in the planning region. For this reason, the CMMPO updated and approved in October 2013 the current Environmental Justice (EJ) definition to reflect regional characteristics and demographic changes based on the decennial US Census. The definition reads as follows:

- A US Census [updated with 2015 American Community Survey (ACS)] Block Group will be designated as a "Neighborhood of Environmental Concern" if the Block Group complies with any of the following criteria:
    - Block Groups where the median household income is less than or equal to 65% of the regional median as determined by the 2015 ACS (65%* $69,078 = $44,901).
    - Block Groups where the percentage of minority population is greater than or equal to the regional proportion of minority population, 22.2%.
    - Households with a person 75 years or older, 9.3%.
    - Households without a vehicle available, 13.5%.
    - Linguistically isolated households, 9.45%.

In addition, the CMMPO identifies other vulnerable populations as a means to both expand outreach activities and to identify possible mitigation efforts and options. **Figure 5** shows both the EJ and Vulnerable Populations in the west subregion communities.

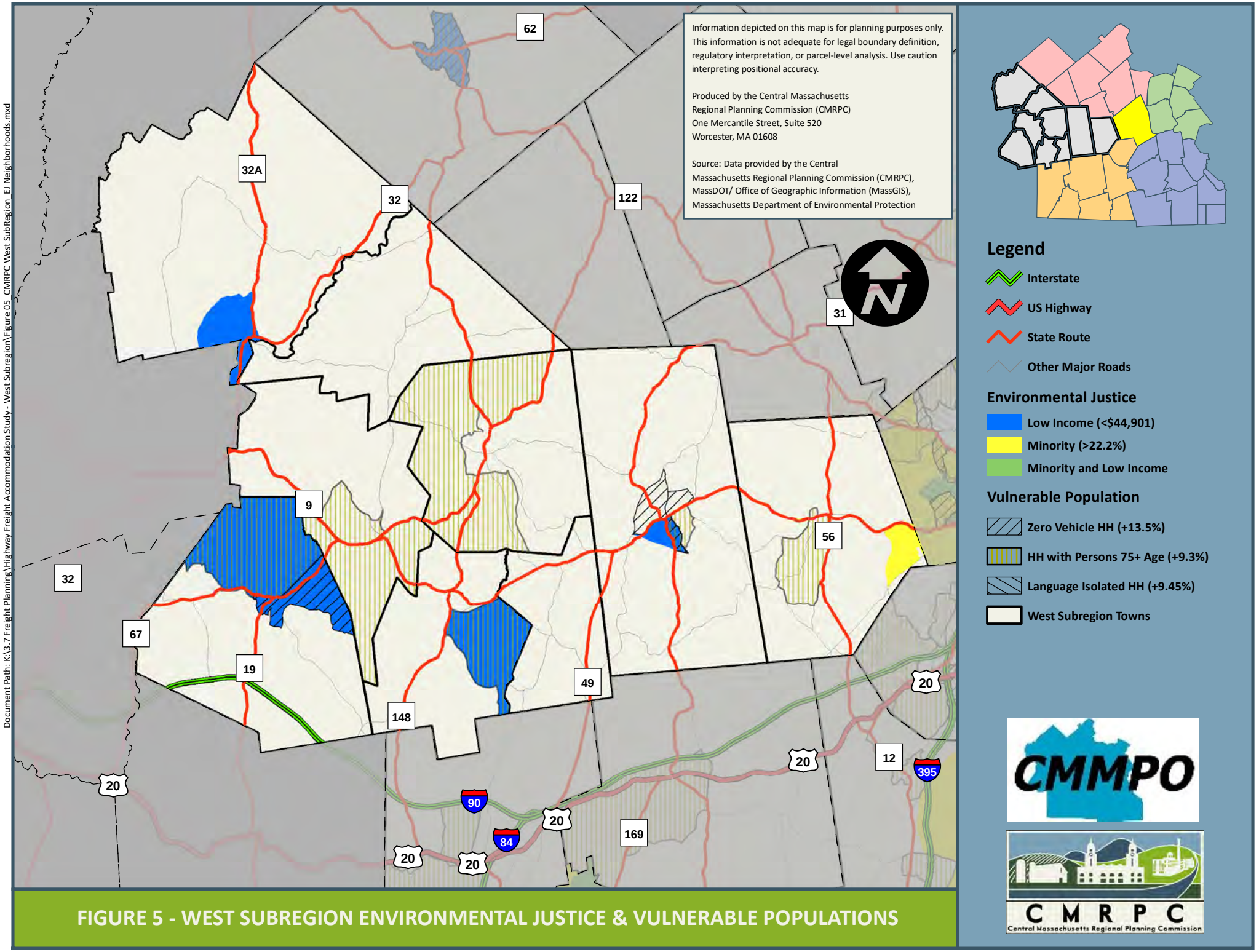
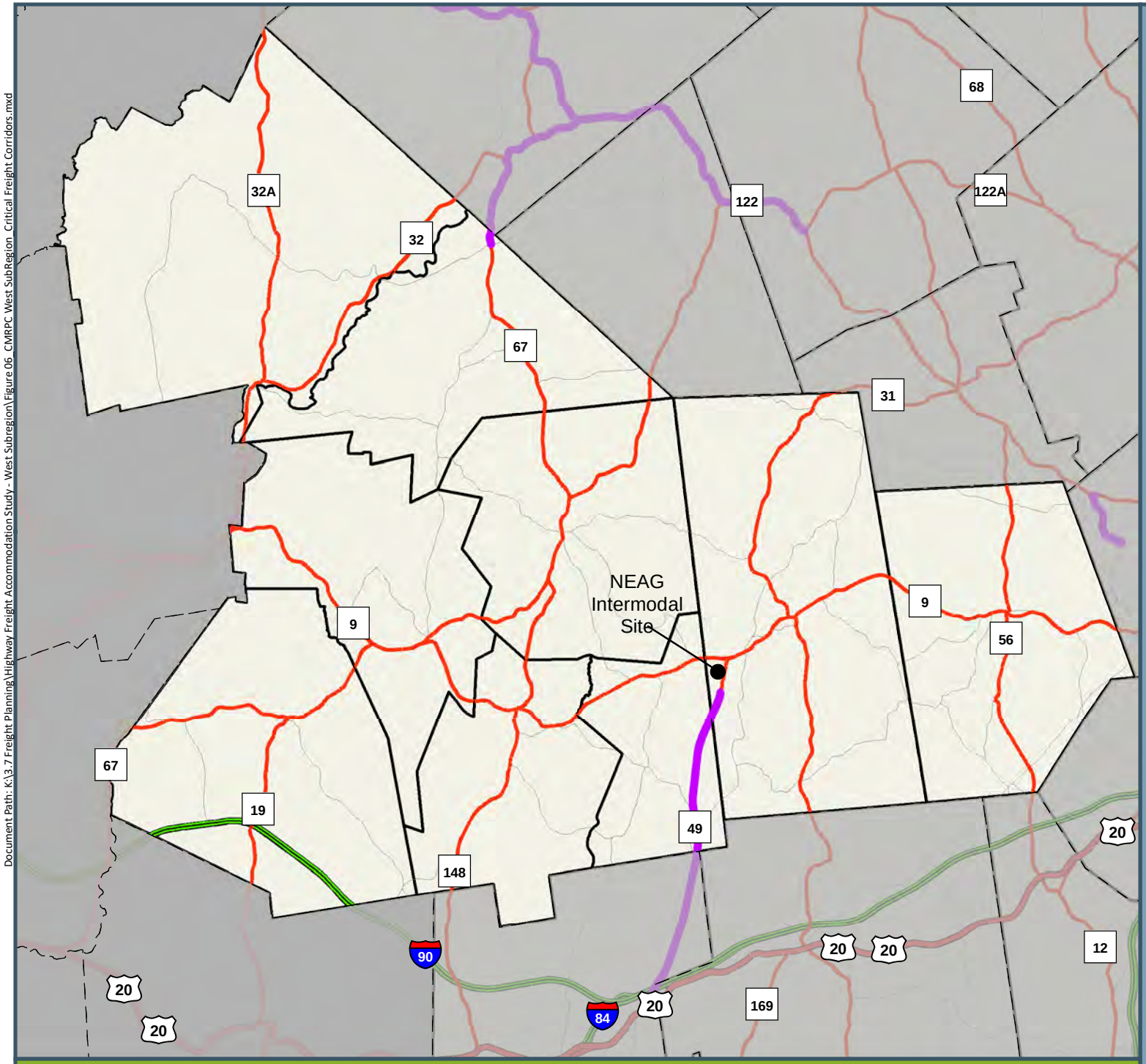


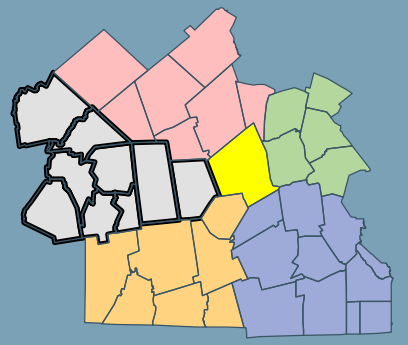
FIGURE 5 - WEST SUBREGION ENVIRONMENTAL JUSTICE & VULNERABLE POPULATIONS

Critical Freight Corridors

As part of the development of the state's 2018 *Massachusetts Freight Plan*, the CMMPO staff took an active role, as requested by MassDOT Office of Transportation Planning (OTP), in designating "Critical Rural & Urban Freight Corridors". This exercise reaffirmed existing and also defined new major highway freight routes in the planning region connecting to the NHS. As requested by MassDOT OTP, staff completed the process of identifying (reaffirming in many cases) primary highway freight routes throughout the region, delineating between those roadways in the urban and rural areas. As part of this exercise, the region also needed to meet MassDOT OTP-allocated mileage parameters established for each of the state's planning regions. The CMMPO region was allocated six (6) urban miles and 23 rural miles.

As shown in **Figure 6**, there are portions of two (2) Critical Rural Freight Corridors within the West subregion. They are located within the communities of East Brookfield, New Braintree, and Spencer. The first Critical Rural Freight Corridor designated by the CMMPO is Route 49, between the CSX Railroad bridge in Spencer to the Interstate 90 (Massachusetts Turnpike) bridge in Sturbridge. The New England Automotive Gateway (NEAG) intermodal site is strategically located adjacent to Route 49, just south of Route 9. The second Critical Rural Freight Corridor is along Route 67 and Route 32, from Ravine Road in New Braintree to Route 122 in Barre. Only a small of this Rural Corridor is included in the West subregion, within the town of New Braintree.





Legend

- Critical Rural Freight Corridor
- Interstate
- US Highway
- State Route
- Other Major Roads
- West Subregion Towns

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FIGURE 6 - WEST SUBREGION CRITICAL RURAL FREIGHT CORRIDORS

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 06_CMRPC West SubRegion_Critical Freight Corridors.mxd

2.2 Transportation Improvement Program (TIP) Projects

The TIP is a federally-required planning document that lists all highway, bridge, transit, bicycle & pedestrian, and intermodal projects in the CMMPO's planning region that are programmed to receive federal-aid funding. Projects that improve air quality and safety are included in the TIP as well as projects of regional & statewide significance. Non federal-aid (NFA) projects, fully funded by the state, are also included for information purposes. Well aware of limited statewide transportation funding resources, the CMMPO's annual program of projects must demonstrate financial constraint within the federal-aid funding targets provided by MassDOT OTP.

Table 3 lists the West subregion's TIP projects that are programmed in the federal fiscal years 2022 – 2026. As can be seen in the table, there are seven (7) projects programmed for federal-aid funding in the West subregion. In FFY 2023, there is a project in the town of New Braintree to reconstruct Ravine Road and Hardwick Road as well as two projects in the town of Spencer, one to rehabilitate Meadow Road (a roadway that serves as a connector between Route 9 and Route 31) and the second to replace the Route 31 bridge over the Seven Mile River. In FFY 2024, there is a TIP project in East Brookfield & Spencer to resurface Route 9 and another project in West Brookfield to both widen and resurface Route 9, Phase 1. The remaining two projects are in FFY 2025. One is in Hardwick/New Braintree to replace the Creamery Road bridge over the Ware River and the second is in West Brookfield, Phase 2 of the widening and resurfacing of Route 9.

Table 3
Current West Subregion TIP Projects

Central Mass Region Program

STIP: 2022 - 2026 (D)

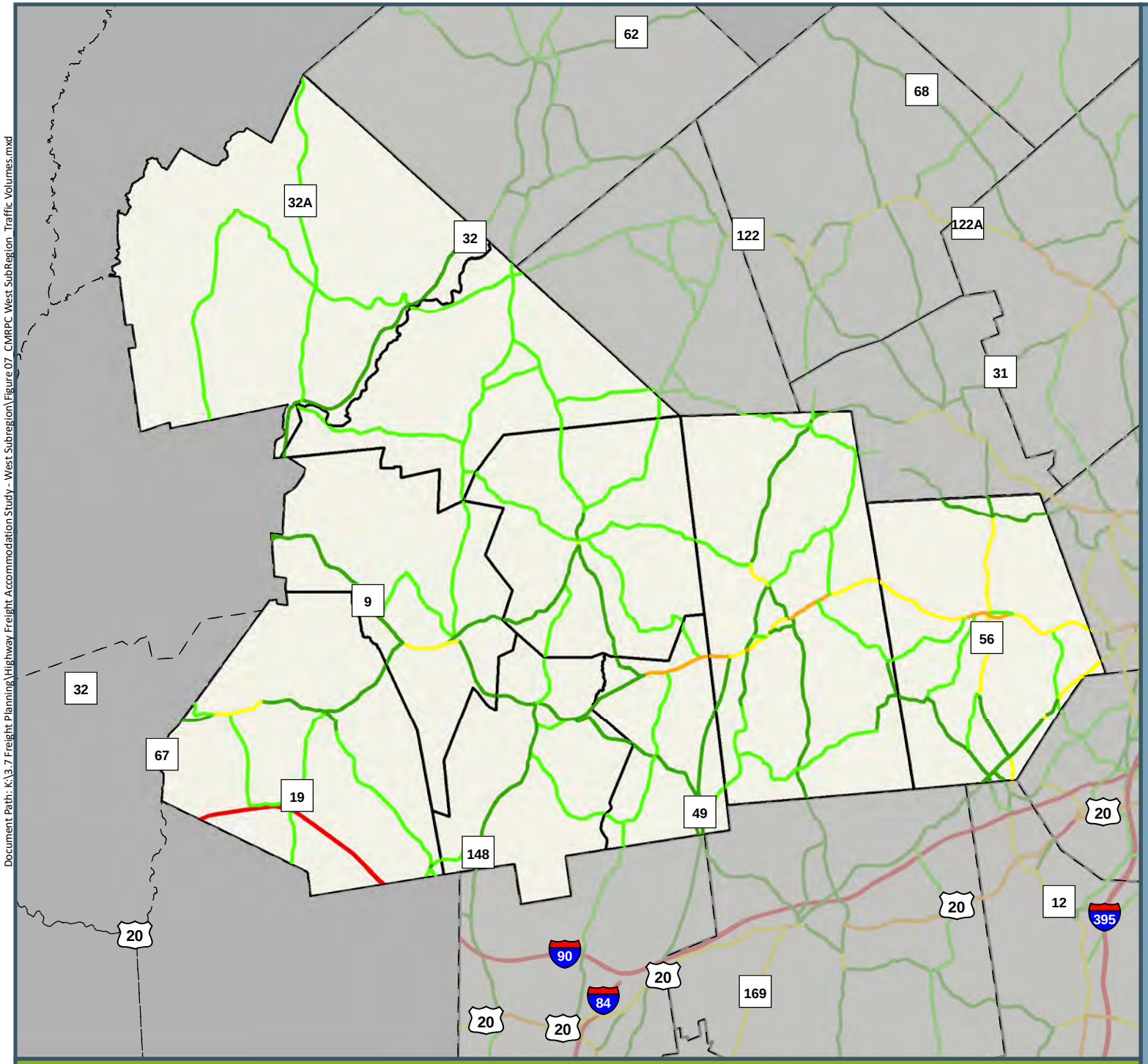
Program	MassDOT Project ID	MPO	Municipality	MassDOT Project Description	District	Funding Source	Total Programmed Funds	Federal Funds	Non-Federal Funds	Other Information
Federal Fiscal Year 2023										
Roadway Reconstruction	605035	Central Mass	New Braintree	NEW BRAINTREE- RECONSTRUCTION & IMPROVEMENTS ON RAVINE ROAD AND HARDWICK ROAD FROM HARDWICK T.L. TO ROUTE 67 (BARRE RD) (2.6 MILES)	2	STBG	$4,106,120	$3,284,896	$821,224	Construction, Total Project Cost = $4,106,120, PM Score = 8, Design Status = 100%, YOE = 4%
Roadway Reconstruction	608873	Central Mass	Spencer	SPENCER- ROADWAY REHABILITATION OF MEADOW ROAD	3	CMAQ	$2,500,000	$2,000,000	$500,000	Construction, CMAQ + STBG Total Project Cost = 9,164,351, PM Score = 16, Design Status = 25%, YOE = 4%
Roadway Reconstruction	608873	Central Mass	Spencer	SPENCER- ROADWAY REHABILITATION OF MEADOW ROAD	3	STBG	$6,664,351	$5,331,481	$1,332,870	Construction, CMAQ + STBG Total Project Cost = 9,164,351, PM Score = 16, Design Status = 25%, YOE = 4%
Bridge On-system Non-NHS	609179	Central Mass	Spencer	SPENCER- BRIDGE REPLACEMENT, S-23-012, NORTH SPENCER ROAD (ROUTE 31) OVER THE SEVEN MILE RIVER	3	STBG	$2,982,990	$2,386,392	$596,598	Construction, Total Project Cost = $2,982,990, Design Status = Approved, YOE = 4%
Federal Fiscal Year 2024										
Roadway Reconstruction	606517	Central Mass	West Brookfield	WEST BROOKFIELD- RESURFACING & RELATED WORK ON ROUTE 9, FROM WARE T.L. TO 850' WEST OF WELCOME ROAD (1.1 MILES - PHASE I)	2	STBG	$6,288,938	$5,031,150	$1,257,788	Construction, Total Project Cost = $6,288,938, PM Score = 10, Design Status = 75%, YOE = 8%
Non-Interstate Pavement	608814	Central Mass	Multiple	SPENCER- EAST BROOKFIELD- RESURFACING AND RELATED WORK ON ROUTE 9	3	NHPP	$8,488,638	$6,790,910	$1,697,728	Construction, Total Project Cost = $8,488,638, Design Status = Approved, YOE = 8%
Federal Fiscal Year 2025										
Roadway Reconstruction	609049	Central Mass	West Brookfield	WEST BROOKFIELD- RESURFACING & RELATED WORK ON ROUTE 9, FROM 850' WEST OF WELCOME ROAD TO PIERCE ROAD (1 MILE - PHASE II)	2	STBG	$6,339,525	$5,071,620	$1,267,905	Construction, Total Project Cost = $6,339,525, PM Score = 11, Design Status = 25%, YOE = 12%
Bridge Off-system	608851	Central Mass	Multiple	HARDWICK- NEW BRAINTREE- BRIDGE REPLACEMENT, H-08-003=N-07-002, CREAMERY ROAD OVER WARE RIVER	2	STBG-BR-Off	$2,422,150	$1,937,720	$484,430	Construction, Total Project Cost = $2,422,150, Design Status = 25%, YOE = 12%

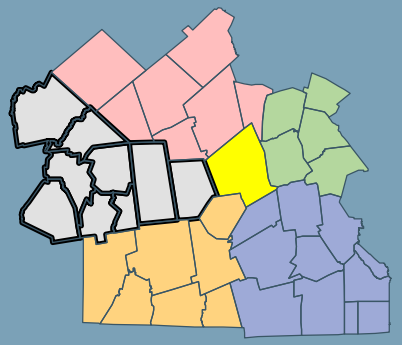
2.3 Traffic Volumes & Truck Percentages

CMRPC conducts mechanical traffic counts on numerous federal-aid highways within the Central Massachusetts planning region. The Automatic Traffic Recorders (ATRs) can collect volume data as well as vehicle classification data. Classification data is separated into 13 categories, established by FHWA, in which more than half of the categories can be considered a heavy vehicle. Heavy vehicle data is only available between the years 2016 and 2020. As such, some of the federal-aid highways monitored by the planning staff have no vehicle classification data at this time. The most current 24-hour traffic volume data available for the federal-aid highways in the West subregion are shown on the following maps.

Figure 7 shows the traffic volumes on the federal-aid highways within the West subregion. The majority of roadways consist of volumes below 7,500 vehicles per day (VPD). Interstate 90 (Massachusetts Turnpike) is the only roadway that carries more than 30,000 VPD. Route 9 is the only highway within the study scope that accommodates more than 15,000 VPD, specifically in East Brookfield, Spencer, and Leicester. Multiple segments of Route 9, Route 31, Route 56, and Route 67 and a few other major roadways carry over 7,500 VPD.

Figure 8 shows heavy vehicle volumes based on the thickness of the red line. The thicker the line, the higher the observed heavy vehicle volumes. Only sections of Route 9 in the towns of East Brookfield, Spencer, and West Brookfield as well as a portion of Route 56 in the town of Leicester have heavy vehicle volumes exceeding 1,000 VPD. Similar to the previous figure, **Figures 9 and 10** also show heavy vehicle volumes by direction of travel. The first map shows daily heavy vehicle volumes for the northbound and eastbound directions. The second map shows daily heavy vehicle volumes for the southbound and westbound directions. As can be seen, the heavy vehicle volumes are color-coded in four categories based on volume totals. In addition to volumes, **Figure 11** shows heavy vehicle volume percentages in the West subregion. Percentages are also separated into four categories, with the color red being the highest (>14%). The majority of highways where vehicle classification data is available range between 5% and 14% heavy vehicles. There are segments on Route 9 in East Brookfield & Spencer, Route 31 in Spencer, and Route 56 in Leicester that exhibit heavy vehicle percentages over 14%.





