CENTRAL MASSACHUSETTS
METROPOLITAN PLANNING ORGANIZATION
(CMMPO)

Highway Freight Accommodation Assessment Study: North Transportation Planning Subregion

CMMPO
Central Massachusetts Metropolitan Planning Organization

C M R P C
Central Massachusetts Regional Planning Commission

August 2021

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 CMRPC transportation planning subregions is adequately accommodating existing trucking needs as well as those projected for the future, the CMMPO UPWP for FFY 2020 initiated a new study series, “Highway Freight Accommodation Assessment” for federal-aid state-numbered routes. This first installment focuses on the North subregion and, based on both field observations and detailed analyses, 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 2017 *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 is intended to assist in addressing this identified need. Accordingly, 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 2021 includes the next installment in this study series that will focus on the ***West*** *transportation planning subregion.*

1.0 Introduction

The CMMPO's Endorsed 2020 Unified Planning Work Program (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 first 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 North transportation planning subregion. The North subregion includes seven (7) host communities: Barre, Holden, Oakham, Paxton, Princeton, Rutland, and West Boylston. A map of the North subregion can be found in **Figure 1**.

All eligible for federal-aid improvement funding, the following ten (10) state-numbered routes in the North subregion are the focus of this study effort:

1. Route 12
2. Route 32
3. Route 62
4. Route 67
5. Route 68
6. Route 110
7. Route 122
8. Route 122A
9. Route 140
10. Route 148

Major topics addressed in the *Accommodation Assessment Study* include a subregional trucking amenities overview, 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, that includes calibration refinements for improved consideration of heavy vehicles, was utilized to identify "hot spots" of 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 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.