Legend

- West Subregion Towns
- < 2,500
- 2,500 - 7,499
- 7,499 - 14.999
- 14,999 - 30,000
- > 30,000

N

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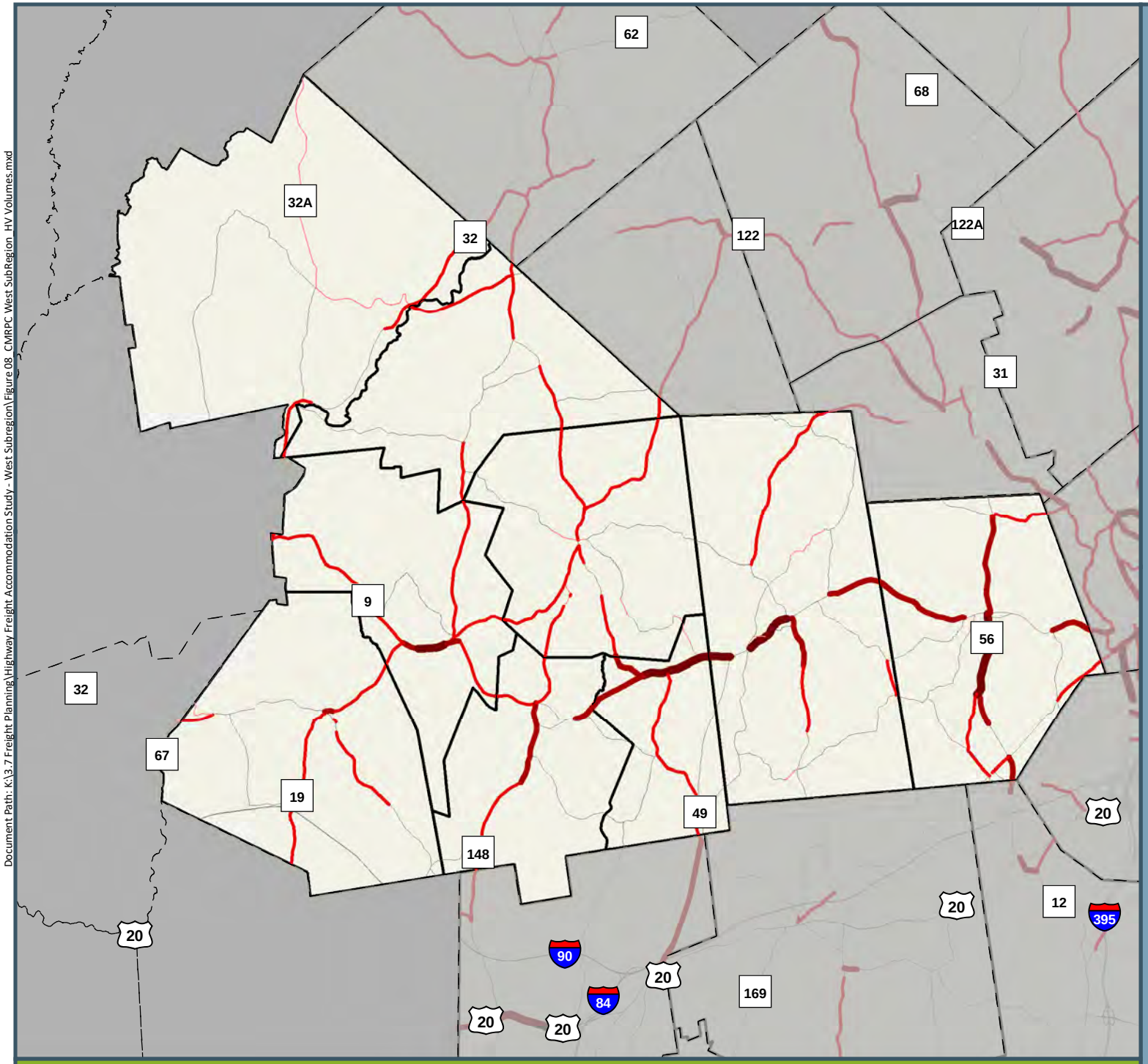
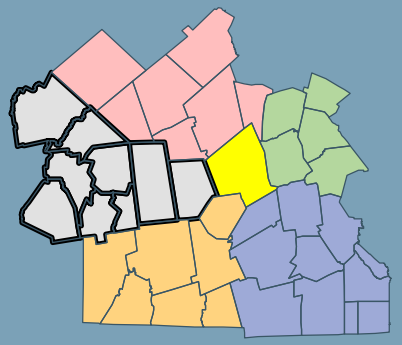
Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 07_CMRPC West SubRegion_Traffic Volumes.mxd

FIGURE 7 - WEST SUBREGION TRAFFIC VOLUMES





Legend

- West Subregion Towns
- 1 - 100
- 101 - 500
- 501 - 1,000
- > 1,000
- No Data

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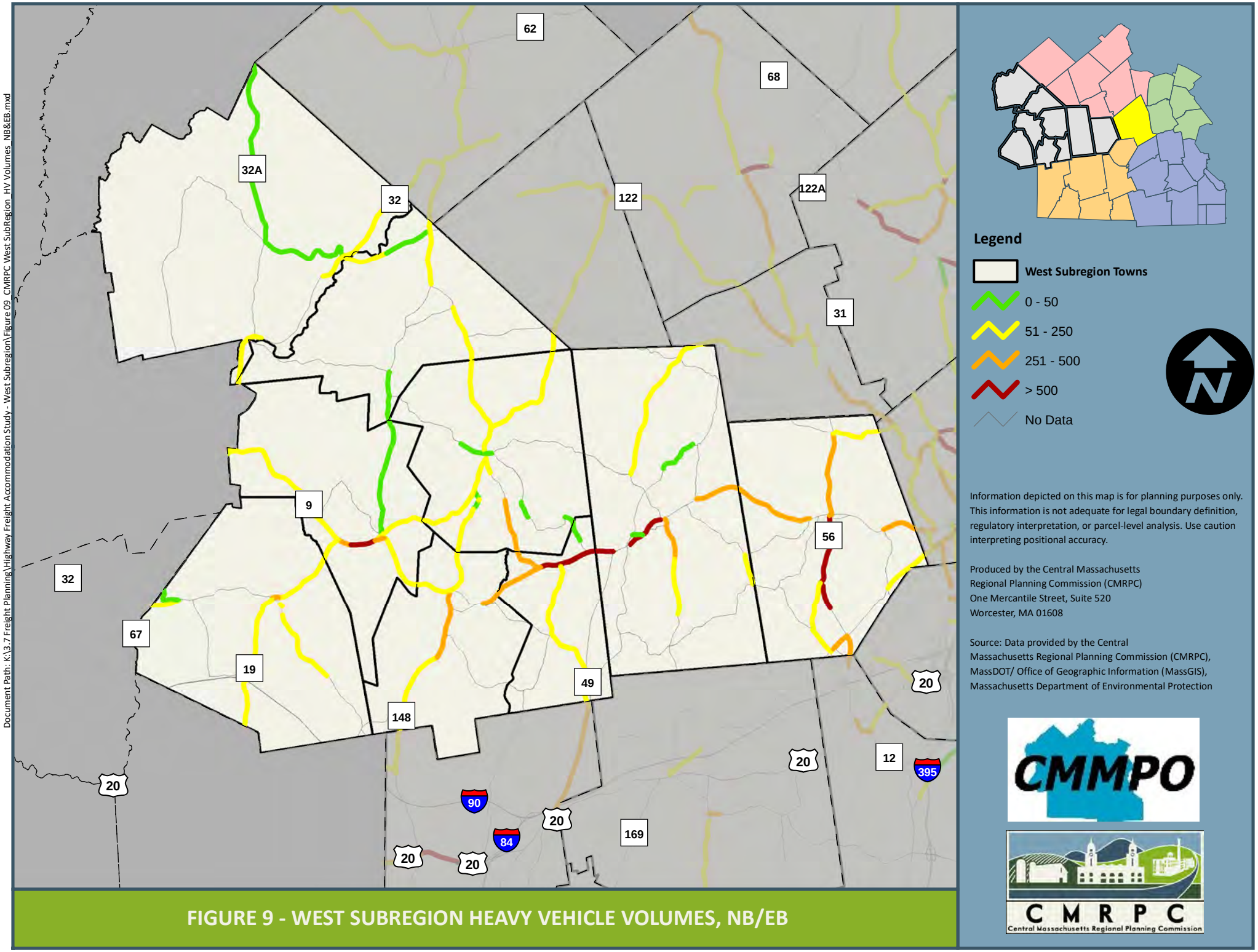
Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 08_CMRPC West SubRegion_HV Volumes.mxd

FIGURE 8 - WEST SUBREGION HEAVY VEHICLE VOLUMES



Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 09_CMRPC West SubRegion_HV Volumes_NB&EB.mxd

FIGURE 9 - WEST SUBREGION HEAVY VEHICLE VOLUMES, NB/EB

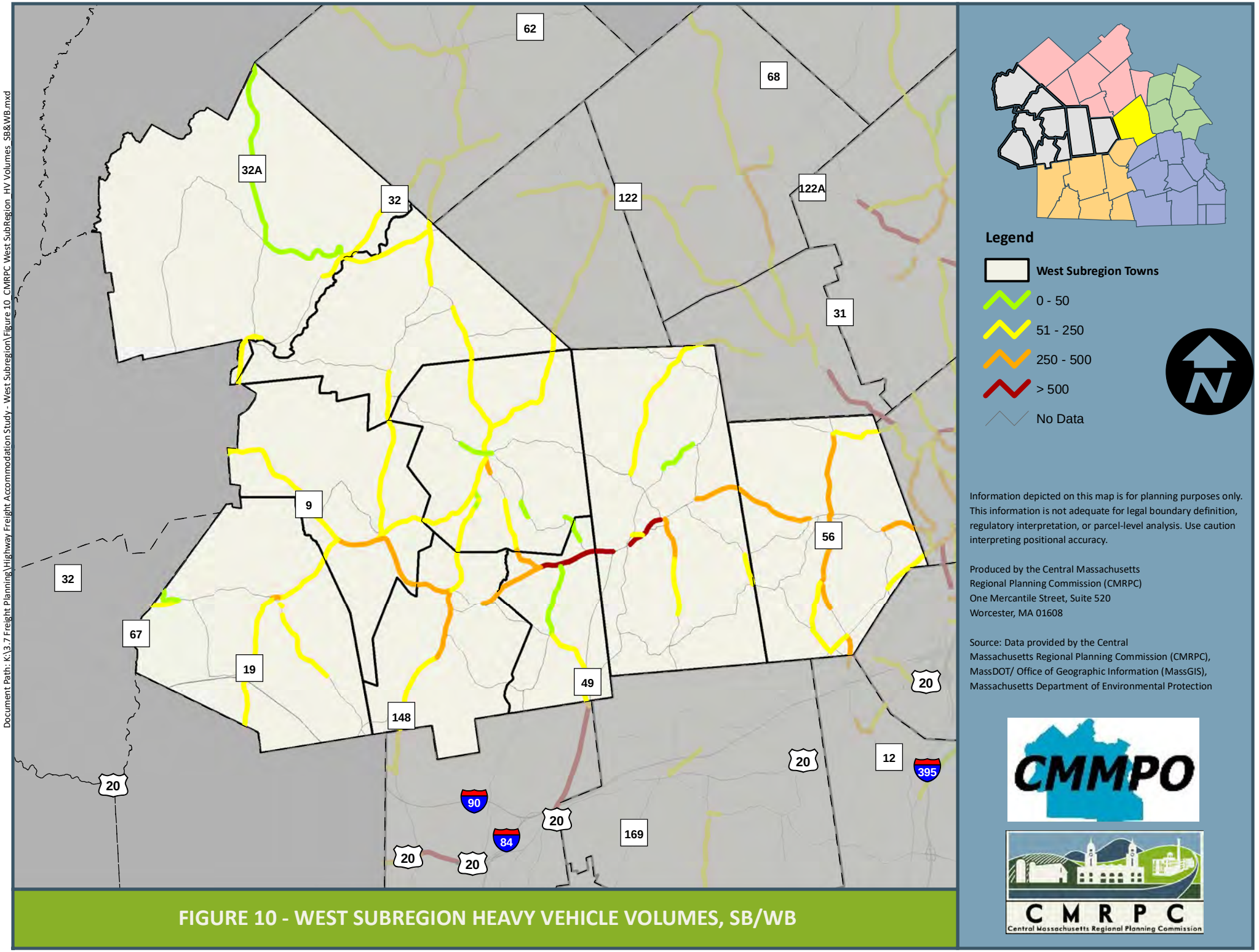


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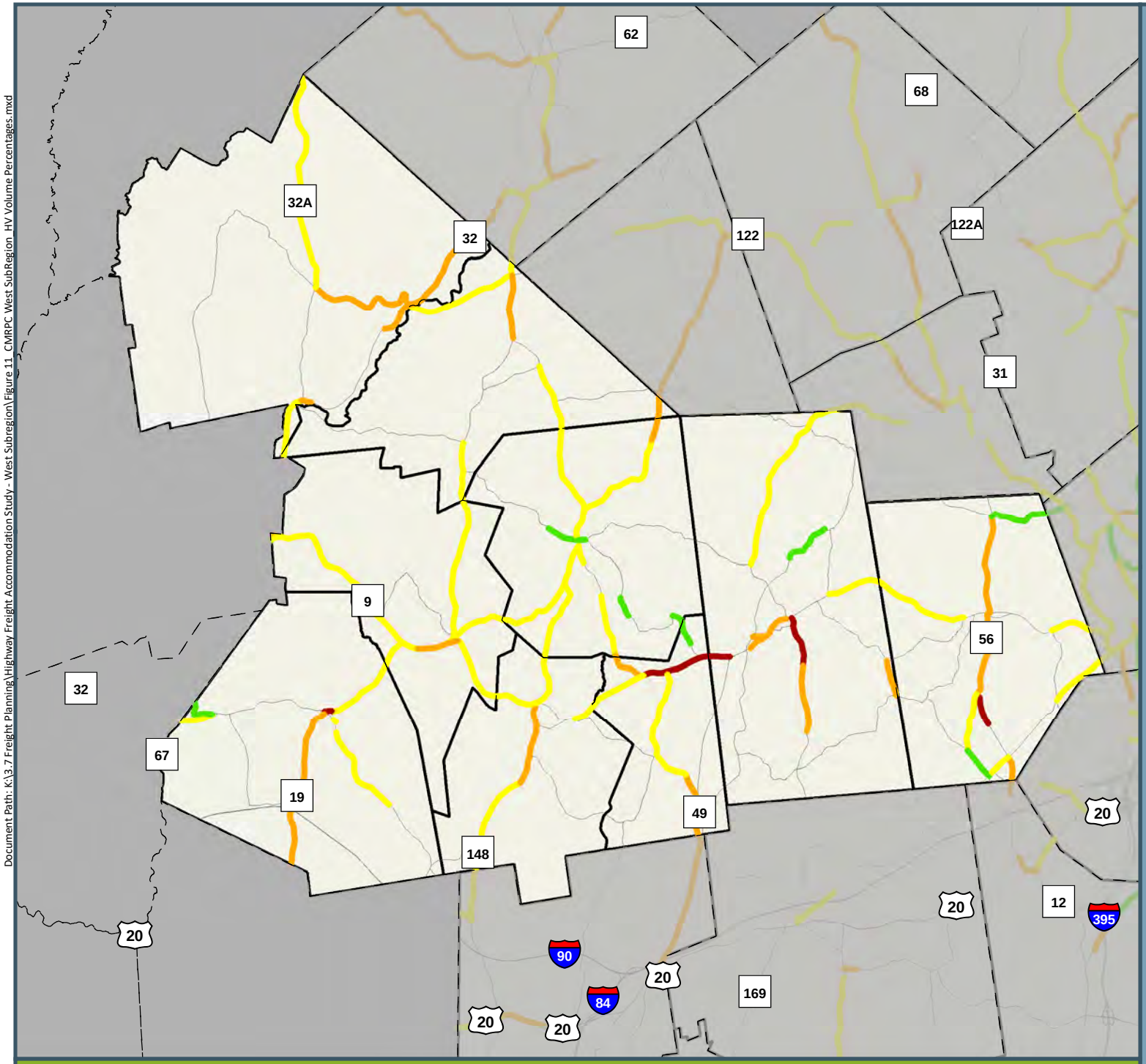
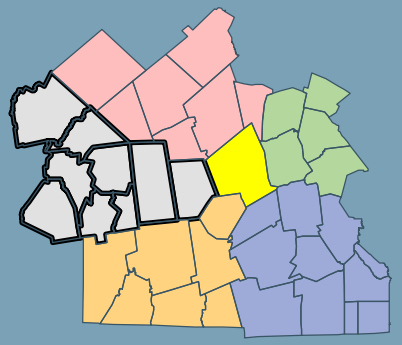
FIGURE 10 - WEST SUBREGION HEAVY VEHICLE VOLUMES, SB/WB





Legend

- West Subregion Towns
- 2.00% - 4.99%
- 5.00% - 8.99%
- 9.00% - 13.99%
- > 14.00%
- No Data

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Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 11_CMRPC West SubRegion_HV Volume Percentages.mxd

FIGURE 11 - WEST SUBREGION HEAVY VEHICLE VOLUME PERCENTAGES

3.0 Host Community Management Systems Information

This section discusses the Management Systems data & analyses that is used for this study. Management Systems data includes congestion data such as highway travel speeds and intersection delays, safety data, pavement condition, traffic volumes and bridge conditions. These types of data are considered separately, but are also analyzed together within a data integration exercise, summarized at the end of this section. Knowing those highways that have multiple identified deficiencies greatly assists in the decision-making process concerning which segments to potentially improve first while also simultaneously addressing a range of identified issues.

3.1 Congestion Management Process (CMP)

A CMP is an accepted, systematic approach for managing network congestion that provides accurate and current information on transportation system performance and assesses alternate strategies for congestion management that meet both state and local needs. As defined in federal regulation, a planning region's CMP should provide for safe and effective integrated management and operation of the multimodal transportation system. There are eight (8) recommended actions taken within a CMP, as follows:

1) Develop regional objectives
2) Define the CMP network
3) Develop multimodal performance measures
4) Monitor and collect data
5) Analyze congestion problems and needs
6) Identify and assess strategies
7) Program and implement strategies, and
8) Evaluate strategy effectiveness.

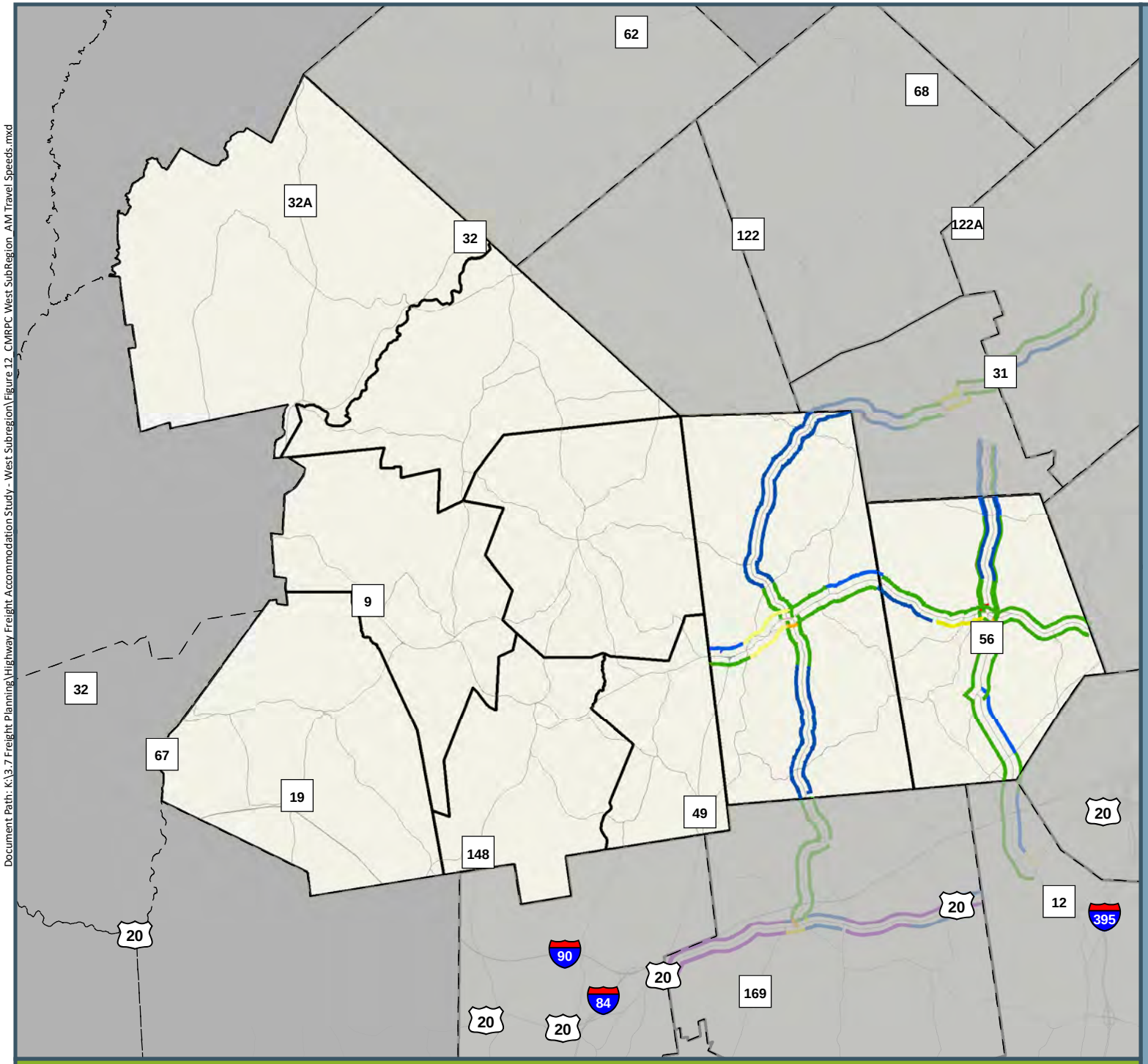
The CMP data included in this section are from both Travel Time & Delay studies and Turning Movement Counts (TMCs) conducted in the field.

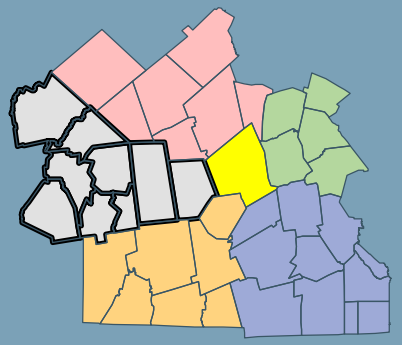
Roadway Segment Travel Speeds

In order to measure congestion on the planning region's highway facilities, Travel Time & Delay studies are periodically conducted on identified CMP focus roadway segments. Data is collected between 7:00 AM and 9:00 AM and from 4:00 PM to 6:00 PM on a single randomly-selected weekday. In addition to determining average highway travel speeds, Travel Time &

Delay studies on a particular roadway segment assist in the identification of critical vehicle delay locations as well as length of encountered delays. The "average car" technique is used to collect this data. In this procedure to collect this data, a test vehicle travels according to the driver's judgement of the average speed of existing traffic flows. A Global Positioning System (GPS) device allows for the automated collection of the travel time data.

The following two maps, **Figures 12 and 13**, show average travel speeds for the West subregion in the AM and PM peak hours. Travel speeds are separated into six (6) categories and have been assigned different colors. The observed travel speeds are shown for both directions. Travel time data was available for the host communities of Leicester and Spencer. No data was available for the towns of Brookfield, East Brookfield, Hardwick, New Braintree, North Brookfield, Warren or West Brookfield at this time. In Leicester, the entire length of Route 9 and Route 56 was studied. Similarly, the entire length of both Route 9 and Route 31 in Spencer was also studied. As shown in both maps, most observed travel speeds range between 30 MPH and 49 MPH.





Legend

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

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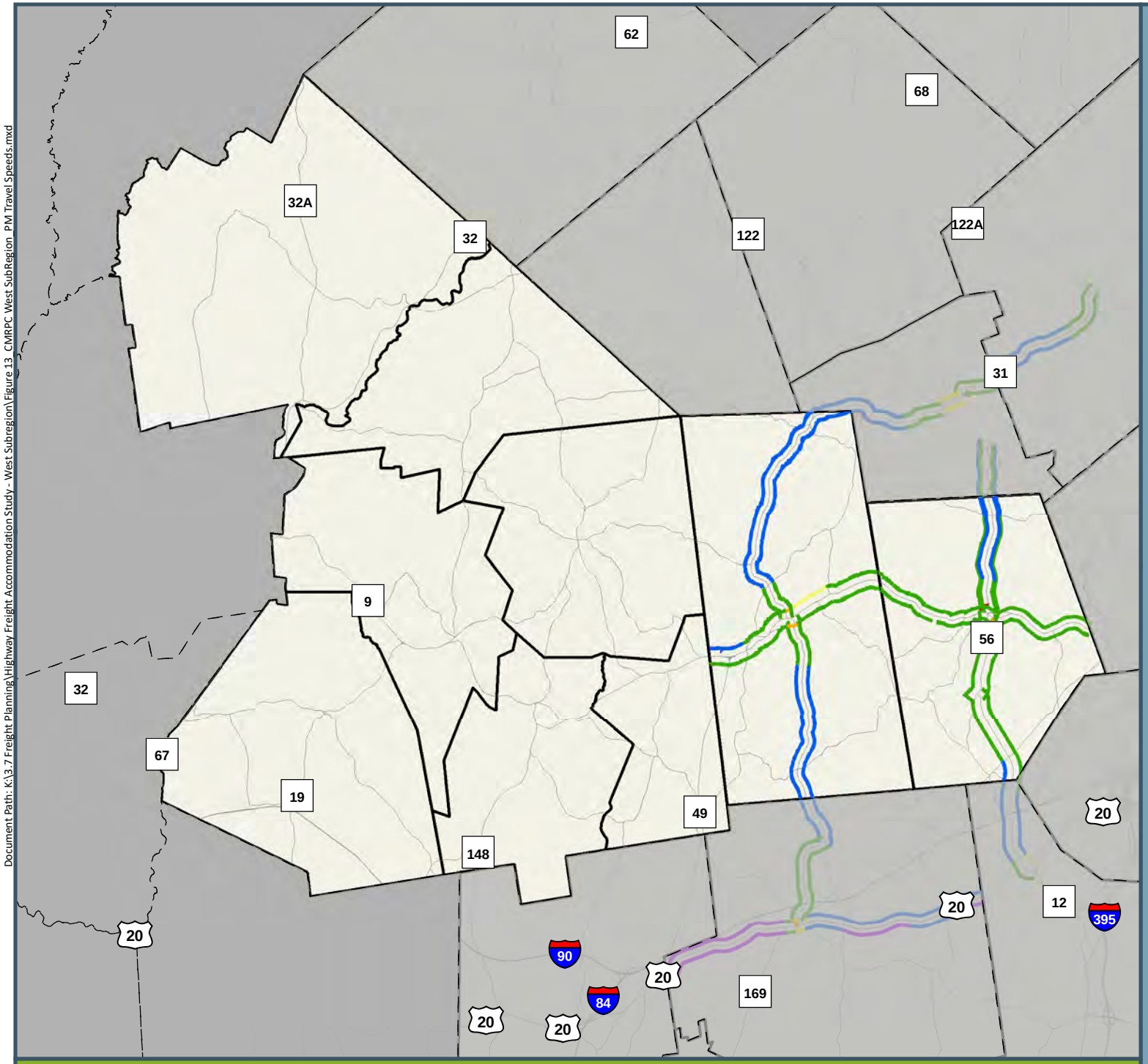
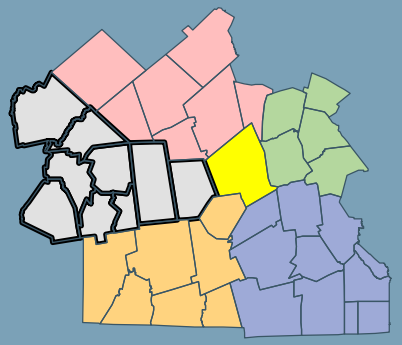
Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 12_CMRPC West SubRegion_AM Travel Speeds.mxd

FIGURE 12 - WEST SUBREGION OBSERVED AM PEAK HOUR TRAVEL SPEEDS





Legend

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

N

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Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 13_CMRPC West SubRegion_PM Travel Speeds.mxd

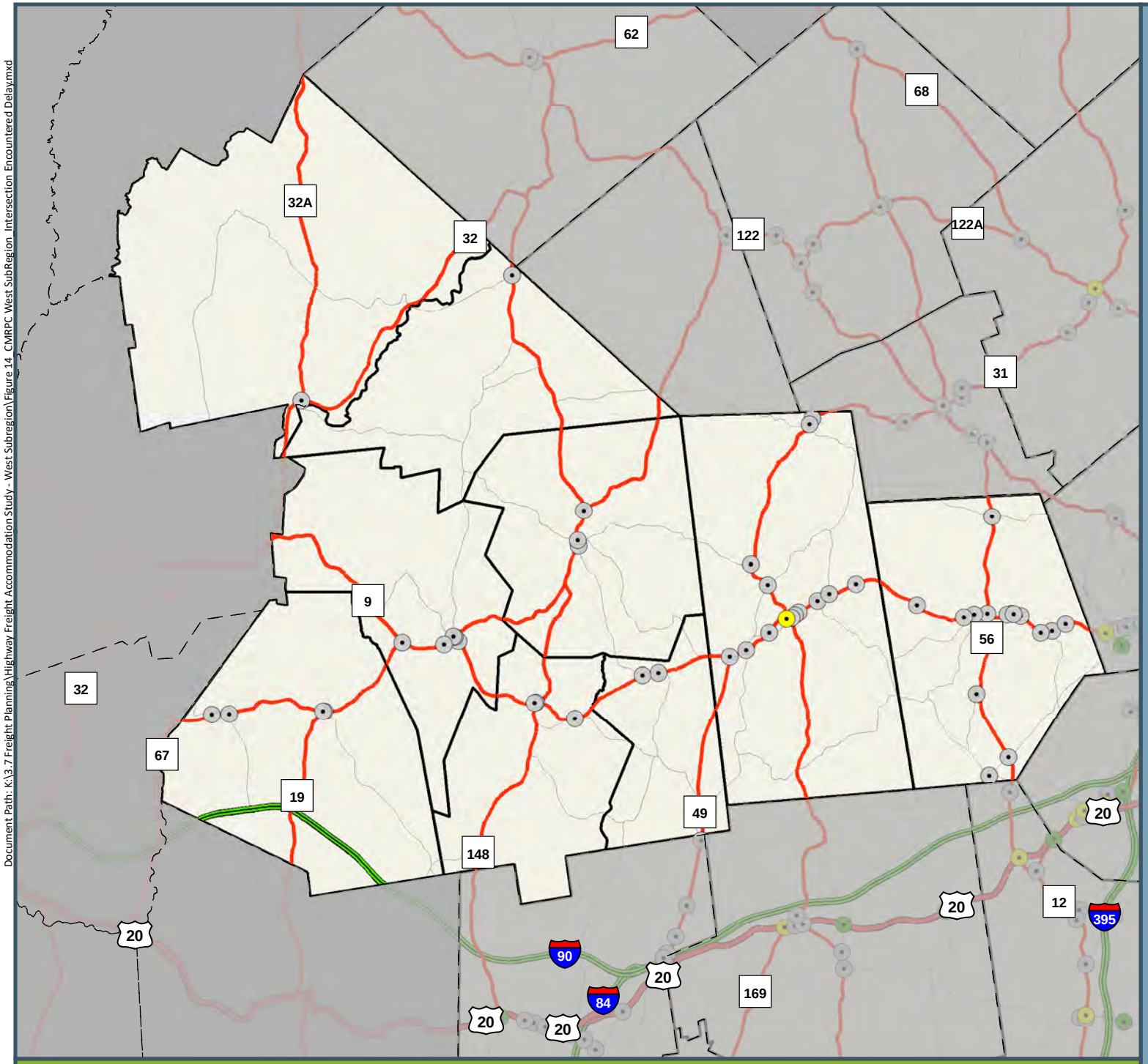
FIGURE 13 - WEST SUBREGION OBSERVED PM PEAK HOUR TRAVEL SPEEDS

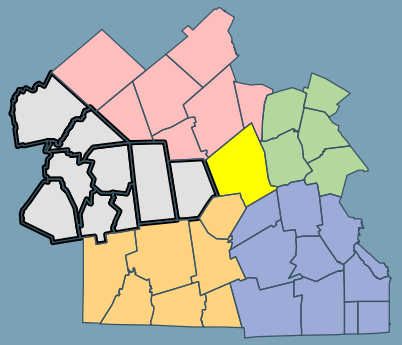
Intersection Encountered Delays

For all intersections where (TMCs) are obtained, it is possible to analyze the total delay encountered during the examined peak hour travel periods. A byproduct of the process that results in intersection Level-of-Service (LOS) ratings is the "average delay encountered for entering vehicles". When multiplied by the number of vehicles to which the particular delay pertains, one can arrive at a total amount of delay, or 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 calculated delays of varying levels on all approaches . "STOP" sign-controlled intersections have delay calculated only for those vehicles arriving on the minor approaches that are required to stop as well as those vehicles on the major approaches waiting in order to make a left turn. Generally, signalized intersections often exhibit more total delay, however, a busy stop-controlled location (that may not presently meet the warrants for signalization) can exhibit substantial delays if volumes on both minor approaches predominately seek to cross the major approaches. Traffic signals establish orderly traffic flows and increase safety by providing the opportunity for traffic volumes 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. Once intersection traffic signal operations are optimized, geometric improvements could potentially be considered, such as the addition of exclusive and/or shared turning lanes.

All nine (9) of the West subregion communities have at least one critical intersection that was analyzed. Data has been collected for these intersections from 2010 to the present. If a location was counted multiple years, then the most recent data was used. **Figure 14** shows the West subregion's identified critical intersections in five categories. All of the intersections are within the lowest category, which have less than 1,525 "car-minutes" of total delay.





Legend

West Subregion Towns

TotalDelay in Minutes

- 7 - 1,525
- 1,525 - 2,500
- 2,500 - 7,500
- 7,500 - 10,000
- > 10,000

N

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FIGURE 14 - WEST SUBREGION ENCOUNTERED DELAY AT CRITICAL INTERSECTIONS

3.2 Safety Management System (SMS)

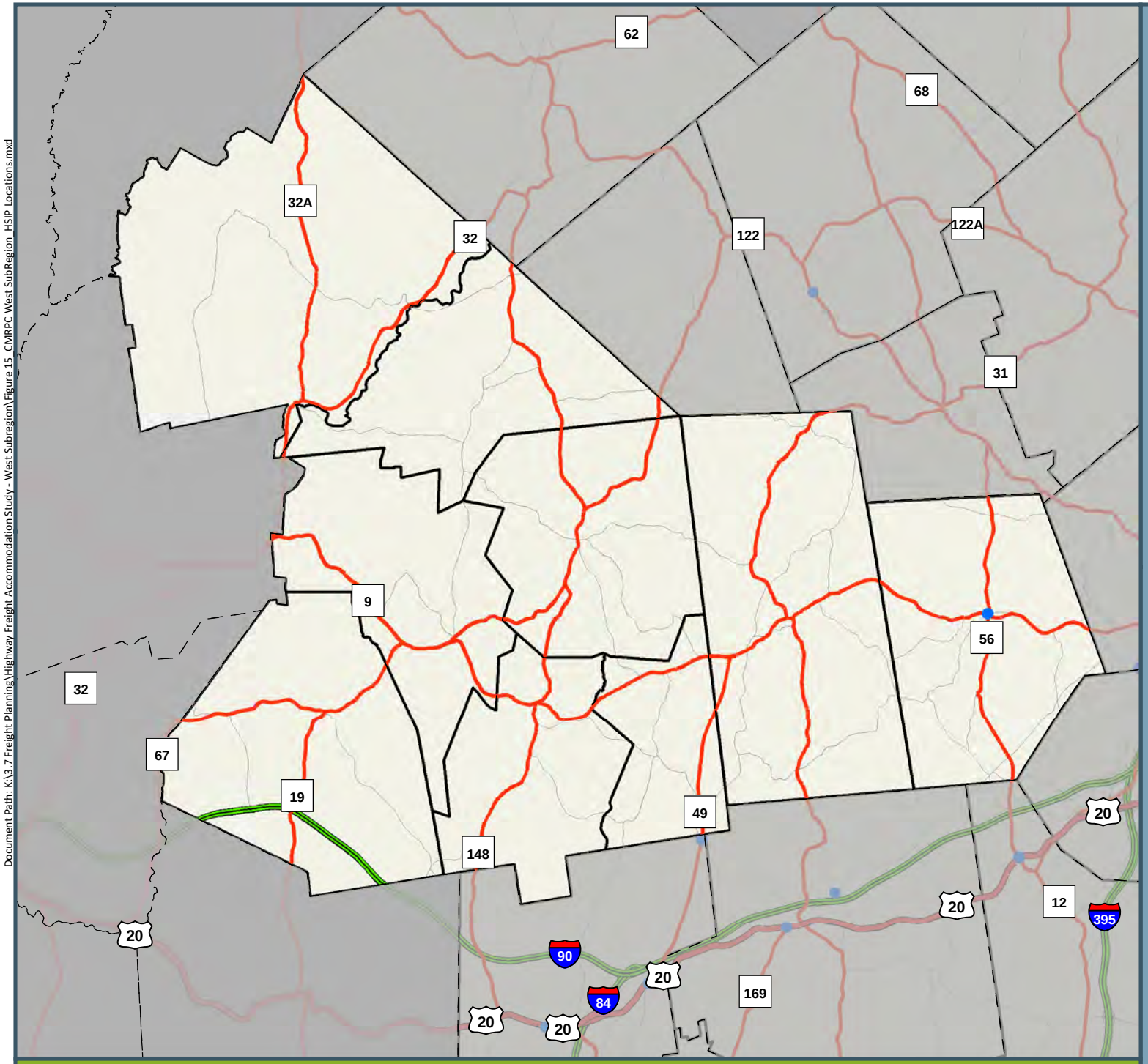
Vehicle crash data is provided from MassDOT through their web-based crash report tool "IMPACT". MassDOT's Registry of Motor Vehicles (RMV) branch provides the crash records incorporated into the IMPACT website. Notably, a quality control analysis is conducted on all crash records. Besides individual crashes, "crash clusters" that are indicative of numerous reported incidents are also identified for vehicles, bicycles and pedestrians.

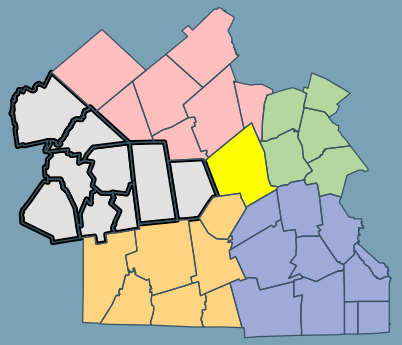
Highway Safety Improvement Program (HSIP) Locations

The purpose of FHWA's HSIP is to reduce the number of fatal and serious injury vehicle crashes by targeting high vehicle crash locations and causes on all public roads. Projects using HSIP funding are required to be data-driven, strategic approaches to improving highway safety that focus on system performance. An overarching requirement is that federal-aid HSIP funds must be used for safety projects that are consistent with MassDOT's established Strategic Highway Safety Plan (SHSP). Such projects are meant to address identified highway safety problems by correcting or improving a hazardous roadway location or feature.

An HSIP-eligible crash cluster is one in which the total number of Equivalent Property Damage Only (EPDO) crashes are within the top 5% in the planning region. The EPDO is a method of combining the number of crashes along with the severity of those crashes based on a weighted scale. Prior to 2016, the weighting factors used were as follows: a fatal crash was worth 10, an injury crash was worth 5 and a property damage-only crash was worth 1. Beginning in 2016, the weighting factors were updated so that fatal and injury crashes are now both worth 21 while a property damage-only crash continues to be worth 1.

As shown in **Figure 15**, there is only one (1) HSIP crash cluster in the West subregion. The crash cluster is located in the town of Leicester at the intersection of Route 9 & Route 56 and had a total of 16 reported crashes between 2015 - 2017. Of the 16 crashes, 10 caused property damage-only and six (6) caused injuries. The total EPDO for this cluster is 136.





Legend

- West Subregion Towns
- HSIP Eligible Crash Clusters
- Interstate
- US Highway
- State Route
- Other Major Roads

N

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FIGURE 15 - WEST SUBREGION HSIP ELIGIBLE CRASH CLUSTERS (2015-2017)

3.3 Pavement Management System (PMS)

Pavement management is an asset management system designed to assist decision-makers in determining the most cost-effective strategies to address poor or failing roadway conditions. In general, a successful PMS defines a roadway network, identifies the condition of each segment of the network, develops a list of needed improvements, and balances those needs with the available resources of the party responsible (local, state or federal) for maintaining the defined roadway network. CMRPC uses *Cartegraph*, a software package developed and supported by Cartegraph Systems Incorporated, for the CMMPO's ongoing pavement management program to assess overall pavement condition in the planning region.

Pavement data has been collected on all federal-aid eligible roadways by conducting "windshield surveys." A team of two CMRPC representatives inspect each roadway segment, taking note of the severity and extent of the following pavement distresses:

- Potholes
- Distortions
- Alligator Cracking
- Transverse and Longitudinal Cracking
- Block Cracking
- Rutting
- Bleeding/Polished Aggregate
- Surface Wear and Raveling
- Corrugations, Shoving, and Slippage

Based on the field-observed pavement distresses, an Overall Condition Index (OCI) was calculated for each surveyed roadway segment. The OCI is used to rate each segment on a scale of 0 to 100. An OCI of 100 indicates optimal pavement conditions, usually a newly paved roadway segment. Conversely, a score of 0 indicates that a roadway has failed entirely and is likely impassable for an average passenger vehicle. Starting at the top index rating of 100, the OCI is calculated by subtracting a series of deduct values, each associated with the severity and extent of the various pavement distresses listed above. The resulting OCI is a quantified rating of observed pavement condition.

Depending on the OCI score, *Cartegraph's* recommended action category definitions are as follows:

- Do Nothing (OCI 100 – 88) – used when a road is in relatively perfect condition and prescribes no maintenance.

- Routine Maintenance (OCI 88 – 68, good condition) – 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, localized repair, or minor localized leveling.
- Preventative Maintenance (OCI 68 – 48) – used on roads in fair condition that have a 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.
- Structural Improvement (OCI 48 – 24) – used on poor roads 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 planning and overlay, and hot in-place recycling.
- Base Rehabilitation (OCI 24 – 0) – used for very poor roads that exhibit weakened pavement foundation base layers. Complete reconstruction and full-depth reclamation are indicated.

Figure 16 shows the pavement condition on the federal-aid highways in the West subregion. As shown on the map, all roadways have been analyzed with the exception of Interstate 90 (Massachusetts Turnpike), which is the exclusive responsibility of MassDOT. Many of the communities in the West subregion, eight (8) out of nine (9), have roadway segments observed to be in "poor" or "very poor" condition. Overall, most of the roadways in the West subregion were determined to be in "fair" condition or better.

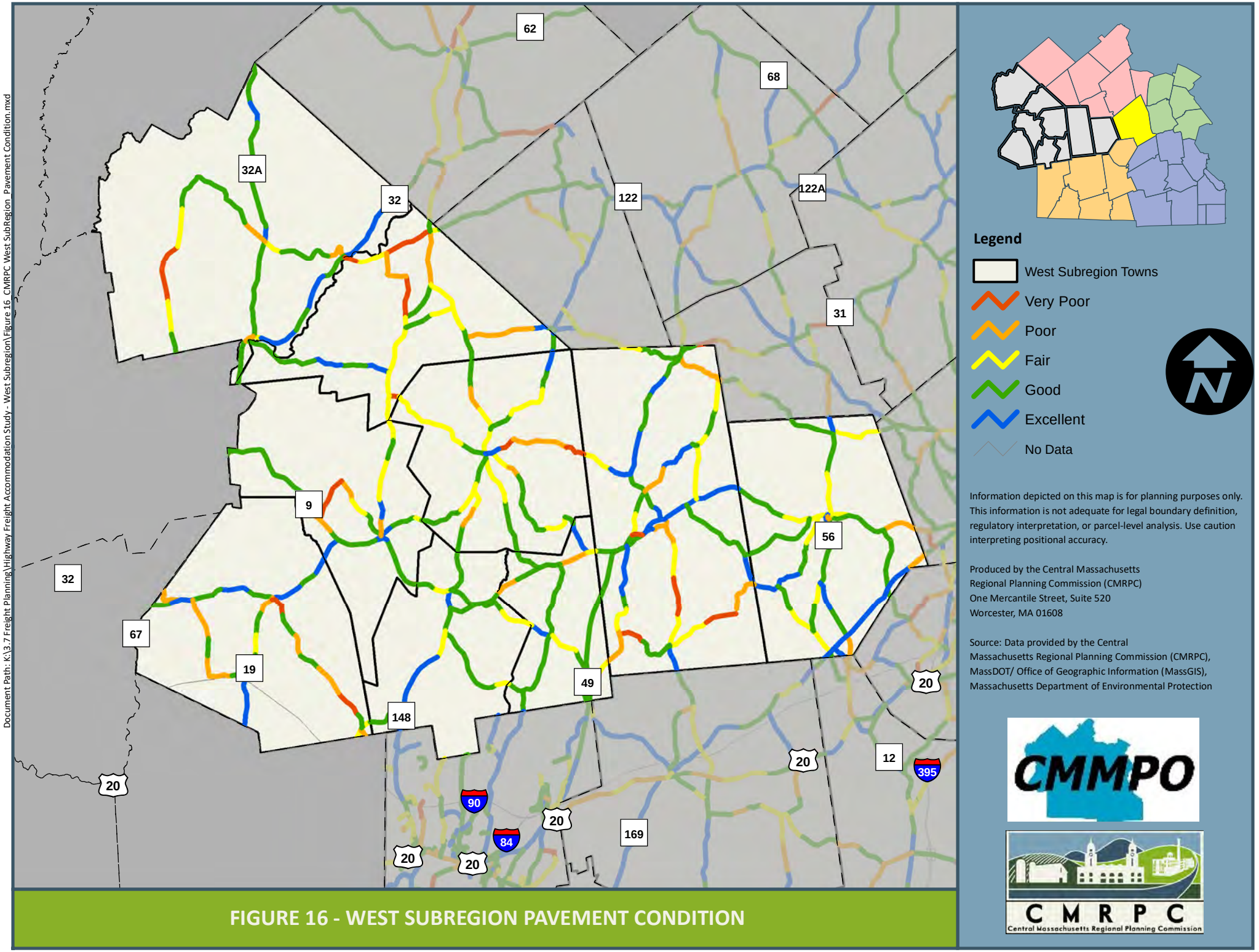

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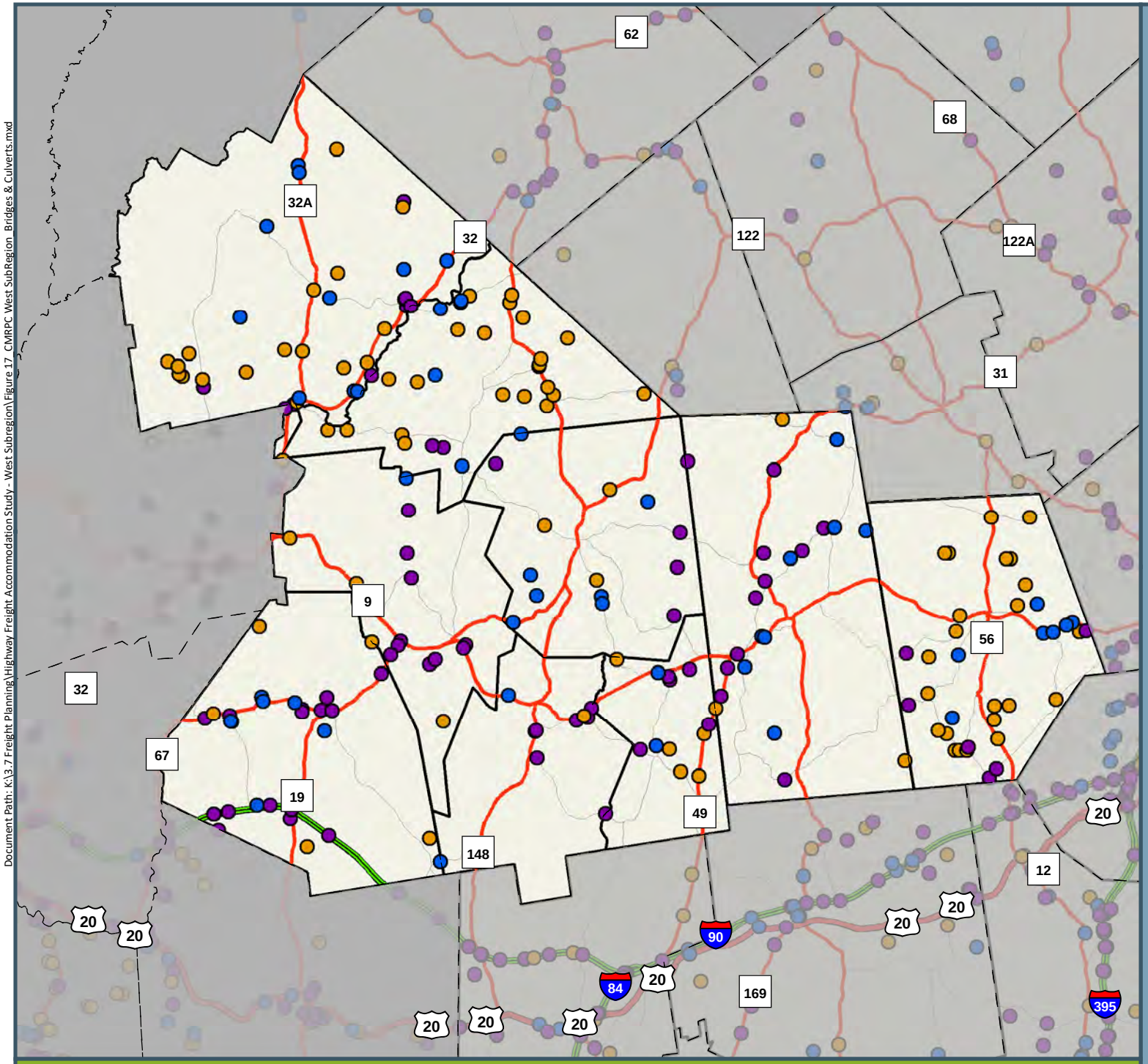
FIGURE 16 - WEST SUBREGION PAVEMENT CONDITION

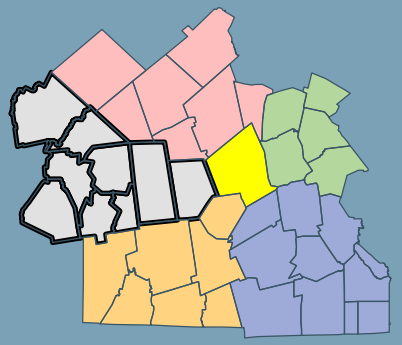
3.4 Bridge Management System (BMS) and Culverts

Figure 17 contains bridge data from the MassDOT – Highway Division Bridge Inspection Management System (BIMS). The types of structures included in the BIMS are:

- MassDOT Highway and municipally-owned structures with spans greater than 20 feet. These are categorized as National Bridge Inventory (NBI) structures. MassDOT inspects NBI bridges on a biannual basis.
- MassDOT Highway and municipally-owned short span bridges with spans between 10 and 20 feet. *The first complete inspection of the short span bridge inventory is currently in progress.*
- MassDOT Highway and municipally-owned culverts with spans of 4 to 10 feet. *This category is incomplete and an inventory effort is currently underway.*

There are a total of 203 bridges and culverts in the West planning subregion. 52 of the total bridges and culverts are on State Numbered Routes. There are 11 structures that are considered Structurally Deficient. 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. The host communities of Hardwick and Leicester have the most structures, each with a total of 36. There are 11 on State Numbered Routes in Hardwick and five (5) on State Numbered Routes in Leicester. The community that has the third most structures is the town of New Braintree with a total of 30, five (5) on State Numbered Routes.