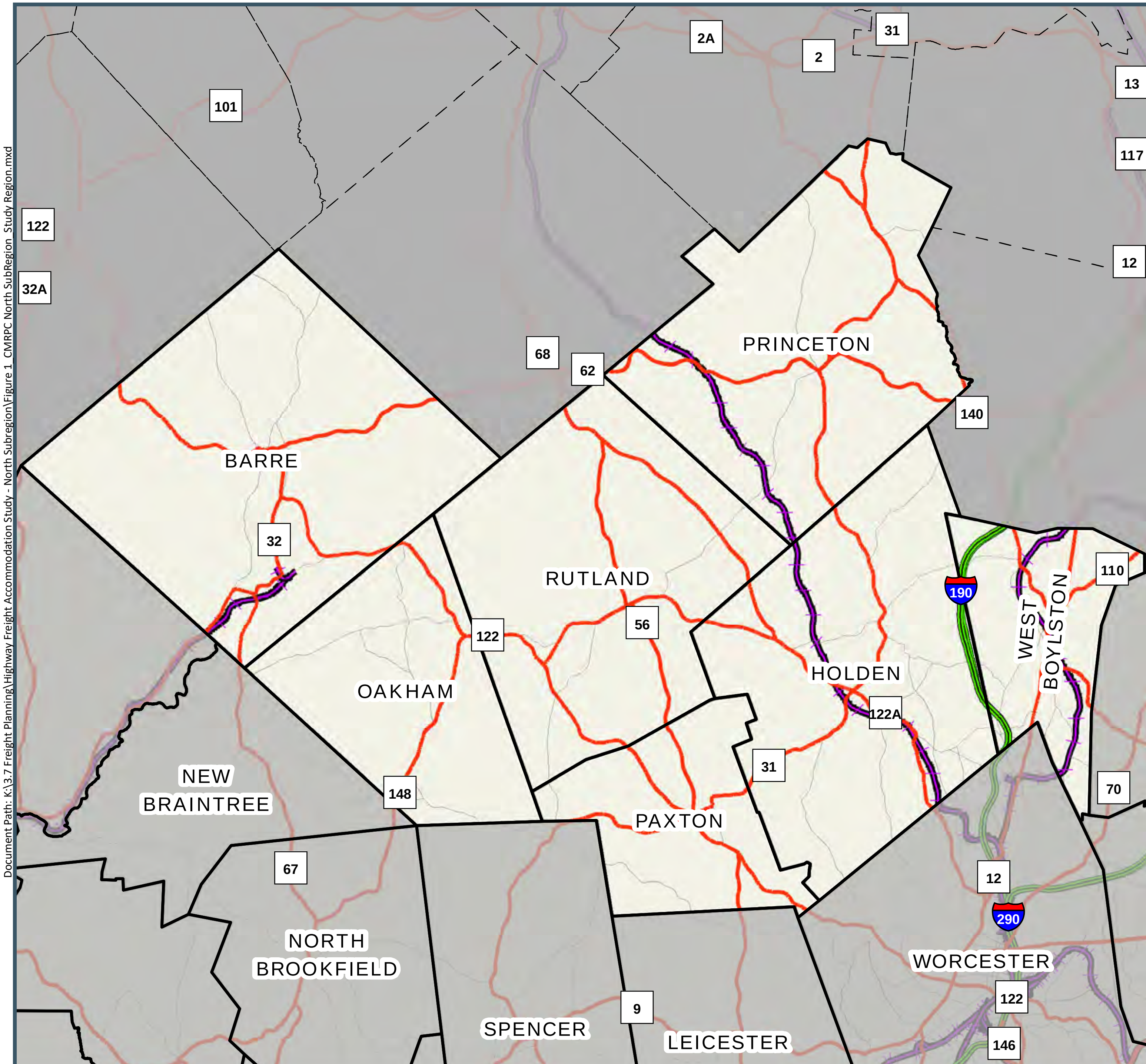

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FIGURE 1 - NORTH SUBREGION STUDY REGION HOST COMMUNITIES

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1.1 Area Trucking Amenities

In general, the state's 2017 *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, 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 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 numerous rest stops operated by the private sector nationwide.) Staff plans to periodically update 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