Legend

- West Subregion Towns
- Bridge (NBI)
- Short Span Bridge
- Culvert
- Interstate
- US Highway
- State Route
- Other Major Roads

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FIGURE 17 - WEST SUBREGION BRIDGES AND CULVERTS

3.5 Management Systems Data Integration

Potential priorities for the West subregion have been screened using a Management Systems approach, resulting in the identification of a number of highway segments that demonstrate the greatest need for improvement. The highway segments used in the integration analyses are based on staff's previously-defined pavement data collection segments. These segments are usually less than one-mile in length and are between two selected minor streets. All available data were analyzed based on these defined segments. The Management Systems integration approach combines the data related to congestion, safety, traffic volume, pavement condition, freight movement, intersection delays, and bridges to define "hot spots" within the West subregion. The Management Systems data was analyzed to create corresponding scores based on pre-determined criteria. **Table 4** shows the scoring method used for the highway segments.

Table 4 – Management Systems Analysis Scoring Criteria

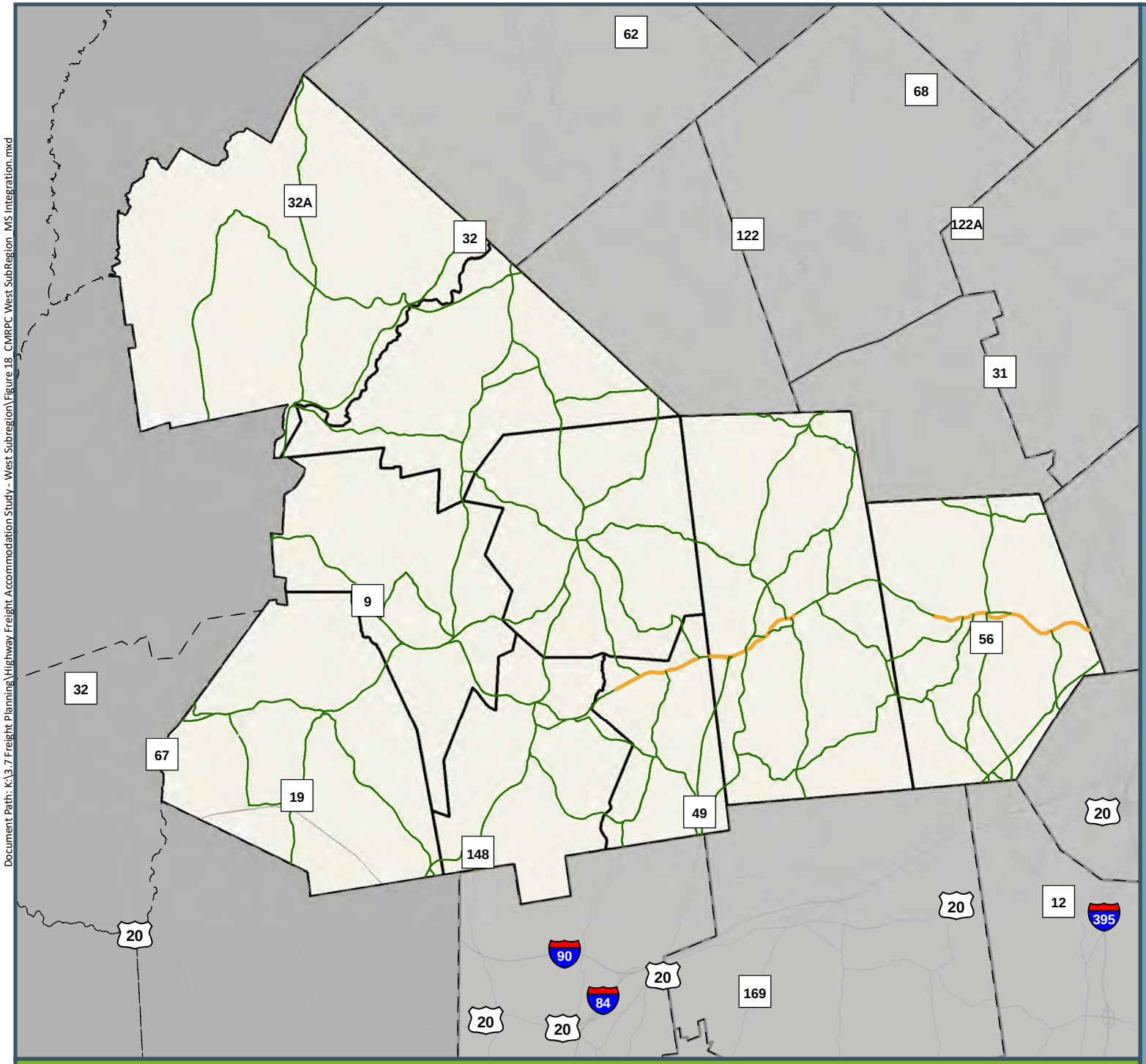
Management System	Type of Data Used	Scoring Criteria	Points
Congestion	CMRPC Travel Demand Model	Segment is Congested	5 points
		Segment is not Congested	0 points
Safety	MassDOT Crash Data (2015-2017)	Segment has a Fatality	5 points
		Segment has an Injury	3 points
		Segment has a Property Damage-Only Crash	1 point
Traffic Volume	CMRPC Traffic Count Data	>20,000 VPD	5 points
		10,000 – 20,000 VPD	3 points
		<10,000 VPD	1 point
Pavement Condition	CMRPC Pavement Data	Segment is rated Very Poor	5 points
		Segment is rated Poor	3 points
		Segment is rated Fair	1 point
Freight	CMRPC Traffic Count Data	>1,000 Heavy Vehicles Per Day	5 points
		500 – 1,000 Heavy Vehicles Per Day	3 points
Freight Routes	Critical Freight Corridors	Segment is a Defined Critical Freight Corridor	3 points
Intersection Delays	CMRPC TMC Data	>7,500 Minutes of Total Delay	5 points
		1,525 – 7,500 Minutes of Total Delay	3 points

Management System	Type of Data Used	Scoring Criteria	Points
		<1,525 Minutes of Total Delay	1 point
Bridges	MassDOT Bridge Data	Segment has a Structurally Deficient or Weight-Restricted Posted Bridge	3 points

Based on the above scoring criteria, **Figure 18** shows the highway segment Management System integration results in three (3) categories. Tier 1 segments are considered "high priority", Tier 2 segments are considered "medium priority", and Tier 3 segments are "low priority". As the map shows, there are no identified Tier 1 highway segments in the West subregion. Corresponding to the map, Tier 2 roadway segments scores are listed in **Table 5**. There are a total of ten (10) Tier 2 highway segments that have been identified in the West planning subregion. All segments are on Route 9 and within the communities of East Brookfield, Leicester and Spencer.

Table 5 – Management Systems Tier 2 Roadway Segments

Community	Roadway	From	To	Total Points
Spencer	Main St (9)	Olde Main St	Grove St	19
Spencer	Dewey St (9)	Meadow Rd	Olde Main St	18
Leicester	Main St (9)	Auburn St	Worcester CL	15
Leicester	Main St (9)	Waite St	Auburn St	15
East Brookfield	East Main St (9)	North Brookfield Rd	Cottage St	15
East Brookfield	East Main St (9)	Cottage St	Harrington St	14
Leicester	Main St (9)	Pleasant St (56)	Waite St	13
Leicester	Main St (9)	Burncoat St	Pleasant St (56)	13
Spencer	West Main St (9)	East Brookfield TL	Meadow Rd	13
East Brookfield	West Main St (9)	Oakland Dr	North Brookfield Rd	13



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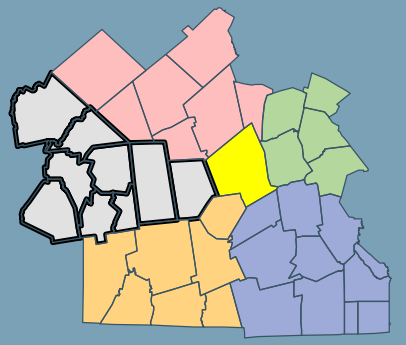

Legend

- Tier 3 = 1 - 12 points
- Tier 2 = 13 - 24 points
- Tier 1 = 25 - 36 points
- West Subregion Towns

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FIGURE 18 - WEST SUBREGION MANAGEMENT SYSTEMS DATA INTEGRATION

4.0 Other Major Considerations

This section of the *West Subregion Highway Freight Accommodation Study* covers a range of other considerations that assist in the decision-making process of where to potentially apply future-year federal-aid improvement funding. Following federal Performance Management requirements, Truck Travel Time Reliability (TTTR) in the planning region is summarized and a comparison is made between statewide MassDOT TTTR targets and the conditions observed in the planning region. Next, a series of Environmental Consultation maps are provided concerning the critical natural features in the West subregion. Findings extracted from the established Municipal Vulnerability Preparedness (MVP) programs for each host community are also reviewed. The trucking-centric findings of the regional Travel Demand Model, a computer simulation of the network of highways in the West subregion, are then summarized. Both existing and future benchmark year truck volumes have been estimated by the Model, as well as potential future-year "bottleneck" highway segments.

4.1 Performance Management

Performance-Based Planning and Programming (PBPP) refers to a transportation agency's application of performance management in their ongoing planning and programming activities. The foundation of PBPP was initially federally-legislated through Moving Ahead for Progress in the 21st Century (MAP-21) and reaffirmed in the Fixing America's Surface Transportation Act (FAST Act). These two Acts transformed the federal-aid highway program by establishing new requirements for performance management to ensure the most efficient investment of federal transportation funds that support the following seven National Goals:

1. Safety
2. Infrastructure Condition
3. Congestion Reduction
4. System Reliability
5. Freight Movement and Economic Activity
6. Environmental Sustainability
7. Reduced Project Delays

The CMMPO's PBPP process is shaped by both federal transportation performance management requirements and the MPO's regional goals and objectives. These locally-customized goals and objectives have been integrated through each of the federally-established "Ten Planning Emphasis Areas" when developing transportation plans and projects. By addressing the defined emphasis areas in all areas of the transportation planning process, the CMMPO is able to create more balanced and holistic transportation projects and corresponding

policy for the region. Likewise, the goal of PBPP is to ensure that transportation investment decisions – both long-term planning and short-term programming – are based on the ability to meet established goals.

The following summary concerns the federally-required performance measure related to freight.

Truck Travel Time Reliability (TTTR)

TTTR is the amount of time it takes trucks to drive the length of a highway segment. This measure is only calculated on the Interstate System. The following methodology is applied to determine TTTR for various times of the day:

1. Calculate the travel times from the five time periods used in this measure (shown in **Figure 19**)
2. Find and calculate the TTTR ratio from the 50th and 95th percentile times for each time period
3. The TTTR Index is generated by multiplying each highway segment's largest ratio of the five periods by its length, then dividing the sum of all length-weighted segments by the total length of Interstate.

Figure 19

Level of Truck Travel Time Reliability (TTTR) *(Single Segment, Interstate Highway System)*		
Monday - Friday	6am – 10am	$TTTR = \frac{55\ sec}{35\ sec} = 1.57$
	10am – 4pm	TTTR = 1.25
	4pm – 8pm	**TTTR = 2.52**
Weekends	6am – 8pm	TTTR = 1.2
All Days	8pm – 6am	TTTR = 1.05

MassDOT TTTR Targets and CMMPO Comparison

MassDOT was unable, at this time, to use multi-year trend data to assist with target setting for this measure. Between 2016 and 2017, FHWA switched contractors for maintaining the National Performance Management Research Data Set (NPMRDS), resulting in significant differences in data consistency between the years. Because of these differences, FHWA has advised that state DOTs set conservative targets based on 2017 data and adjust future targets when more data becomes available.

Table 6 shows the annual results for the TTTR ratio for both statewide and CMMPO Interstate highways. The Interstate TTTR target of 1.85 is also included in the table. For an Interstate segment to be considered reliable, the TTTR ratio must be under 1.85. As the data shows, the statewide Interstate ratio has met the target for three (3) of the four (4) years of data. For the CMMPO region, the target was met for all four (4) years. The TTTR ratios in 2020 are well below the previous three (3) years of data due largely to the COVID-19 pandemic as people were either required to stay at home or work from home, which generated less vehicles on the state's Interstate System. The CMMPO region includes I-90 (Massachusetts Turnpike), I-190, I-290 and I-395. Only I-90 passes through the West subregion community of Warren.

Table 6 – Annual TTTR Ratio Results for Statewide & CMMPO Interstates

Year	Statewide Interstate TTTR Ratio	CMMPO Interstate TTTR Ratio	Interstate TTTR Target
2017	1.81	1.71	1.85
2018	1.88	1.79	
2019	1.84	1.77	
2020*	1.44	1.22	

**COVID-19 pandemic occurred during 2020*

4.2 Environmental Consultation

Major features of the natural environment in the West planning subregion were also identified as part of this *Accommodation Assessment tudy*. The following maps show major environmental systems within the study area that have impacts on such things as drainage, water quality and wildlife migration.

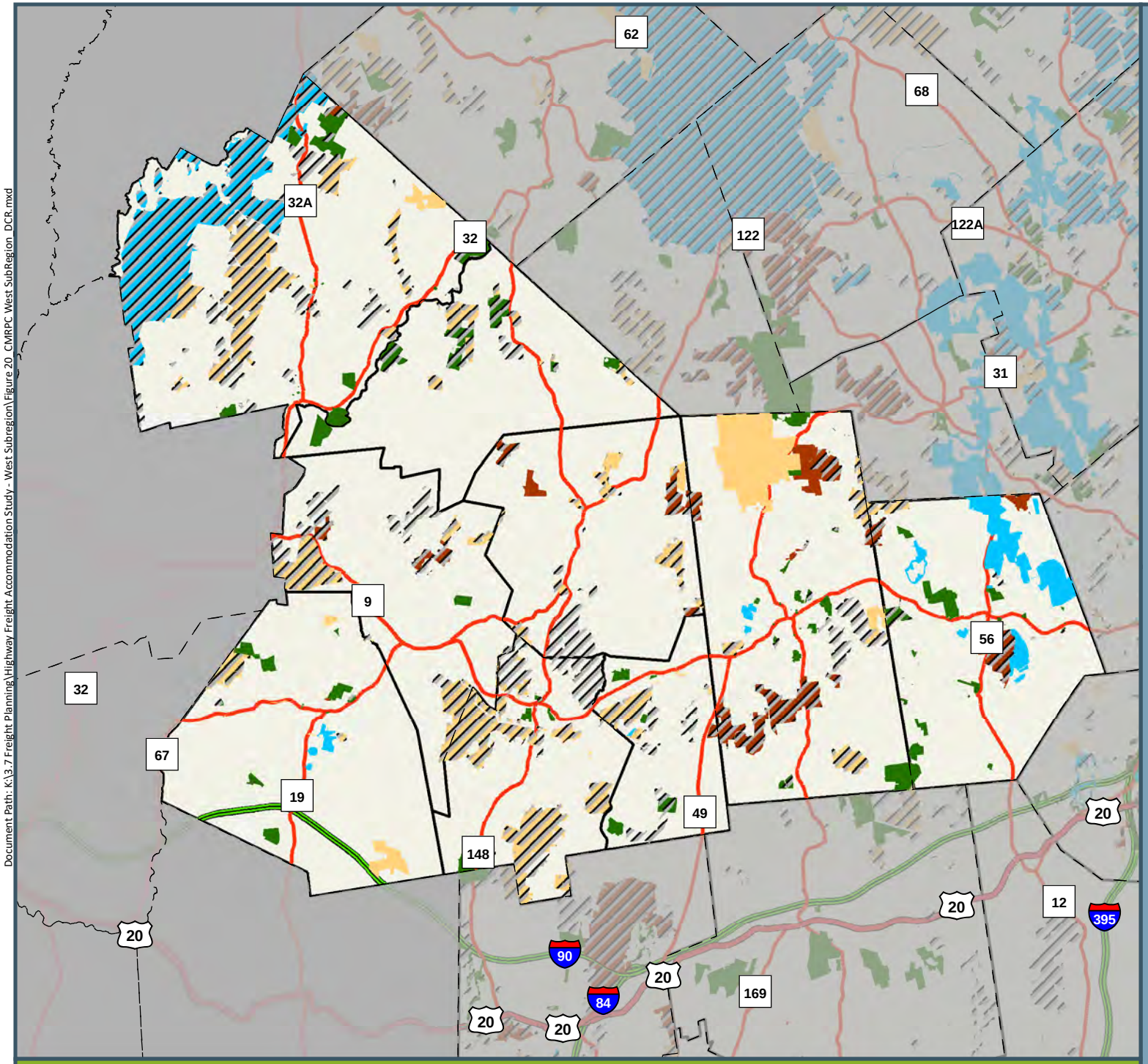
Figure 20 shows general land use within the West subregion. This data is managed by the Massachusetts Department of Conservation and Recreation (DCR). The mission of the DCR is to protect, promote and enhance the state's wealth of natural, cultural and recreational resources. As the map shows, there is a large water supply protection area within the community of Hardwick, which is adjacent to the Quabbin Reservoir. The Quabbin Reservoir has a capacity of 412 billion gallons. In addition, the map also shows conservation and recreational areas.

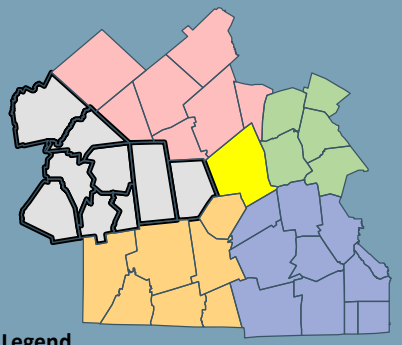
Figure 21 shows wetland areas within the West subregion study area. Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year. The data comes from the Massachusetts Department of Environmental Protection (DEP). The DEP is responsible for ensuring clean air and water, safe management and recycling of solid and hazardous wastes, timely cleanup of hazardous waste sites and spills, and the preservation of wetlands and coastal resources. Included in the

map are bogs, marshes, swamps, and open water. The large area of open water in Hardwick is a portion of the extensive Quabbin Reservoir. As can be seen, there are numerous wetlands in this largely rural subregion.

As shown in **Figure 22**, the federal National Heritage & Endangered Species Program (NHESP) provides the data for vernal pools and rare species habitats (plants & animals). Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. The overall goal of the NHESP is the protection of the state's wide range of native biological diversity. The NHESP is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state. As can be seen in the map, there are significantly far more potential vernal pools when compared to certified vernal pools in the West planning subregion. Most of the certified vernal pools are located in the community of Hardwick. Further, each of the nine (9) towns in the study area has priority habitats of rare species.

Flood zones were created by the Federal Emergency Management Agency (FEMA) in regards to National Flood Insurance Rates. The 100-year flood zone means that there is a one percent annual chance of a flood within that defined area. The 500-year flood zone means that there is a 0.2 percent annual chance for a flood. The closer something is to the flooding source - river, stream, pond, etc. - the greater the risk of flooding. Flood zones are also used to calculate flood insurance rates for homes and businesses. **Figure 23** shows all the 100 and 500-year flood zones in the West planning subregion. The majority of flood zones in the West subregion are 100-year, specifically large areas in Hardwick and through the Brookfields. In addition, there are a number of smaller 500-year flood zones in each of the West subregion communities.





Legend

DCR Open Space

- Recreation/Conservation
- Conservation (Non Facility)
- Recreation (Facility Based)
- Water Supply Protection
- Open Space in Perpetuity
- Interstate
- US Highway
- State Route
- West Subregion Towns

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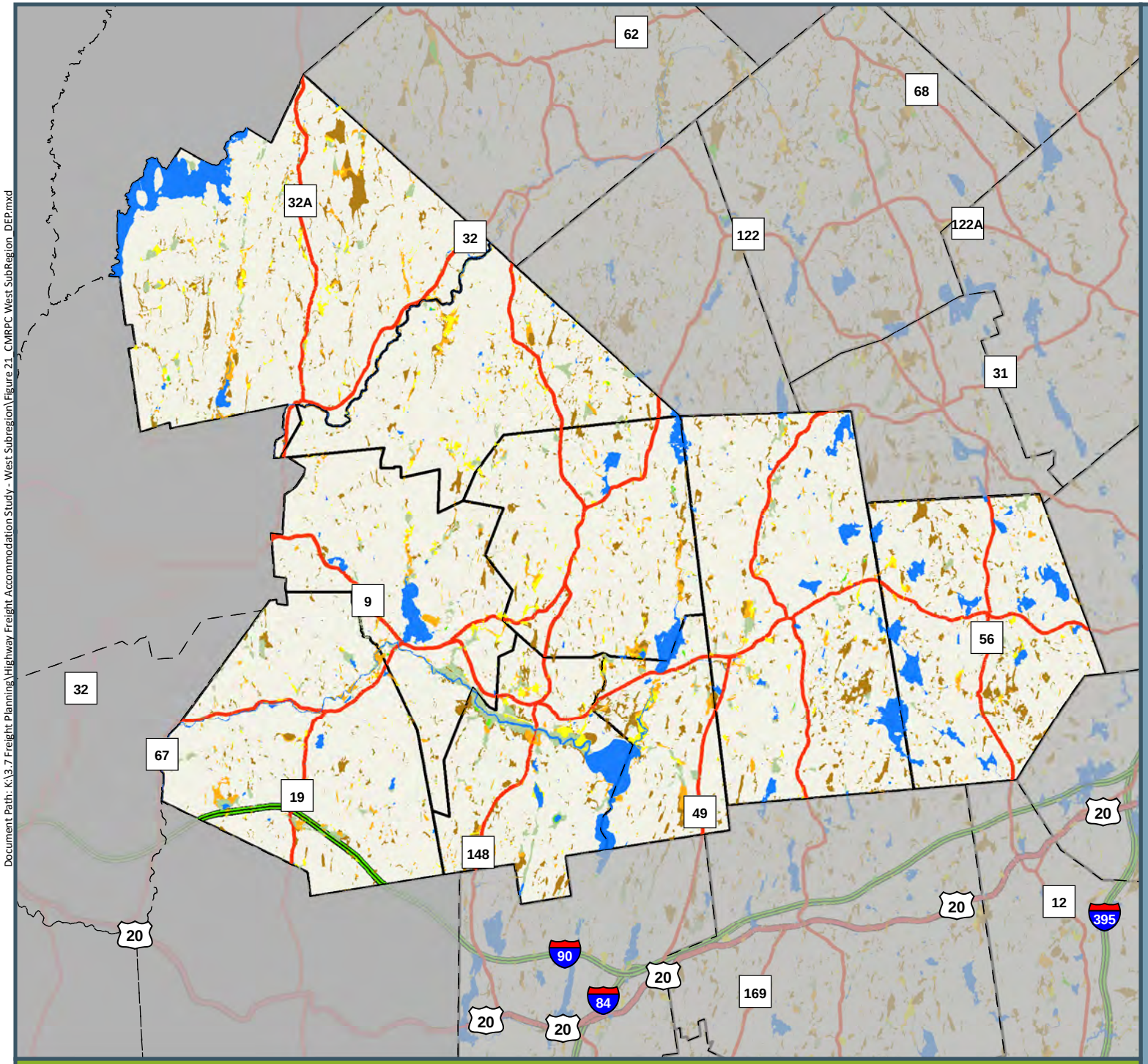
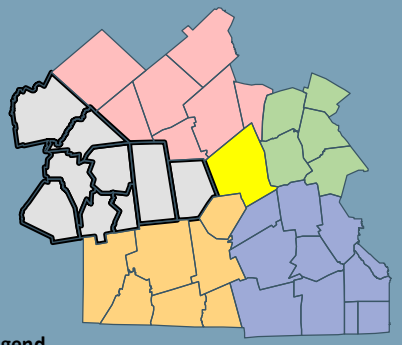
FIGURE 20 - WEST SUBREGION GENERAL LAND USE (DCR)





Legend

- OPEN WATER
- BOG
- DEEP MARSH
- SHALLOW MARSH MEADOW OR FEN
- SHRUB SWAMP
- WOODED SWAMP
- Interstate
- US Highway
- State Route
- West Subregion Towns

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FIGURE 21 - WEST SUBREGION WETLANDS (DEP)

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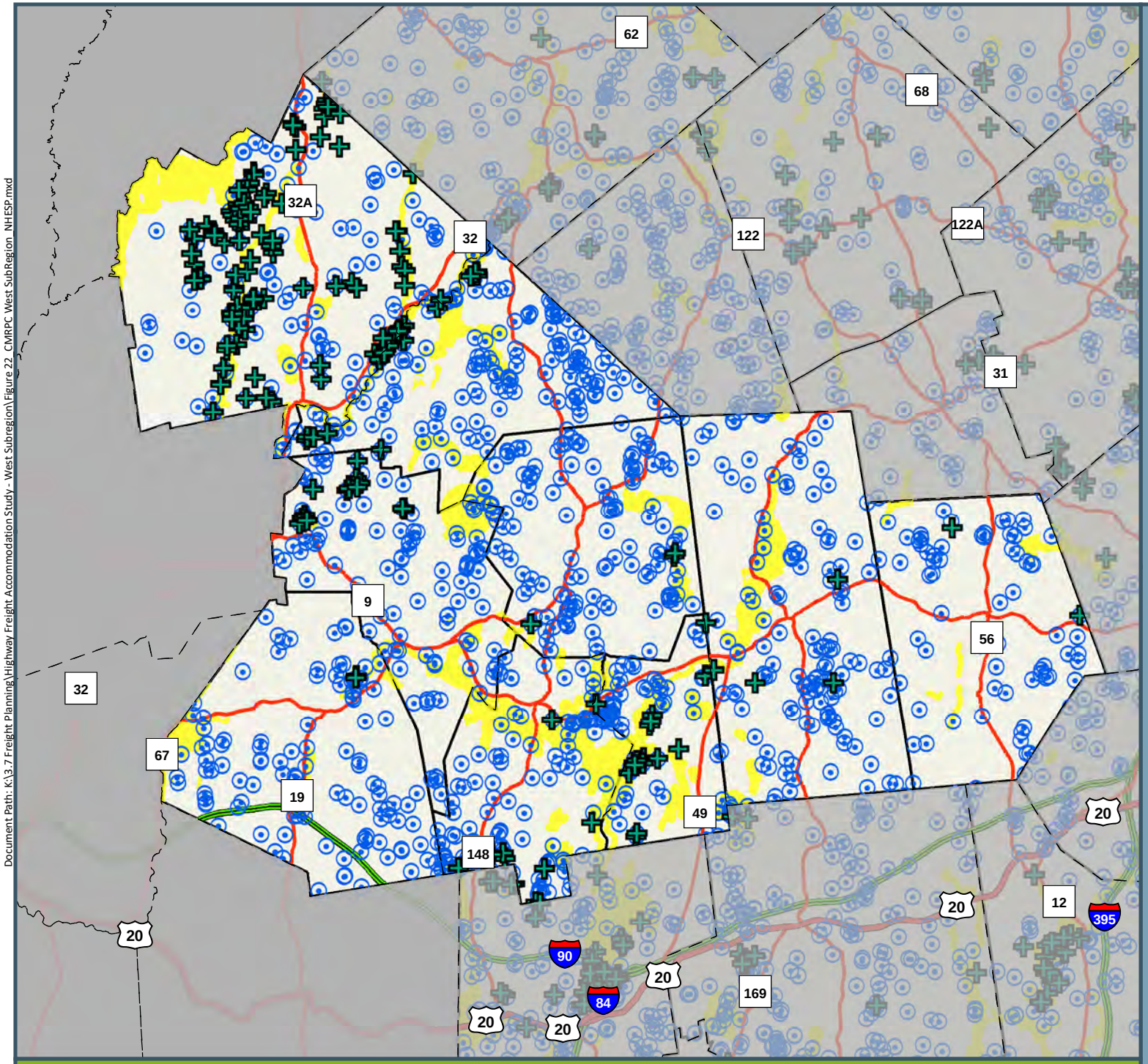

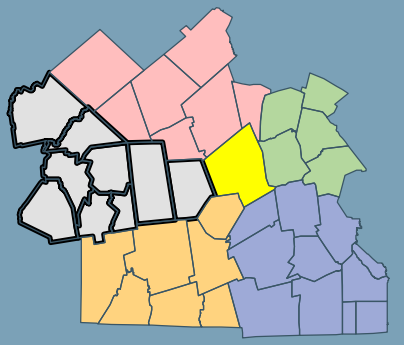

Legend

- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- NHESP Priority Habitats of Rare Species
- Interstate
- US Highway
- State Route
- West Subregion Towns

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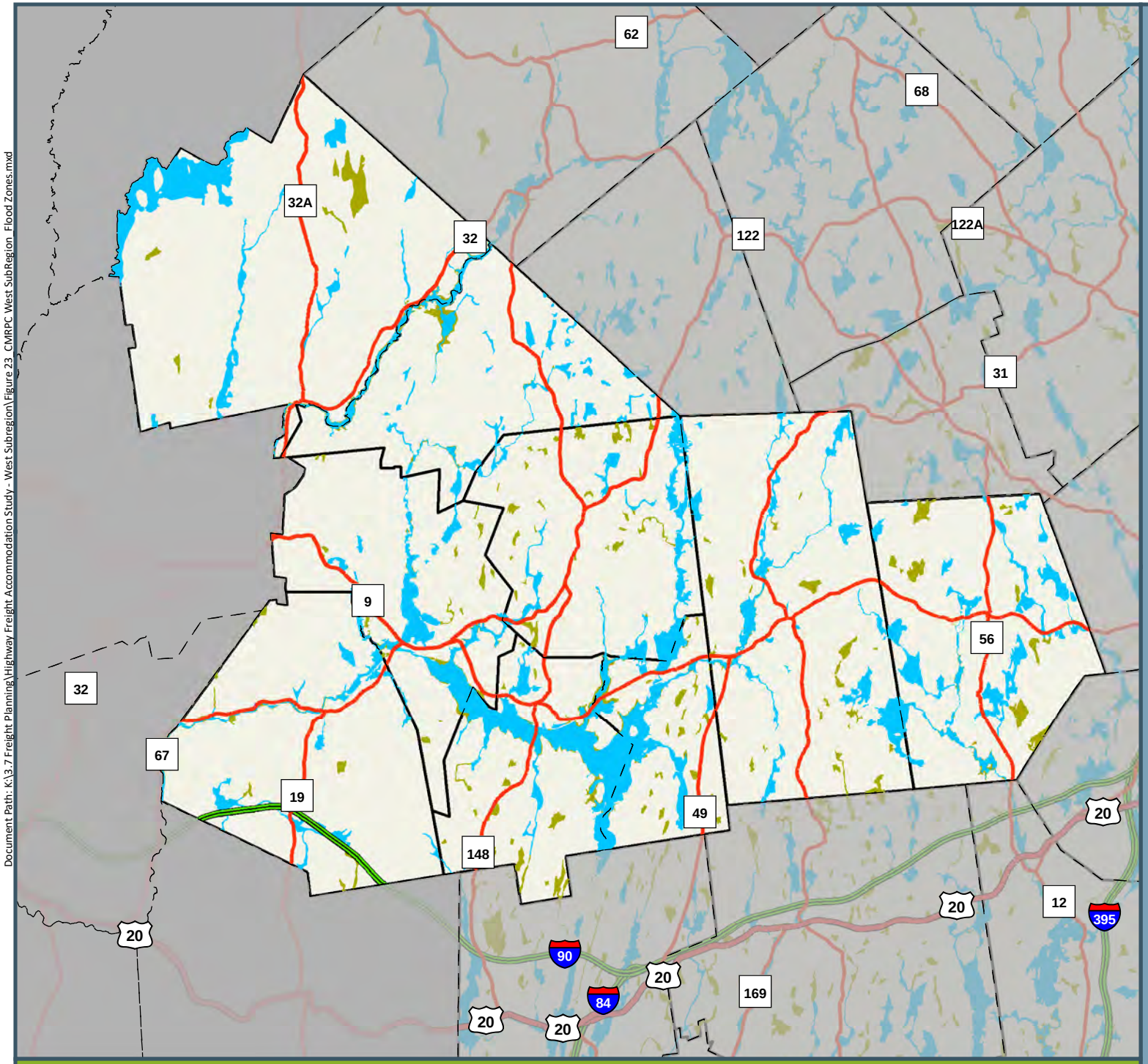
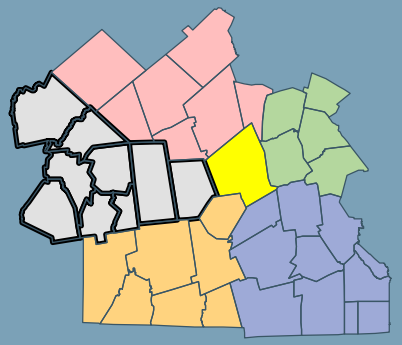
Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 22_CMRPC West SubRegion_NHESP.mxd

FIGURE 22 - WEST SUBREGION VERNAL POOLS & RARE SPECIES HABITATS (NHESP)





Legend

- FEMA 100 Year Flood Zone
- FEMA 500 Year Flood Zone
- Interstate
- US Highway
- State Route
- West Subregion Towns

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FIGURE 23 - WEST SUBREGION 100/500 YEAR FLOOD ZONES (FEMA)

4.3 Municipal Vulnerability Preparedness (MVP)

The state's MVP Program provides planning grants to municipalities to complete vulnerability assessments and develop action-oriented resiliency plans. Communities that complete the MVP planning process become certified "MVP Communities" and are eligible for Action Grant funding and other opportunities through the Commonwealth. Critical to this process, various stakeholders actively engage in discussions to determine the top hazards related to climate change that currently impact or could have a future impact on a community.

Figure 24 shows the established Evacuation Routes and the Hazardous Dams within the West subregion communities. The Evacuation Routes were developed as part of the Worcester County Evacuation Plan. During the compilation of the Evacuation Plan, each community identified their important roadways and defined them as primary, secondary, or tertiary Evacuation Routes. Besides the State Numbered Routes, other major roads were designated as Evacuation Routes. As the map shows, the Evacuation Routes may have a primary designation in one town but a secondary designation in an adjoining town.

As for the Hazardous Dams, this data is maintained by the Massachusetts Office of Dam Safety. The map shows the dams classified into three categories. The categories are High Hazard, Significant Hazard, and Low Hazard. The hazards are defined as follows:

- **High Hazard**: Located where failure will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways or railroads.
- **Significant Hazard**: Located where failure may cause loss of life and damage homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- **Low Hazard**: Located where failure may cause minimal property damage to others. Loss of life is not expected.

The towns of Leicester and Spencer each have multiple High Hazard dams. A number of the dams are located near a State Numbered Route, both Route 9 & Route 56 in Leicester and Route 31 in Spencer. In fact, all of the West subregion communities have at least one hazardous dam.

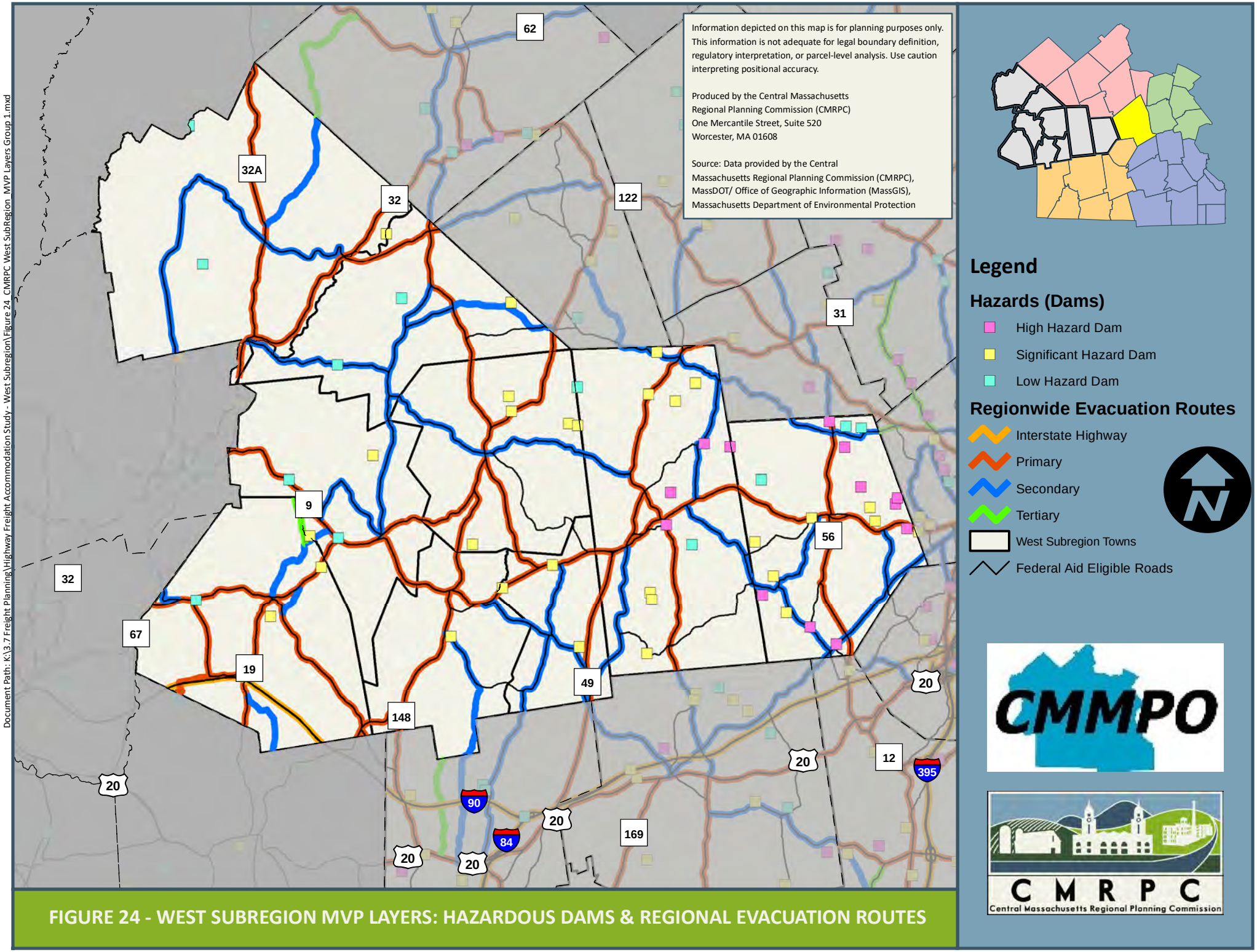


FIGURE 24 - WEST SUBREGION MVP LAYERS: HAZARDOUS DAMS & REGIONAL EVACUATION ROUTES

Figure 25 shows locally-identified vulnerable critical infrastructure and hazards within the West subregion communities. The types of vulnerable critical infrastructure can differ for each community. The types of infrastructure include major roadways, dams, water & sewer pumping stations, and important buildings such as police stations, fire stations, or Department of Public Works (DPW) garages. The towns of East Brookfield, Hardwick, Leicester, New Braintree, Spencer and Warren consider all the State Numbered Routes in their respective communities as critical infrastructure. Most of the communities in the West subregion considered the police stations, fire stations, and DPW garages as critical infrastructure. Bridges, dams, railroads, schools and solar farms were also considered critical infrastructure in most of the towns.

Each town in the West subregion contains numerous locally-identified hazards. These hazards include dams, flooding issues (past & present), snowdrifts during the winter, and areas for potential fires. Fire hazards were identified in the towns of East Brookfield, New Braintree, and Spencer. Flooding hazards were identified in each of the West subregion communities.

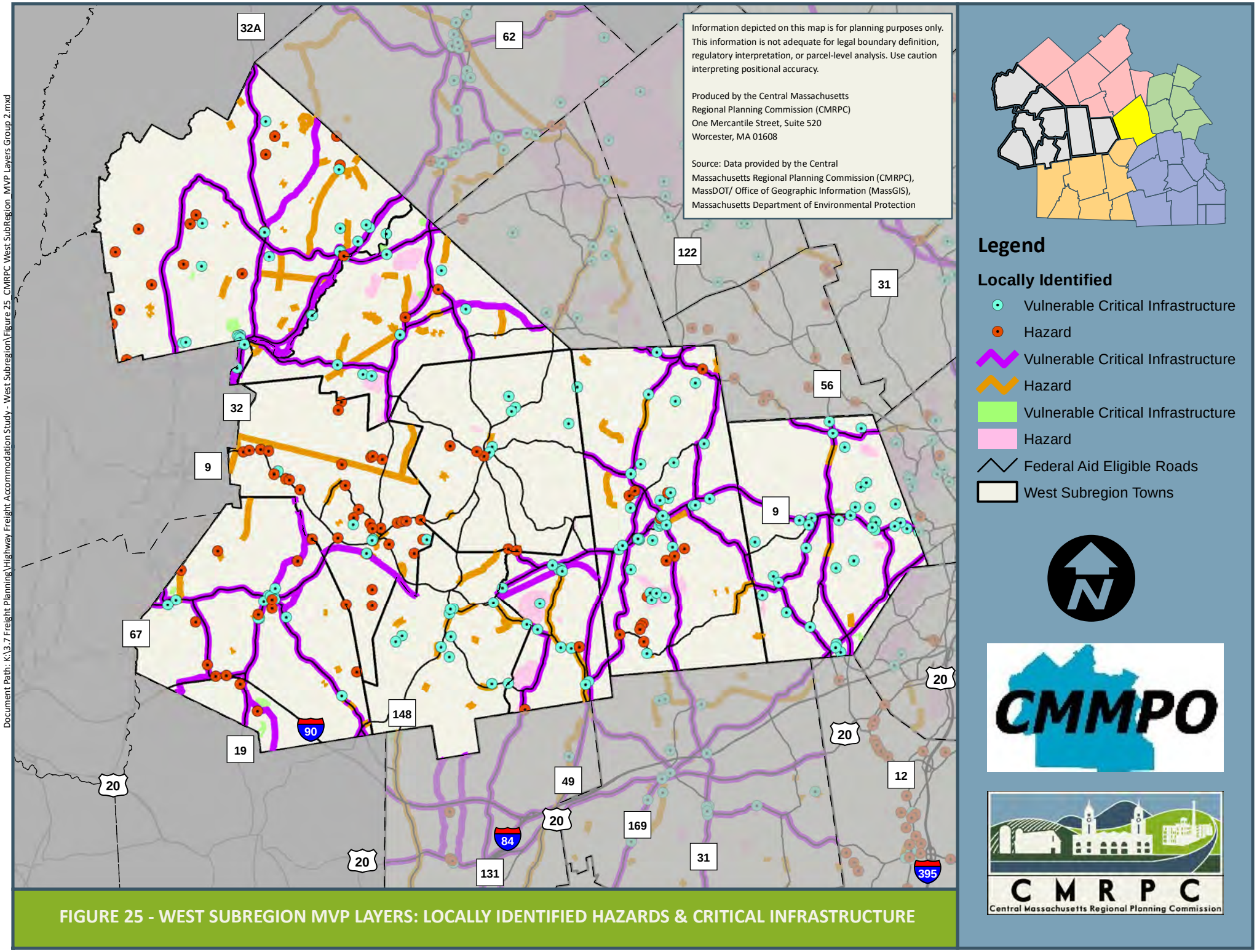


FIGURE 25 - WEST SUBREGION MVP LAYERS: LOCALLY IDENTIFIED HAZARDS & CRITICAL INFRASTRUCTURE

4.4 Travel Demand Model

Introduction

In this second installment in the series of "Highway Freight Accommodation Assessment" studies focusing on the federal-aid highway system, the region's Travel Demand Forecasting Model ("Model") software was used to estimate and compile the anticipated Vehicle Miles of Travel (VMT) of heavy vehicles - transporting a broad range of freight - for both existing & projected future conditions in the West planning subregion. Potential future year land development impacting the Southwest planning subregion was assessed by the CMRPC staff and this information was used to craft future benchmark year growth scenarios for all host communities in the subregion. Considered a tool for projecting future year traffic impacts, the results of the Model need to be considered in a relative sense and must be viewed only as "best estimates" based on currently available information.

The Model is a computer-based simulation of the greater planning region's multimodal transportation network and includes all roads on the federal-aid highway system and public fixed-route transit routes. After developing traffic volumes by time of day for all network roads, the Model then reports VMT (and Vehicle Hours of Travel, VHT) aggregated to a community level for each roadway classification - the Federal Highway Administration's (FHWA) roadway functional classifications are used - and vehicle type. The Model's 2018 base year analysis network, representing an existing case, has been "calibrated", or adjusted, to essentially simulate existing roadway travel conditions, based on field-observed traffic volumes which include the percentage of heavy vehicles.

For the purposes of this study effort, the regional Model was utilized to estimate heavy vehicle VMT for the Morning (6 AM-9 AM) peak travel period, Mid-Day (9 AM-3 PM) period, the Evening (3 PM-6 PM) peak, as well as Nighttime (6 PM-6 AM) travel period, resulting in Daily totals. The Model-calculated estimated VMT have also been summarized for each host community in the West planning subregion. Using the 2018 existing scenario as a basis for the projected future-year analyses, heavy vehicle VMT estimates have been derived by the Model for the benchmark years of 2030 and 2040. *(It should be noted that the Model analyses do not reflect the known/unknown impacts of the Covid-19 crisis.)*

Truck Type Groupings

The Model results provide truck VMT estimates within three (3) broad groupings of the FHWA's Vehicle Classifications. Shown in **Table 7** are the 13 established FHWA Vehicle Classifications. The table indicates the equivalences between the FHWA Vehicle Classifications and the corresponding three (3) categories of truck type groupings used by the Model. As can be seen in the table, in addition to "Auto", these groupings are defined as "Light Trucks", "Medium Trucks" and "Heavy Trucks". Light Trucks are commercial vehicles with 4 or 6 tires while

Medium Trucks are single unit commercial vehicles with more than 6 tires. Heavy Trucks are all articulated vehicles.

Table 7
FHWA Vehicle Classification

Classification Number	Description	Type of Vehicle
1	Motorcycles	Auto
2	Passenger Cars	Auto
3	Pickups and Vans	Auto
4	Buses	Medium Truck
5	Single Unit 2 Axle Truck	Light Truck
6	Single Unit 3 Axle Truck	Medium Truck
7	Single Unit 4 Axle Truck	Medium Truck
8	Trailer 3 or 4 Axle Truck	Heavy Truck
9	Trailer 5 Axle Truck	Heavy Truck
10	Trailer 6 Axle Truck	Heavy Truck
11	Multi-Trailer 5 Axle Truck	Heavy Truck
12	Multi-Trailer 6 Axle Truck	Heavy Truck
13	Multi-Trailer 7 or More Axle Truck	Heavy Truck

These Model analyses results for each host community in the West planning subregion are summarized in **Tables 8, 9, & 10** for each defined truck type grouping. **Table 8** includes the estimated truck VMT for the 2018 existing case, **Table 9** includes the projected truck VMT for the future year 2030, and **Table 10** lists the projected truck VMT for the future year 2040. Again, the listed VMT are by time of day: AM Peak, Mid-Day (MD), PM Peak, Nighttime (NT) as well as the Daily total.

Truck Vehicle Miles of Travel (VMT) Observations

As can be seen in **Table 8**, truck Vehicle Miles of Travel (VMT) under the existing 2018 case are significant in the towns of Leicester and Spencer, with total estimated daily truck VMT of nearly 11,300 miles and 10,200 miles, respectively, largely due to the heavily utilized Route 9 corridor as well as State Numbered Routes 31, 49 and 56. Next, the towns of Warren and West Brookfield exhibit truck VMT of over 4,700 miles and 4,000 miles, respectively. In the case of Warren, the high truck VMT demonstrates the importance of the I-90 (Massachusetts Turnpike) corridor while in West Brookfield both Route 9 and Route 67 carry significant truck VMT. In East Brookfield and Brookfield, truck VMT of nearly 3,300 miles and 3,100 miles are respectively accommodated, again largely due to the crucial Route 9 corridor as well as Route 148. The town of North Brookfield accommodates a more modest total daily truck VMT estimate of nearly 2,700 miles on that host community's highway network which includes Route 67 and

Route 148. Lastly, the towns of Hardwick and New Braintree have the lowest total daily truck VMT in the vicinity of 1,700 miles and 1,000 miles, respectively.

Table 8
Existing Truck VMT: 2018 Benchmark Year

	2018												
	AM			MD			PM			NT			
	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	VMT Totals
Brookfield	523	57	121	712	76	161	602	64	137	469	50	107	3,078
East Brookfield	530	68	145	723	93	199	610	78	167	475	60	129	3,277
Hardwick	240	45	110	326	61	150	276	52	127	215	40	98	1,739
Leicester	1,923	201	439	2,620	272	591	2,214	229	499	1,724	178	388	11,279
New Braintree	152	21	47	207	28	65	175	24	55	136	19	42	970
North Brookfield	476	42	88	648	57	119	547	48	101	426	38	79	2,668
Spencer	1,779	168	363	2,423	228	493	2,048	193	416	1,594	150	326	10,182
Warren	596	133	346	815	182	474	694	154	400	534	119	309	4,755
West Brookfield	656	83	176	894	112	237	755	95	200	588	74	156	4,025
Totals	6,874	817	1,835	9,366	1,110	2,489	7,921	937	2,102	6,161	729	1,633	41,974

Shown in **Table 9**, under anticipated 2030 conditions, total daily estimated truck VMT remains highest in the towns of Leicester and Spencer, with total estimated daily truck VMT of over 12,100 miles and nearly 11,000 miles, respectively. Again, truck VMT are most prevalent on the heavily utilized State Numbered Route 9 corridor as well as the Route 31, Route 49 and Route 56 corridors. The towns of Warren and West Brookfield are next with future year daily estimated truck VMT of over 4,800 miles and 4,100 miles, respectively, again largely due to the I-90 (Massachusetts Turnpike) corridor passing through the southern part of Warren and, in West Brookfield, both the Route 9 and Route 67 corridors. Similar to the existing case, East Brookfield and Brookfield are anticipated to accommodate truck VMT of 3,500 miles and nearly 3,300 miles, respectively. This is indicative of measurable future year truck VMT increases on State Numbered Routes 9 and 148. Elsewhere, in North Brookfield, truck VMT are similarly anticipated to increase under projected 2030 conditions. Estimated future year truck VMT of nearly 2,800 miles are projected in North Brookfield. Further, the towns of Hardwick and New Braintree will also likely see increases in daily truck VMT resulting in a total daily truck VMT of over 1,800 miles and over 1,000 miles, respectively, anticipated for the 2030 benchmark year.

Table 9
Projected Truck VMT: Future 2030 Condition

	2030												
	AM			MD			PM			NT			
	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	VMT Totals
Brookfield	556	60	129	757	81	172	640	69	145	499	54	114	3,276
East Brookfield	563	73	157	768	100	215	649	85	181	505	65	139	3,500
Hardwick	255	47	115	348	64	158	294	54	133	229	42	103	1,844
Leicester	2,068	218	476	2,817	295	642	2,378	248	542	1,854	193	421	12,152
New Braintree	161	22	51	219	31	70	185	26	59	144	20	46	1,035
North Brookfield	494	44	92	673	60	125	569	51	106	443	40	83	2,778
Spencer	1,907	182	393	2,597	247	534	2,196	209	451	1,709	163	352	10,940
Warren	615	135	348	837	184	479	715	156	406	551	121	313	4,860
West Brookfield	671	85	182	914	115	243	772	97	205	601	75	160	4,121
Totals	7,291	866	1,943	9,930	1,177	2,638	8,398	994	2,229	6,535	773	1,731	44,507

Looking to the 2040 future benchmark year, as shown in **Table 10**, overall truck VMT estimates are projected to further grow in these same West subregion host communities, although, based on currently available information, at a more modest rate than projected between 2018 & 2030. Total daily truck VMT will remain highest in the towns of Leicester and Spencer due largely to State Numbered Routes 9, 31, 49 and 56. Similar to the prior decade, total daily estimated truck VMT in the towns of Warren (I-90, Massachusetts Turnpike) and West Brookfield will continue to increase under projected 2040 conditions, although at a lesser rate. This is also the case for the host communities of East Brookfield and Brookfield where the anticipated truck VMT increases will perhaps be more limited than the prior decade. Elsewhere, in the West subregion towns of North Brookfield, Hardwick and New Braintree, modest increases in total daily truck VMT are anticipated under projected future year 2040 conditions.

Table 10
Projected Truck VMT: Future 2040 Condition

	2040												
	AM			MD			PM			NT			
	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	VMT Totals
Brookfield	573	62	134	780	84	179	659	71	151	514	56	119	3,381
East Brookfield	578	75	162	789	103	223	667	87	188	518	67	144	3,602
Hardwick	264	49	118	359	66	162	303	56	137	236	44	106	1,900
Leicester	2,115	222	486	2,880	300	657	2,430	254	556	1,896	198	433	12,427
New Braintree	166	23	53	227	32	73	191	27	61	149	21	47	1,071
North Brookfield	510	46	96	695	62	130	587	53	110	457	41	86	2,872
Spencer	1,950	187	409	2,656	254	554	2,245	214	466	1,747	167	364	11,214
Warren	636	138	356	867	189	492	740	160	416	570	124	320	5,008
West Brookfield	698	88	188	950	118	252	803	100	213	625	78	166	4,277
Totals	7,490	890	2,002	10,202	1,210	2,721	8,624	1,022	2,298	6,713	794	1,784	45,751

The corresponding percentage increases in projected truck VMT in the West transportation planning subregion are provided in **Tables 11 & 12. Table 11** summarizes the percentage increases anticipated in the 12-year period between 2018 and 2030. Corresponding anticipated percentage increases in excess of 8% are likely in the towns of Leicester and Spencer. Similarly, in the town of East Brookfield, increases of approximately 8% are projected in both medium and heavy trucks during both the morning and evening peak flow periods. Further, New Braintree is anticipated to realize mid-day percentage increases also in excess of 8%, however, this community will likely continue to have the lowest daily VMT of heavy vehicles in the West subregion.

Table 11
Projected Truck VMT: Percentage Increases 2018-2030

	Change 2018 to 2030											
	AM			MD			PM			NT		
	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck
Brookfield	6.38%	6.52%	6.50%	6.39%	6.65%	6.66%	6.38%	6.34%	6.34%	6.41%	6.65%	6.67%
East Brookfield	6.32%	7.96%	8.08%	6.31%	7.84%	7.94%	6.32%	8.32%	8.49%	6.29%	7.86%	7.96%
Hardwick	6.48%	5.48%	5.14%	6.48%	5.49%	5.13%	6.48%	5.47%	5.12%	6.48%	5.47%	5.11%
Leicester	7.52%	8.38%	8.49%	7.52%	8.39%	8.53%	7.44%	8.39%	8.64%	7.53%	8.36%	8.48%
New Braintree	6.01%	7.63%	7.71%	6.02%	8.38%	8.65%	6.01%	7.58%	7.64%	6.01%	7.59%	7.65%
North Brookfield	3.87%	4.94%	5.16%	3.87%	4.95%	5.16%	3.87%	4.98%	5.24%	3.87%	4.97%	5.21%
Spencer	7.22%	8.26%	8.23%	7.21%	8.20%	8.18%	7.22%	8.28%	8.27%	7.21%	8.20%	8.18%
Warren	3.17%	0.98%	0.74%	2.76%	1.33%	1.17%	3.00%	1.61%	1.38%	3.25%	1.50%	1.22%
West Brookfield	2.29%	2.60%	2.95%	2.28%	2.42%	2.74%	2.27%	2.25%	2.57%	2.29%	2.59%	2.95%
Averages	5.47%	5.86%	5.89%	5.43%	5.96%	6.02%	5.44%	5.91%	5.96%	5.48%	5.91%	5.94%

Similarly, **Table 12** summarizes the percentage increases anticipated between the future benchmark years of 2030 and 2040. Less is presently known about likely travel conditions in this future time parameter. As such, more modest truck grouping percentage increases in VMT are anticipated than in the previous 12-year analysis period. During the ten-year period between 2030 and 2040, the anticipated percentage increases in truck VMT are in the 2.1-4.1% range. During this decade, the percentage increase of “Heavy” trucks is anticipated to outpace the VMT growth in “Light” and “Medium” trucks in the West transportation planning subregion.

Table 12
Projected Truck VMT: Percentage Increases 2030-2040

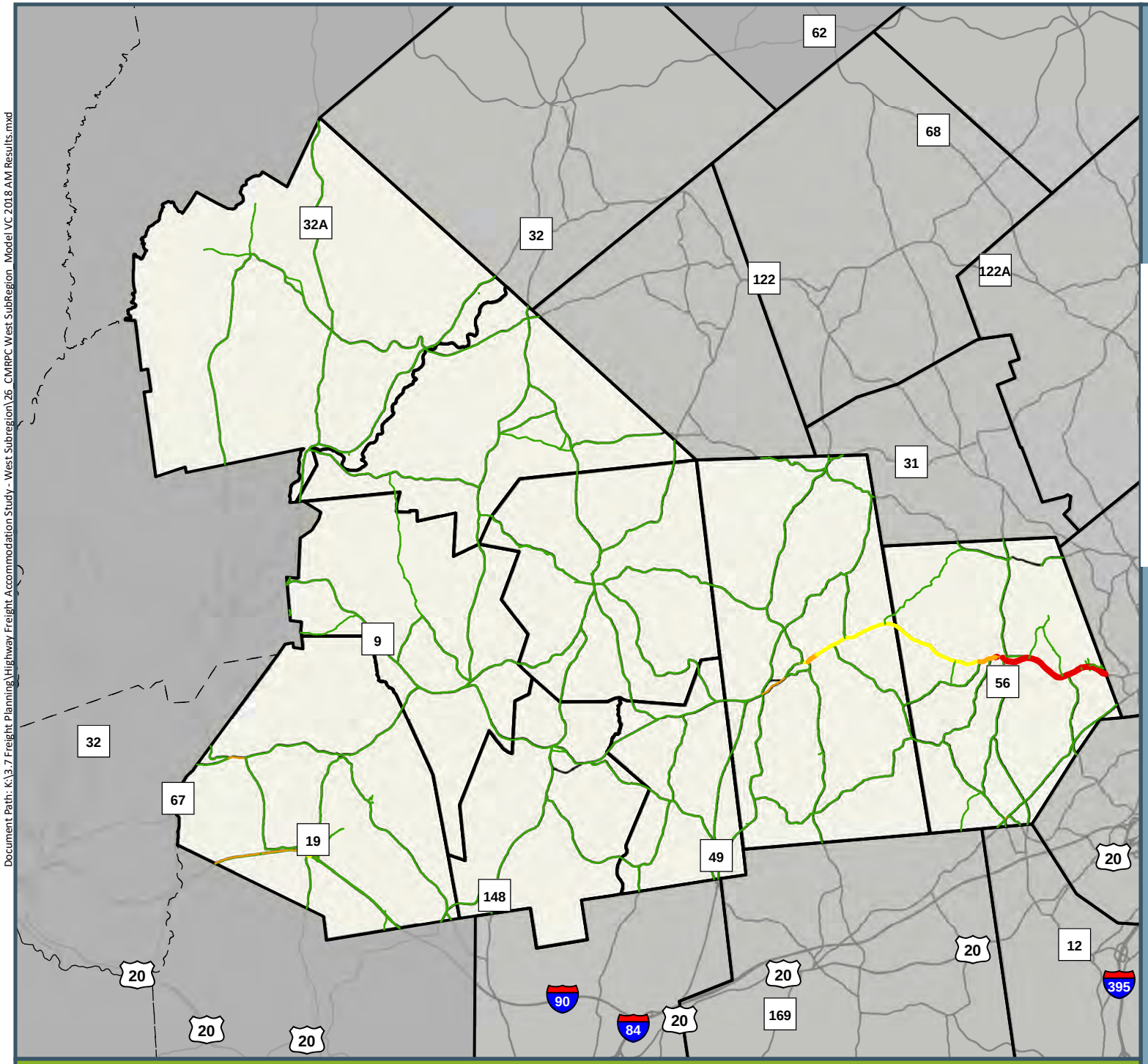
	Change 2030 to 2040											
	AM			MD			PM			NT		
	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck	Light Truck	Medium Truck	Heavy Truck
Brookfield	3.03%	3.46%	3.88%	3.03%	3.46%	3.90%	3.03%	3.36%	3.76%	3.03%	3.40%	3.79%
East Brookfield	2.67%	2.93%	3.67%	2.68%	2.94%	3.65%	2.68%	3.11%	3.87%	2.68%	2.94%	3.66%
Hardwick	3.28%	2.84%	2.59%	3.28%	2.85%	2.61%	3.28%	2.83%	2.57%	3.28%	2.82%	2.56%
Leicester	2.30%	1.80%	2.03%	2.26%	1.96%	2.37%	2.15%	2.07%	2.62%	2.27%	2.23%	2.78%
New Braintree	3.33%	3.86%	3.94%	3.33%	3.78%	3.77%	3.33%	3.85%	3.92%	3.33%	3.94%	4.05%
North Brookfield	3.25%	3.52%	3.91%	3.25%	3.51%	3.90%	3.25%	3.52%	3.92%	3.25%	3.52%	3.91%
Spencer	2.23%	3.14%	4.00%	2.23%	3.05%	3.83%	2.24%	2.79%	3.46%	2.23%	2.66%	3.25%
Warren	3.42%	2.35%	2.32%	3.54%	2.73%	2.70%	3.48%	2.50%	2.47%	3.41%	2.35%	2.32%
West Brookfield	3.94%	3.31%	3.50%	3.94%	3.23%	3.38%	3.94%	3.28%	3.44%	3.94%	3.23%	3.36%
Averages	3.05%	3.02%	3.32%	3.06%	3.06%	3.35%	3.04%	3.04%	3.34%	3.05%	3.01%	3.30%

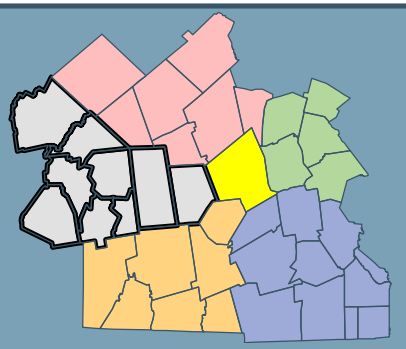
Rural Congestion in the West Subregion

In an effort to detect existing rural congestion and its potential future year spread, the Model was used to calculate Volume-to-Capacity ("V/C") ratio data ranges for the host communities in the West planning subregion. The higher the V/C ratio, the more indicative of heavy travel. Where the peak period Models cover a 3-hour period, using a V/C ratio of 0.80 for the 3 hours would suggest that one of the 3 hours is close to or beyond a V/C ratio value of 1.0. This is indicative of the fact that traffic volumes are not distributed uniformly over the 3 hours, but rather have a peak hour within the 3 hours with traffic volumes building or declining on either side of the peak. V/C ratios in excess of 0.80 often indicate congested, or sluggish, travel conditions. V/C ratios exceeding 1.0 theoretically indicate *over-capacity* conditions with significant incurred vehicle delay. As a product of this exercise, the following color-coded maps showing the analyses results were compiled and are shown in **Figures 26 through 31.**

Model-Calculated V/C Ratio Observations

As previously mentioned, the Model's 2018 analysis network has been "calibrated", or adjusted, to best estimate existing roadway travel conditions, based on field-observed traffic volumes which include the percentage of heavy vehicles. Under the 2018 existing case, shown in **Figures 26 & 27**, during the morning peak travel period, the segment of Route 9 between downtown Spencer and the Worcester city line exhibits V/C ratios ranging from 0.61 to more than 0.80, east of Leicester center. During the evening peak travel period, calculated V/C ratios rise relative to increased traffic volumes throughout the highway network. This is reflected particularly along the Route 9 corridor in both host communities of Leicester and Spencer where V/C ratios in excess of 0.80 are typically experienced on a reoccurring basis.





Legend

2018 VC Ratios_AM

- 0.00 - 0.40
- 0.41 - 0.60
- 0.61 - 0.70
- 0.71 - 0.80
- > 0.80
- **West Subregion Towns**

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 interpreting positional accuracy.

Produced by the Central Massachusetts Regional Planning Commission (CMRPC)
One Mercantile Street, Suite 520
Worcester, MA 01608

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/ Office of Geographic Information (MassGIS), Massachusetts Department of Environmental Protection

CMMPO

C M R P C
Central Massachusetts Regional Planning Commission

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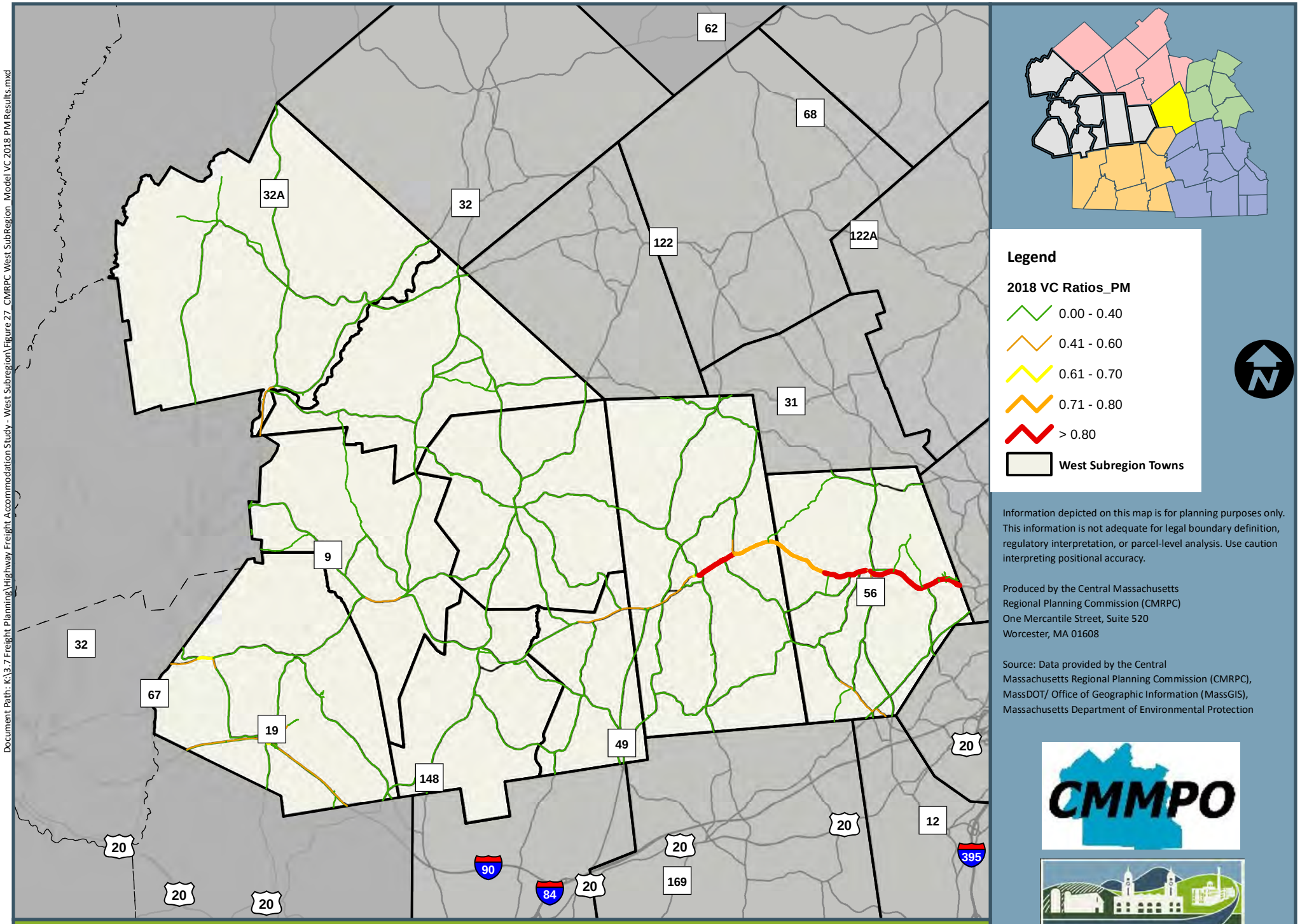
FIGURE 26 - WEST SUBREGION EXISTING 2018 V/C RATIOS, AM PEAK PERIOD



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Produced by the Central Massachusetts Regional Planning Commission (CMRPC)
One Mercantile Street, Suite 520
Worcester, MA 01608

Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/ Office of Geographic Information (MassGIS), Massachusetts Department of Environmental Protection

CMMPO

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Central Massachusetts Regional Planning Commission

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FIGURE 27 - WEST SUBREGION EXISTING 2018 V/C RATIOS, PM PEAK PERIOD

Under the 2030 scenario, shown in **Figures 28 & 29**, the Model results continue to indicate morning peak travel period V/C ratios in excess of 0.80 along various segments of the Route 9 corridor in both the towns of Leicester and Spencer. This projected condition also expands, or "spills over", during the evening peak travel period under projected 2030 conditions. Elsewhere in the mostly rural West subregion, especially during the evening peak travel period in 2030, calculated V/C ratios increase relative to increased traffic volumes throughout the highway network. Segments of Route 9 in East Brookfield, Brookfield and West Brookfield, as well as Route 32 in the Gilbertville section of Hardwick exhibit these anticipated V/C increases in the 2030 future benchmark year. In other West subregion communities, the Model results also reveal potential increased usage of seemingly unattractive local roads, perhaps indicative of anticipated future year cut-through traffic.

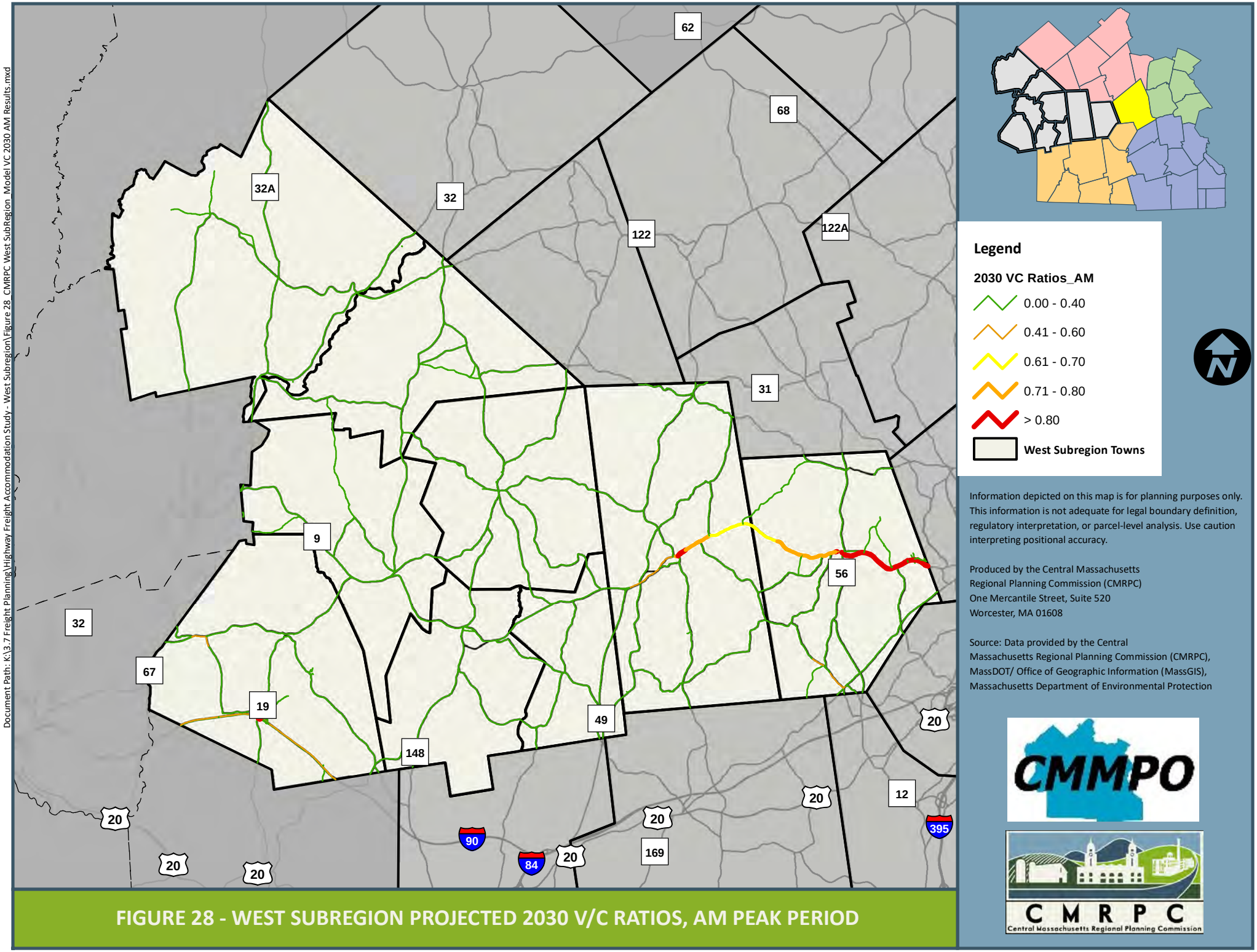

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FIGURE 28 - WEST SUBREGION PROJECTED 2030 V/C RATIOS, AM PEAK PERIOD

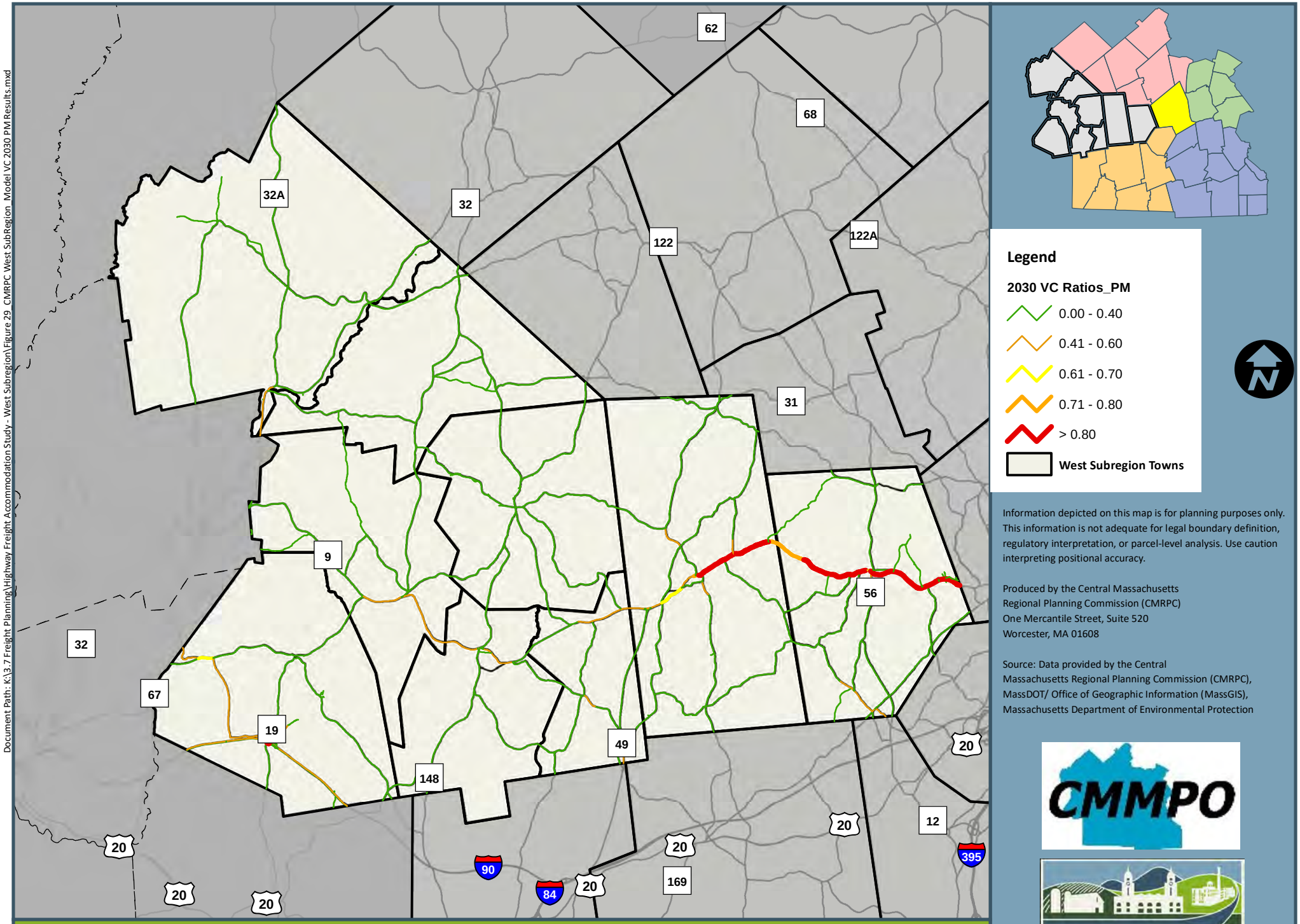

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FIGURE 29 - WEST SUBREGION PROJECTED 2030 V/C RATIOS, PM PEAK PERIOD

Under the projected 2040 scenario, shown in **Figures 30 & 31**, during the morning peak travel period, both Leicester and Spencer continue to experience V/C ratios in excess of 0.80 along the heavily traveled Route 9 corridor. Throughout the highway network during the projected 2040 morning peak travel period, calculated V/C ratios rise relative to the modest increases in traffic volumes anticipated between 2030 and 2040 at the present time. Congested conditions are anticipated to spread on Route 9 in the area of downtown Spencer. Elsewhere, under the projected 2040 evening peak travel period, V/C ratios are observed to increase on a number of highway segments in the town of Leicester, beyond Route 9 proper, notably in the Rochdale Village area. This is indicative of the likely spread of congestion and travel delays in the 2040 future year. Again, the Model results also appear to reveal the potential increased usage of seemingly unattractive local roads, perhaps indicative of likely future year cut-through traffic.

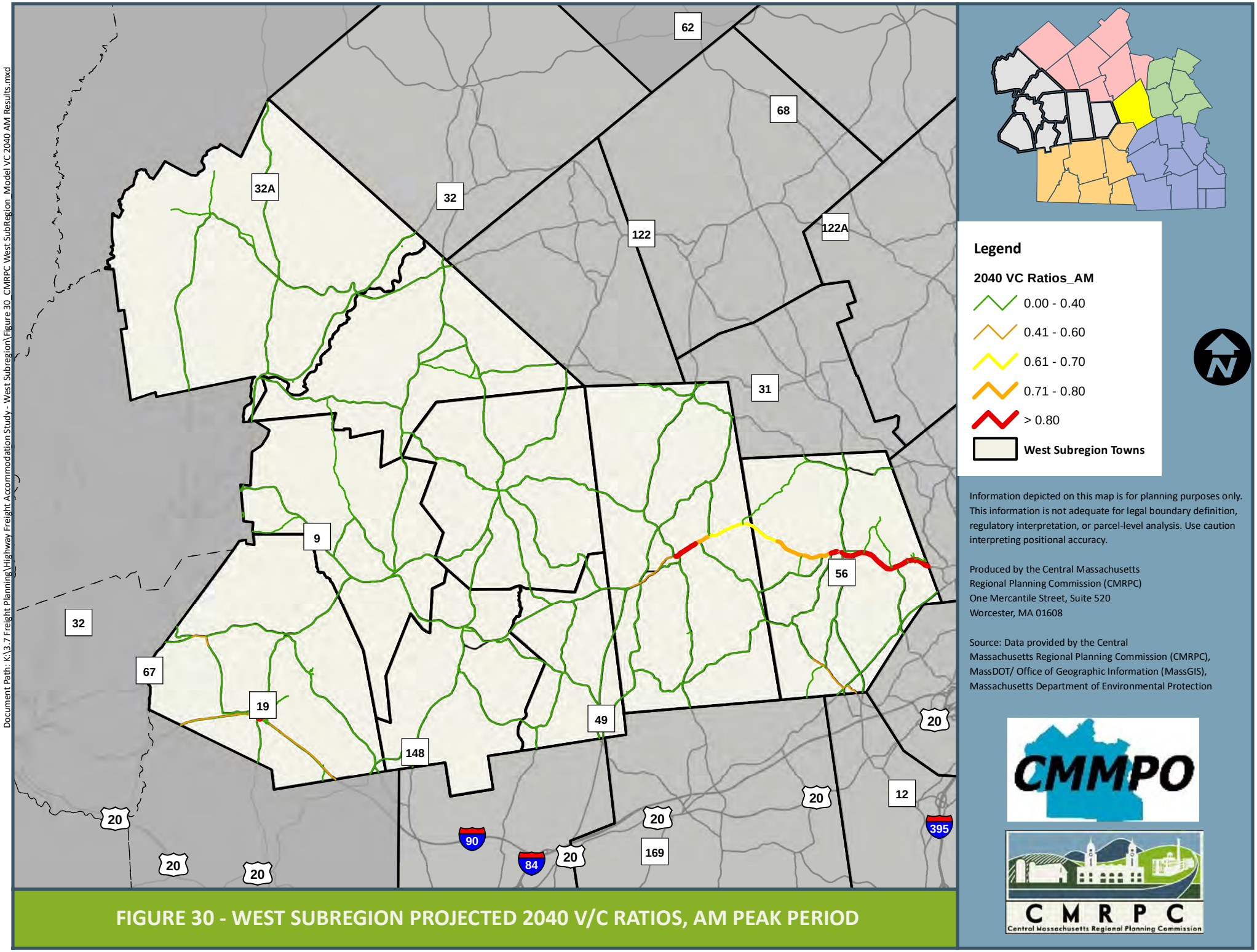
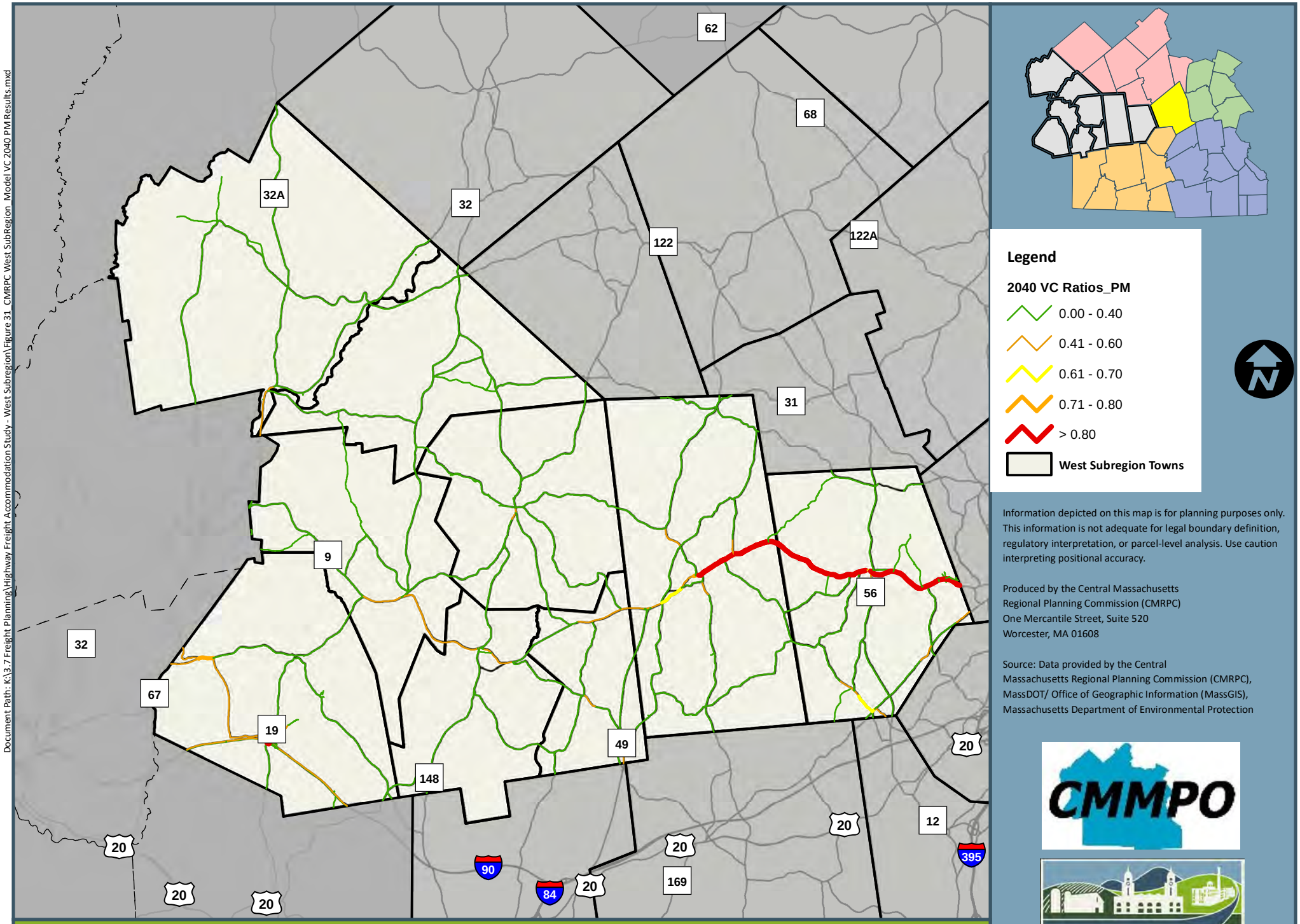


FIGURE 30 - WEST SUBREGION PROJECTED 2040 V/C RATIOS, AM PEAK PERIOD



Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - West Subregion\Figure 31_CMRPC West SubRegion_Model VC 2040 PM Results.mxd

FIGURE 31 - WEST SUBREGION PROJECTED 2040 V/C RATIOS, PM PEAK PERIOD

Potential Highway "Bottleneck" Segments in the West Subregion

The Travel Demand Forecasting Model software, or "Model", was also used to identify potential "Bottleneck" segments on the West subregion's federal-aid highways and other major locally-maintained roads. This analysis is based on the number of "Origin/Destination" (O/D) pairs using the highway network. The "Origin" is the location of the beginning of a vehicle trip. The "Destination" is the location of the end of the vehicle trip. This particular analysis is customized to the CMRPC region's Model which has a definitive number of calculated O/D pairs: 837,225. In a relative sense, Models for larger planning areas would have more O/D pairs, such as the greater Boston region. Conversely, smaller planning regions would have fewer O/D pairs, such as Franklin County in western Massachusetts.

Three (3) Scenarios were analyzed: "Stage 1", "Stage 2" & "Stage 3". The "Stage 1" Scenario Model results indicate where there are over 5,000 O/D pairs estimated to be using a particular segment of highway in the suburban and mostly rural West subregion. Under the "Stage 2" Scenario, Model results identify where there are over 7,500 O/D pairs using a particular highway segment in the West subregion. Finally, a "Stage 3" Scenario shows where there are in excess of 10,000 O/D pairs using the major federal-aid highways in the West planning subregion.

The results of the three (3) analyzed Scenarios are shown on **Figure 32**. The figure shows *potential* Model-derived highway Bottleneck segments in the West planning subregion. The identified potential Bottleneck segments affect all traffic using the highway network, including the range of heavy vehicles transporting a wide array of freight. The major State Numbered Route highlighted by the Model analysis, Route 9 from the Worcester city line, through the entirety of the town of Leicester through the downtown Spencer area. In downtown Spencer, Route 9 intersects with Route 31 southbound and Route 31 northbound at two offset intersections under signalized control. To the west of the downtown area, Route 9 continues under a "Stage 1" scenario to just beyond East Brookfield center, only to again arise on a segment of Route 9 in the town of Brookfield.

As such, travel conditions on Route 9 throughout the West planning subregion need to be monitored on a continued, periodic basis to verify Model results based on observed conditions in the field. Analytical estimates often need to be verified, perhaps through Travel Time & Delay studies conducted by a survey vehicle during both peak and off-peak travel periods. If congestion based on roadway capacity constraints becomes apparent on an ongoing, reoccurring basis, then the consideration of improvements will become more apparent. Such improvements could be targeted towards those roadway segments experiencing regular, reoccurring congestion-related incidents, delays, etc. Again, all vehicles, including those heavy vehicles carrying freight, are impacted by the potentially sluggish projected travel conditions.

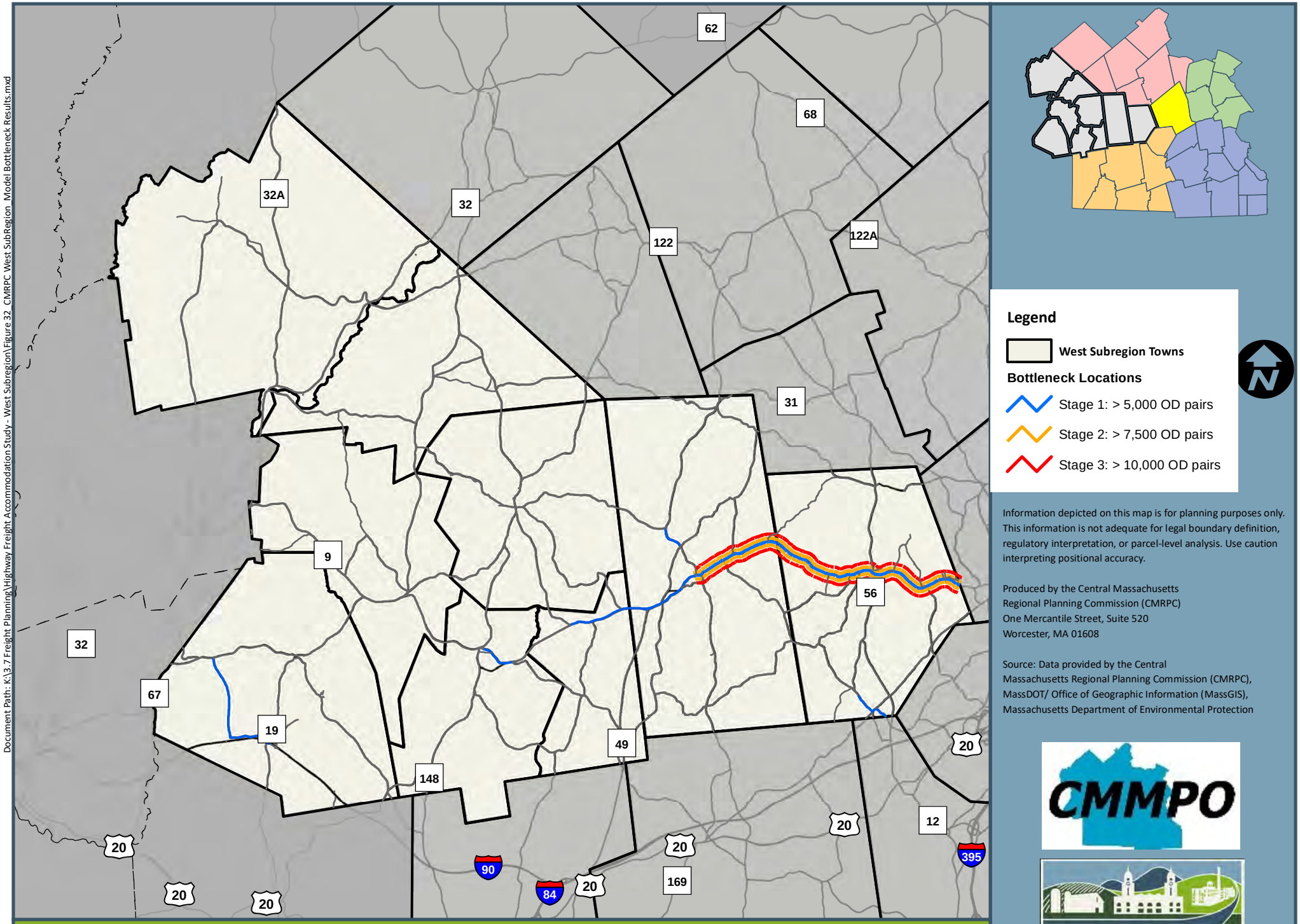


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FIGURE 32 - POTENTIAL HIGHWAY "BOTTLENECK" SEGMENTS IN THE WEST SUBREGION

5.0 Summary of Findings

Table 13 contains a summary of findings extracted from the range of maps previously presented. The information is summarized by West subregion host community and then by each State Numbered Route within the community. For some of the columns, as explained earlier, there was no useable data yet available. Further, some of the columns have multiple findings listed while other columns contain a range of findings such as overall traffic volumes as well as heavy vehicle volumes. The information within the table includes:

- Highway federal-aid eligibility
- Highway Ownership
- Environmental Justice (EJ) & Vulnerable Populations
- Critical Freight Corridor
- Transportation Improvement Program (TIP) Projects
- Traffic volume
- Heavy vehicle volume
- Heavy vehicle volume (northbound/eastbound)
- Heavy vehicle volume (southbound/westbound)
- Heavy vehicle percentage
- Average AM travel speeds
- Average PM travel speeds
- CMP Congested intersections
- Highway Safety Improvement Program (HSIP) crash clusters
- Pavement condition
- Bridges and culverts
- Management Systems data integration
- Environmental Profiles
- Evacuation Routes
- Hazardous Dams
- Locally-identified hazards and vulnerable infrastructure

The following are observations concerning each host community that pertain to the above listed information categories:

Brookfield

State Numbered Routes 9 and 148 are located in the town of Brookfield. On the eastern side of Brookfield, there is a large low income EJ population as well as a vulnerable population of

households with persons 75+ years of age. Both populations are adjacent to Routes 9 and 148. The highest traffic volumes are observed on Route 9 with daily totals ranging between 6,000 and 7,500 VPD. Route 148 daily traffic volumes range broadly between 1,800 and 6,800 VPD. Additionally, the daily percentage of heavy vehicles are 7% on Route 9 and between 6% and 12% on Route 148, depending on location. There are no known congested intersections or HSIP crash clusters in Brookfield. In regards to pavement condition, both State Numbered Routes are at least in fair condition. There are two (2) bridges and one (1) culvert along Route 9 and two (2) bridges on Route 148. Lastly, Route 148 has nearby hazards and locally-identified vulnerable critical infrastructure.

East Brookfield

State Numbered Routes 9 and 49 are located in the town of East Brookfield. Currently, there are no known EJ or vulnerable populations in the town of East Brookfield. Route 49 is considered a critical freight corridor and there is a currently programmed TIP resurfacing project for the entire portion of Route 9. The highest daily traffic volumes and heavy vehicle percentages in East Brookfield are on Route 9. There are no known congested intersections or HSIP crash clusters located on either State Numbered Route. Route 49 pavement has been observed to be in good condition, while Route 9 has a notable amount of pavement in poor condition. There is one (1) short span bridge along Route 9 while Route 49 has one (1) bridge, two (2) short span bridges, and two (2) culverts. Resulting from the Management Systems integration exercise, there are three (3) "Tier 2" rated segments on Route 9. Also, along Route 9 there are two (2) Significant Hazard dams. Additionally, locally-identified vulnerable critical infrastructure is located near both Routes 9 and 49.

Hardwick

In the town of Hardwick, the State Numbered Routes are Route 32 and Route 32A. There is a low income EJ neighborhood near both Route 32 and Route 32A. Route 32 has the highest daily traffic volumes while both Route 32 and Route 32A have a daily percentage of about 8% heavy vehicles. There are no known congested intersections or HSIP crash clusters located on either State Numbered Route. Pavement condition is good and excellent for Route 32A and mostly good or excellent for Route 32, except for a limited segment observed to be in poor condition. There are two (2) bridges, two (2) short span bridges, and four (4) culverts on Route 32 and two (2) short span bridges and one (1) culvert on Route 32A. There is also one (1) Low Hazard dam near Route 32 while both Route 32 and Route 32A have nearby vulnerable critical infrastructure identified by the community.

Leicester

State Numbered Routes 9 and 56 are located in the town of Leicester. There is a vulnerable population of households with persons 75+ years of age in the center of town that is found along both Route 9 and Route 56. In addition, there is an identified minority population near Route 9 at the Worcester City Line. The highest observed daily traffic volumes are on Route 9, however the highest daily heavy vehicle percentages are found on Route 56, ranging between 10% and 15%. There are no known congested intersections, but there is a MassDOT-identified HSIP crash cluster at the signalized Route 9 & Route 56 intersection. Overall, pavement was observed to be in fair to good condition for both State Numbered Routes except for two (2) segments of poor pavement. There are two (2) short span bridges - one (1) is structurally deficient - and one (1) culvert on Route 9. There are two (2) culverts on Route 56. Resulting from the Management Systems integration exercise, four (4) "Tier 2" segments have been identified on Route 9. Further, both Route 9 and Route 56 have nearby High Hazard dams and other locally-identified vulnerable critical infrastructure.

New Braintree

In the town of New Braintree, the State Numbered Routes are Route 67 and Route 148. Currently, there are no known EJ or vulnerable populations in the town of New Braintree. A small portion of Route 67 near the Barre town line is considered a Critical Rural Freight Corridor. Both State Numbered Routes have essentially the same daily traffic volumes and heavy vehicle percentages. There are no known congested intersections or HSIP crash clusters located on either Route 67 or Route 148. It was observed that Route 67 has a mix of pavement conditions ranging from poor to fair while Route 148 has pavement observed to be in good condition. Route 67 has five (5) culverts and no bridges while Route 148 has no bridges or any known culverts. Lastly, there are locally-identified hazards and vulnerable critical infrastructure situated near Route 67.

North Brookfield

State Numbered Route 67 and Route 148 are located in the town of North Brookfield. There is a vulnerable population of households with persons 75+ years of age that is found along both Routes 67 and 148. The highest observed daily traffic volumes are on the combined segment of Route 67 & 148 while the highest daily percentage of heavy vehicles are using Route 148. There are no known congested intersections or HSIP crash clusters located on either State Numbered Route. Most of the highway pavement was observed to be in fair or good condition except for two (2) segments rated as poor on both Route 67 and Route 148. Route 67 has one (1) short span bridge that is considered structurally deficient. Along Route 148 there is a

nearby Significant Hazard dam. There are also other locally-identified hazards and vulnerable critical infrastructure along both Route 67 and Route 148.

Spencer

In the town of Spencer, the State Numbered Routes are Route 9, Route 31, and Route 49. A low-income population, a vulnerable population of households with persons 75+ years of age as well as zero vehicle households are located in the downtown area of Spencer. These populations are found along both Route 9 and Route 31. Route 49 is considered a Critical Freight Corridor. There is a currently programmed TIP resurfacing project for a portion of Route 9. Route 9 has the highest daily traffic volumes with up to 19,000 VPD while both Route 31 and Route 49 have up to 6,000 VPD. Route 31 has the highest daily heavy vehicle percentages ranging between 8% and 19%. There are no known congested intersections or HSIP crash clusters on either State Numbered Route in the town of Spencer. Regarding pavement, Routes 9 and 49 are in good to excellent condition while Route 31 was observed to have a variety of pavement conditions. Route 9 has one (1) bridge and one (1) short span bridge while Route 31 has two (2) bridges, with one (1) deemed structurally deficient. Route 49 has two (2) bridges and one (1) culvert. According to the results of the Management Systems integration exercise, there are three (3) "Tier 2" segments on Route 9. There are both a Significant Hazard dam and a High Hazard dam nearby Route 31. Lastly, there are locally-identified hazards or vulnerable critical infrastructure nearby Route 9, Route 31, and Route 49.

Warren

State Numbered Route 19 and Route 67 are located in the town of Warren. A low-income population, a vulnerable population of households with persons 75+ years of age and zero vehicle households are all located in Warren near Routes 19 and 67. Route 67 has the highest daily traffic volumes with up to 8,000 VPD. The combined segment of Routes 19 & 67 has the highest daily heavy vehicle percentage with nearly 17%. There are no known congested intersections or HSIP crash clusters located on either State Numbered Route. Pavement on Route 67 was observed to be in good and excellent condition while Route 19 was observed to have a mix of all conditions with the exception of very poor. There is one (1) bridge on Route 19. There are three (3) bridges and one (1) culvert on Route 67, and two (2) bridges on the combined section of Routes 19 & 67. Further, there is a Significant Hazard dam nearby the Routes 19 & 67 combined section. Lastly, there are locally-identified hazards or vulnerable critical infrastructure nearby both Route 19 and Route 67.

West Brookfield

In the town of West Brookfield, the State Numbered Routes are Route 9, Route 32, and Route 67. There is a vulnerable population of households with persons 75+ years of age near both

Routes 9 and 67. There is a currently programmed TIP project for the reconstruction of Route 9 between the Ware town line and Pierce Road. Route 9 has the highest daily traffic volumes with over 7,000 VPD west of Route 67 and over 9,000 VPD on the combined section of Routes 9 & 67. As for daily heavy vehicle percentages, all State Numbered Routes ranged between 6% and 10%. There are no known congested intersections or HSIP crash clusters located in West Brookfield. Most of the pavement on each State Numbered Route was observed to be in at least fair condition. There is one (1) segment on Route 9, just west of Route 67, where the pavement was observed to be in poor condition. There are two (2) bridges and two (2) culverts on Route 9 and two (2) bridges on the combined section of Routes 19 & 67. In addition, there are locally-identified hazards or vulnerable critical infrastructure nearby both Route 9 and Route 67. However, none appear to have a potential impact on Route 32.

Table 13 - Summary of Findings

Host Community	Route #	Fed-Aid Eligible	Highway Ownership	EJ & Vulnerable Populations	Critical Freight Corridor	TIP Projects	Traffic Volume	Heavy Vehicle Volume	Heavy Vehicle Volume (NB/EB)	Heavy Vehicle Volume (SB/WB)	Heavy Vehicle %	Average Travel Speeds (AM)	Average Travel Speeds (PM)	CMP Congested Intersections	HSIP Crash Clusters	Pavement Condition	Bridges & Culverts	Management Systems Data Integration	Environmental Profiles	Evacuation Route	Dams	Locally-Identified Hazards & Vulnerable Infrastructure
Brookfield	9	Yes	MassDOT	Yes	No	No	6,000 - 7,500	500 - 550	175 - 275	275 - 300	7%	No Data	No Data	No	No	Fair / Good	1 Bridge, 1 Short Span Bridge, 1 Culvert	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	None
	148	Yes	Town	Yes	No	No	1,800 - 6,800	150 - 700	75 - 345	80 - 375	6% - 12%	No Data	No Data	No	No	Fair / Good / Excellent	2 Bridges	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
East Brookfield	9	Yes	MassDOT	No	No	Yes	7,500 - 16,000	500 - 2,400	260 - 1,480	275 - 1,035	7% - 15%	No Data	No Data	No	No	Poor / Fair / Good	1 Short Span Bridge	Tiers 2 & 3	Nearby conservation & recreation area, wetlands, vernal & potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	Nearby Significant Hazard Dam	Nearby Vulnerable Critical Infrastructure
	49	Yes	MassDOT	No	Yes	No	7,700	545	260	185	7%	No Data	No Data	No	No	Good	1 Bridge, 1 Short Span Bridge, 2 Culverts	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, 500 year flood zones.	Primary	None	Nearby Vulnerable Critical Infrastructure
Hardwick	32	Yes	MassDOT & Town	Yes	No	No	2,100 - 4,600	225 - 350	115 - 175	100 - 180	8% - 10%	No Data	No Data	No	No	Poor / Fair / Good / Excellent	2 Bridges, 2 Short Span Bridges, 4 Culverts	Tier 3	Nearby conservation & recreation area, wetlands, vernal & potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	Nearby Low Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
	32A	Yes	Town	Yes	No	No	600 - 1,500	55	30	25	8%	No Data	No Data	No	No	Good / Excellent	2 Short Span Bridges, 1 Culvert	Tier 3	Nearby recreation & water supply area, wetlands, vernal & potential vernal pools, rare species habitat, and 100 year flood zones.	Primary	None	Nearby Vulnerable Critical Infrastructure
Leicester	9	Yes	MassDOT	Yes	No	No	13,500 - 17,500	900 - 915	445 - 465	440 - 470	6% - 7%	25 - 40 MPH	30 - 40 MPH	No	Yes	Poor / Fair / Good	2 Short Span Bridges (1SD), 1 Culvert	Tiers 2 & 3	Nearby recreation area, wetlands, potential vernal pools, and 100 year flood zones.	Primary	Nearby Significant & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	56	Yes	Town	Yes	No	No	3,400 - 9,900	800 - 1,100	400 - 740	300 - 450	10% - 15%	36 - 42 MPH	32 - 43 MPH	No	Yes	Poor / Fair / Good / Excellent	2 Culverts	Tier 3	Nearby conservation, recreation & water supply area, wetlands, potential vernal pools, and 100 year flood zones.	Primary	Nearby High Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
New Braintree	67	Yes	Town	No	Yes	No	1,600 - 1,900	130 - 225	60 - 80	70 - 150	6% - 9%	No Data	No Data	No	No	Poor / Fair / Good	5 Culverts	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 year flood zones.	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	148	Yes	Town	No	No	No	1,900	225	145	80	9%	No Data	No Data	No	No	Good	None	Tier 3	Nearby potential vernal pools and 100 year flood zones.	Primary	None	None
North Brookfield	67	Yes	Town	Yes	No	No	1,900 - 2,700	130 - 215	60 - 70	60 - 145	5% - 7%	No Data	No Data	No	No	Poor / Fair / Good	1 Short Span Bridge (SD)	Tier 3	Nearby conservation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Hazards
	148	Yes	Town	Yes	No	No	1,400 - 2,200	75 - 225	40 - 150	35 - 80	6% - 9%	No Data	No Data	No	No	Poor / Fair / Good / Excellent	None	Tier 3	Nearby conservation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	Nearby Signigicant Hazard Dam	Nearby Vulnerable Critical Infrastructure
	67/148	Yes	Town	Yes	No	No	4,000 - 9,700	230 - 315	145 - 160	85 - 150	6%	No Data	No Data	No	No	Fair / Good	None	Tier 3	Nearby conservation area, wetlands, potential vernal pools, and 500 year flood zones.	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure

Table 13 - Summary of Findings

Host Community	Route #	Fed-Aid Eligible	Highway Ownership	EJ & Vulnerable Populations	Critical Freight Corridor	TIP Projects	Traffic Volume	Heavy Vehicle Volume	Heavy Vehicle Volume (NB/EB)	Heavy Vehicle Volume (SB/WB)	Heavy Vehicle %	Average Travel Speeds (AM)	Average Travel Speeds (PM)	CMP Congested Intersections	HSIP Crash Clusters	Pavement Condition	Bridges & Culverts	Management Systems Data Integration	Environmental Profiles	Evacuation Route	Dams	Locally-Identified Hazards & Vulnerable Infrastructure
Spencer	9	Yes	MassDOT & Town	Yes	No	Yes	14,000 - 18,900	915 - 2,375	450 - 1,475	475 - 900	6% - 15%	30 - 45 MPH	30 - 45 MPH	No	No	Good / Excellent	1 Bridge, 1 Short Span Bridge	Tiers 2 & 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Vulnerable Critical Infrastructure
	31	Yes	Town	Yes	No	No	2,700 - 5,900	350 - 750	170 - 330	150 - 410	8% - 19%	32 - 44 MPH	32 - 46 MPH	No	No	Very Poor / Poor / Fair / Good / Excellent	2 Bridges (1SD)	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 year flood zones.	Primary	Nearby Significant & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	9/31	Yes	Town	Yes	No	No	16,800	No Data	No Data	No Data	No Data	20 MPH	10 - 18 MPH	No	No	Excellent	None	Tier 3	None	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	49	Yes	MassDOT	No	Yes	No	6,000	500	275	225	6%	No Data	No Data	No	No	Good	2 Bridges, 1 Culvert	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 year flood zones.	Primary	None	Nearby Vulnerable Critical Infrastructure
Warren	19	Yes	Town	Yes	No	No	1,400 - 1,600	150 - 200	55 - 100	100	12%	No Data	No Data	No	No	Poor / Fair / Good / Excellent	1 Bridge	Tier 3	Nearby conservation & water supply area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	67	Yes	MassDOT	Yes	No	No	4,800 - 8,000	355	160	95	7%	No Data	No Data	No	No	Good / Excellent	1 Bridge, 2 Short Span Bridges, 1 Culvert	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	Nearby Low Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
	19/67	Yes	MassDOT	Yes	No	No	5,200 - 6,200	375 - 875	230 - 425	155 - 460	7% - 17%	No Data	No Data	No	No	Good / Excellent	2 Bridges	Tier 3	Nearby recreation area, wetlands, potential vernal pools, rare species habitat, and 100 year flood zones.	Primary	Nearby Significant Hazard Dam	Nearby Vulnerable Critical Infrastructure
West Brookfield	9	Yes	MassDOT & Town	Yes	No	Yes	4,800 - 7,700	350 - 675	175 - 275	190 - 400	7% - 10%	No Data	No Data	No	No	Poor / Good / Excellent	2 Bridges, 2 Culverts	Tier 3	Nearby conservation & recreation area, wetlands, potential vernal pools, rare species habitat, 100 & 500 year flood zones.	Primary	Nearby Low Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	32	Yes	MassDOT	Yes	No	No	2,500	260	130	130	10%	No Data	No Data	No	No	Good	None	Tier 3	None	Primary	None	None
	67	Yes	Town	Yes	No	No	2,700 - 3,800	215 - 250	70 - 100	140 - 150	6% - 7%	No Data	No Data	No	No	Fair / Good / Excellent	None	Tier 3	Nearby wetlands, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Hazards
	19/67	Yes	MassDOT	Yes	No	No	6,100	390	230	160	7%	No Data	No Data	No	No	Excellent	2 Bridges	Tier 3	Nearby wetlands, potential vernal pools, rare species habitat, and 100 & 500 year flood zones.	Primary	None	Nearby Vulnerable Critical Infrastructure
	9/67	Yes	MassDOT & Town	Yes	No	No	9,700 - 9,900	750 - 1,050	330 - 550	415 - 480	7% - 10%	No Data	No Data	No	No	Good	None	Tier 3	Nearby rare species habitat and 100 year flood zones.	Primary	Nearby Low Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure

6.0 Suggested Improvement Options

Based on the previous Summary of Findings section, a number of suggested improvement options have been compiled for consideration by both MassDOT and the nine (9) host communities in the West planning subregion. The following **Figure 33** shows suggested priority infrastructure improvements for each of the towns. Highway segments that are on the federal-aid network are eligible for potential future-year project funding through the CMMPO's TIP. Other available funding resources also have the potential to be applied, such as various grant opportunities and state-provided Chapter 90 funds.

6.1 West Subregion-Wide Improvement Options

- In the spirit of Jason's Law, contemplate revised local policy and strongly consider truck parking-friendly bylaws that allow for federally-required driver rest periods for long distance truckers at key commercial and/or industrial locations in each of the host communities.
- Potential improvement of truck turning radii at major intersections, limited box widening where necessary, the installation of truck climbing lanes on steep grades as well as the elimination of hazardous highway curves.
- Check and optimize traffic signal timing & phasing at high-volume signalized intersections.
- Maintain all pavement to a condition of "Good" or above. Pavement condition is especially critical on established Critical Freight Corridors.
- Address all structurally deficient (SD) bridges. Address those bridges with posted weight limits associated with reduced load-carrying capabilities.
- Numerous culverts need attention in the West transportation planning subregion. As such, commence corridor-wide and/or town-wide culvert assessment programs that can allow for the future targeted replacement of key vulnerable drainage system components. *(The CMRPC transportation staff is available to discuss this program further.)*
- Improve/repair the hazardous dams identified in the West subregion, especially those located upstream of State Numbered Routes.

6.2 West Subregion Host Community Improvement Options

Brookfield

- Consider improving the Significant Hazard dam in the community adjacent to Route 148.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

East Brookfield

- Improve the poor pavement segments identified on Route 9 between Cottage Street and Harrington Street and from Brookfield town line to Oakland Drive. The poor pavement segments will be improved once the Route 9 resurfacing project, currently programmed in FFY 2024 TIP, is completed.
- Consider improving the Management Systems data integration analysis-identified Tier 2 priority segments on Route 9 between North Brookfield Road & Harrington Street.
- Consider improving all Significant Hazard dams in the community, specifically near and upstream of Route 9.
- Improve the structural-deficient bridge on South Pond Road over South Pond. This bridge is also posted for load.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

Hardwick

- Improve the poor pavement observed on Route 32 between Route 32A and New Braintree Road, and other federal-aid eligible roadways.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

Leicester

- Improve the poor pavement segments identified on Route 9 between Auburn Street and the Worcester city line as well as on Route 56, between Stafford Street and the Oxford town line.
- Improve the structurally-deficient bridge on Route 9 over Kettle Brook.
- Consider improving the Management Systems data integration analysis-identified Tier 2 priority segments on Route 9 between Burncoat Street and the Worcester city line.
- Address the 2015-2017 HSIP-identified location at heavily traveled Route 9/Route 56 intersection. After 2017, the intersection was reconstructed with geometry improvements, upgraded traffic signal, and an updated lane configuration.

- Consider improving all High and Significant Hazard dams in the community, specifically near Route 9 and Route 56.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

New Braintree

- Improve the poor pavement segments identified on Route 67 between Ravine Road & Barre Cutoff Road and on other federal-aid eligible roadways.
- Consider improving the one (1) Significant Hazard dam in town located just north of Worcester Road, near the Oakham town line.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

North Brookfield

- Improve the poor pavement segments observed on Route 67 between Bell Road & Mill Road as well as on Route 148, between Birch Hill Road & Donovan Road and other federal-aid eligible roadways.
- Improve the structurally-deficient bridge on Route 67 over Coys Brook. This bridge is also currently posted for load.
- Consider improving all Significant Hazard dams in the community, specifically upstream and/or near Route 148.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

Spencer

- Improve the poor pavement segments identified on Route 31 between Main Street and Charlton Road as well as the very poor pavement segments observed on Route 31, between East Charlton Road and Sundberg Road.
- Improve the structurally-deficient bridge on Route 31 over the Seven Mile River.
- Consider improving the Management Systems data integration analysis-identified Tier 2 priority segments on Route 9 between East Brookfield town line and Grove Street.
- Consider improving all High and Significant Hazard dams in Spencer, specifically upstream and/or near Route 31.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

Warren

- Improve the poor pavement segments identified on Route 19 between Main Street and Reed Street as well as other federal-aid eligible roadways.
- Consider improving the Significant Hazard dam situated near the combined section of Routes 19 & 67.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

West Brookfield

- Improve the poor pavement segments observed on Route 9 between Old Warren Road and Cutler Road as well as other federal-aid eligible roadways.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested subregion-wide improvement options.

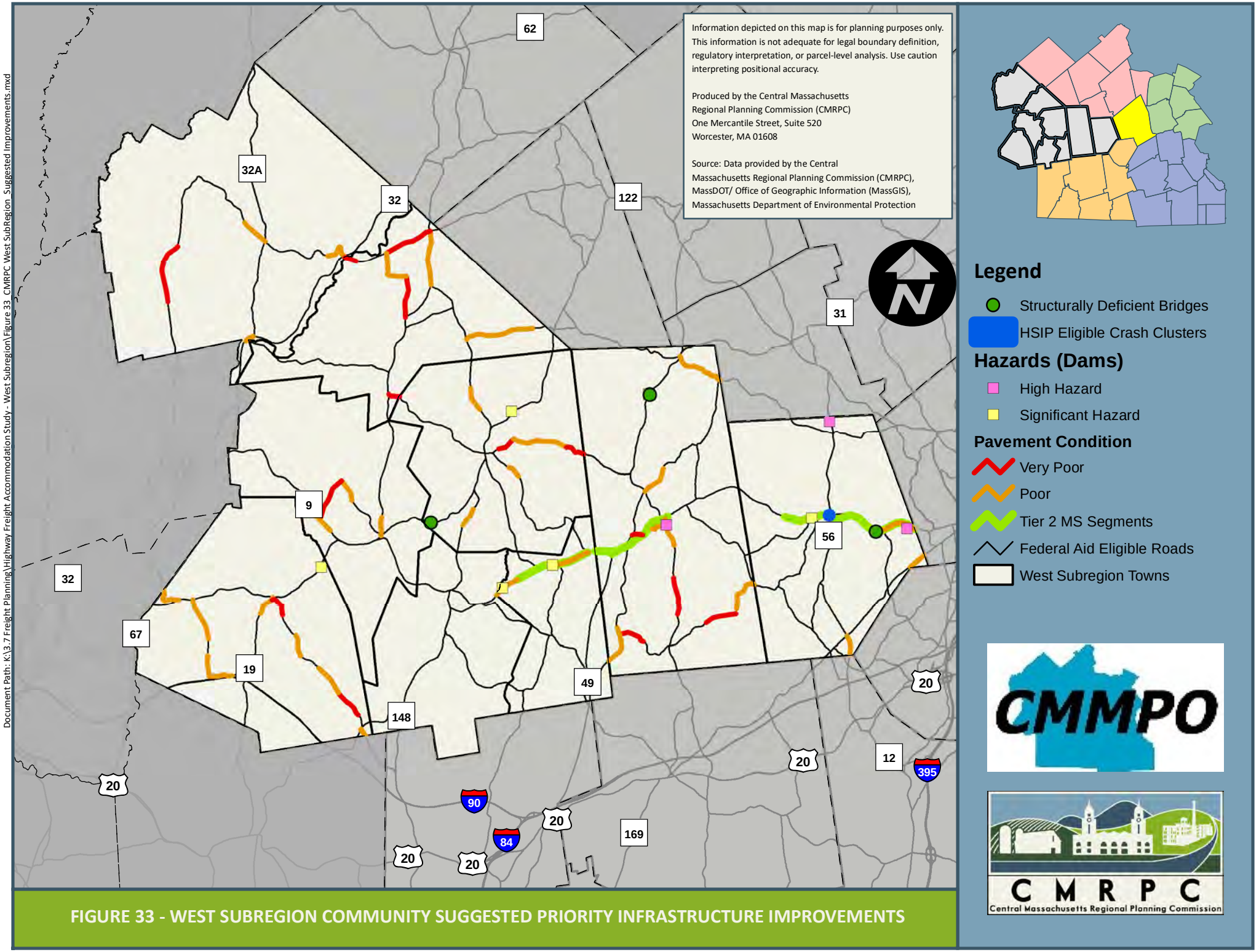

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FIGURE 33 - WEST SUBREGION COMMUNITY SUGGESTED PRIORITY INFRASTRUCTURE IMPROVEMENTS

Central Massachusetts Regional Planning Commission

Member Communities

Auburn	Northborough
Barre	Northbridge
Berlin	Oakham
Blackstone	Oxford
Boylston	Paxton
Brookfield	Princeton
Charlton	Rutland
Douglas	Shrewsbury
Dudley	Southbridge
East Brookfield	Spencer
Grafton	Sturbridge
Hardwick	Sutton
Holden	Upton
Hopedale	Uxbridge
Leicester	Warren
Mendon	Webster
Millbury	West Boylston
Millville	West Brookfield
New Braintree	Westborough
North Brookfield	Worcester

Central Mass Regional Planning Commission

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