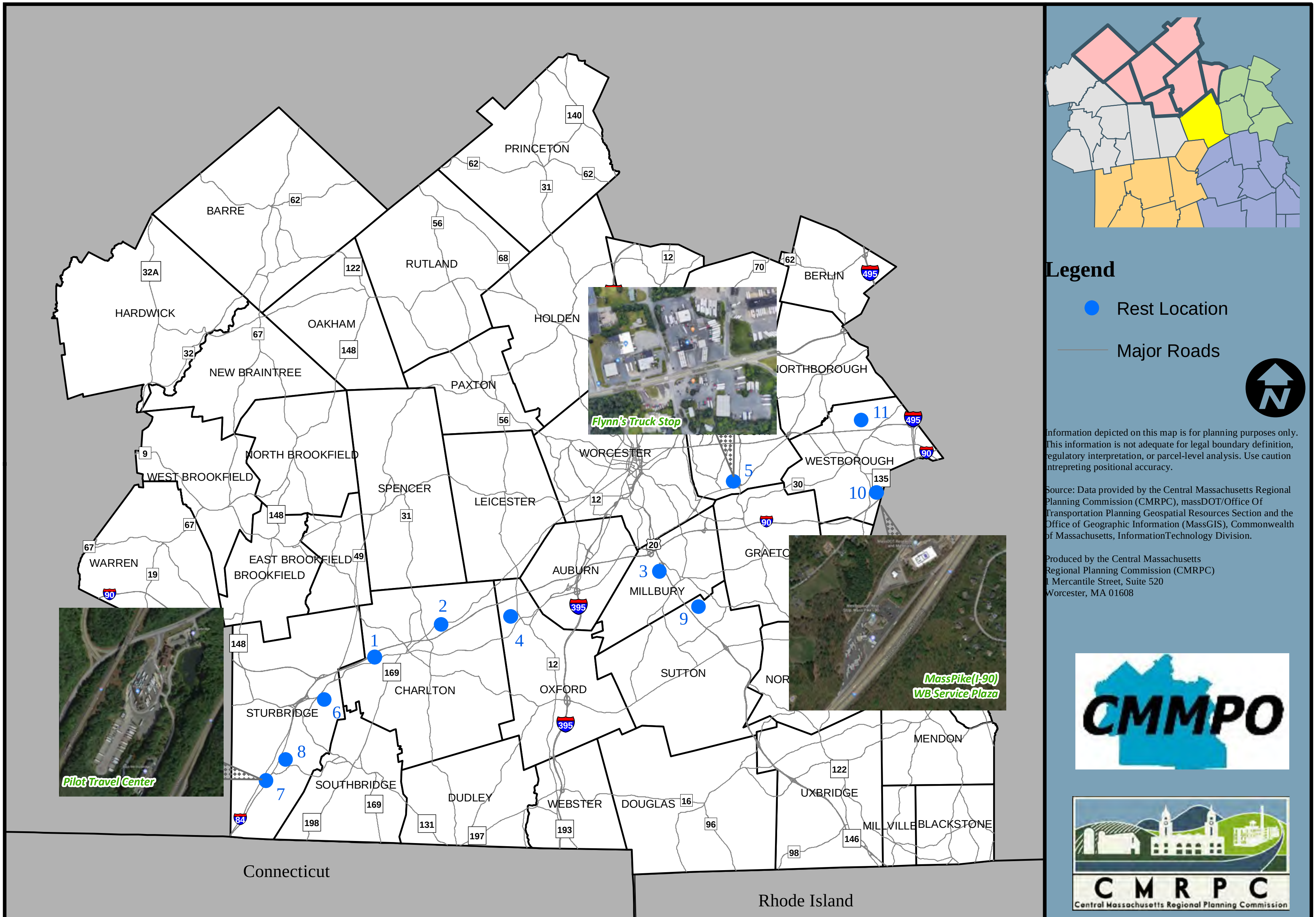

FIGURE 2 - MAJOR REST LOCATIONS FOR LONG-DISTANCE TRUCK DRIVERS

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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 need 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 forthcoming statewide trucking study that MassDOT commenced in 2020 is welcome. The CMMPO staff hopes to directly participate in this 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 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 Weight Station Tuck Parking Opportunities

It is suggested that both underutilized or dormant MassDOT Weight 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 Weight Stations are currently in use, as activity levels appear to vary over time. Further, still 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 utilized 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 North subregion at the following locations, one in each of the seven (7) host communities encompassed in this study:

- **Barre:** Route 32 at Phoenix Plaza
- **Holden:** Route 122, Industrial Park & Route 31, Big Y Plaza
- **Oakham:** Route 122, MassCentral Trail Head
- **Paxton:** Route 122 corridor
- **Princeton:** Route 140 corridor
- **Rutland:** Route 122/Route 122A intersection
- **West Boylston:** Route 12, Walmart Plaza & I-190 at Route 140
- *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 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 North 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 seven (7) host communities in the North 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 North transportation planning subregion providing diesel fuel sales. As can be seen from the table, the only diesel stations are in the communities of Holden, Rutland, and West Boylston.

Table 2
Diesel Fuel Locations in the North Subregion

Facility Name	Facility Address	Host Community
Global Montello Group #1427	1175 Main Street	Holden
Speedway #2466	770 Main Street	Holden
Rutland Saveway Gas	249 Main Street	Rutland
Colonial Convenience	222 Barre-Paxton Road	Rutland
Cumberland Farms #2525	184 West Boylston Street	West Boylston
HandR	21 West Boylston Street	West Boylston

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. The Genesee & Wyoming Inc. P&W Railroad serves the North planning subregion on the Gardner Branch that passes through both Holden and Princeton. *A regional freight stakeholder has experience in this area and can be contacted for further information through the CMRPC staff.*

1.2 Host Community Bylaws Concerning Trucking

Staff reviewed local community bylaws for the North 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.)* It was determined that a number of the host communities in the North subregion – Barre, Rutland, Paxton, and Princeton - have no local bylaws governing trucking operations. Those towns that do - Oakham, Holden, and West Boylston – are summarized as follows:

Barre – ***None Posted***

Oakham

Section 6 – Special Regulations

> **6.3 - Removal of Soil**: The removal of soil including but not limited to sand, gravel, loam, clay, stone, or other subsurface materials, except water, in amounts greater than five hundred cubic yards shall be in accordance with the following conditions, as well as any other conditions that the Planning Board may set forth to ensure public safety and the general welfare of the Town.
>
> > **6.3.4**. - Unless otherwise granted by the Planning Board, hours of operation shall be limited to 7:00 A.M. to 5:00 P.M. Monday through Friday, and 7:00 A.M. to 12:00 noon on Saturdays. There shall be no operation of trucks or equipment on Sundays or holidays.
>
> *Chapter XIV, Zoning, Section VI, Special Regulations, 6.3 Removal of Soil amended from fifteen hundred cubic yards to five hundred cubic yards, at Annual Town Meeting, June 17, 2002. Approved by Attorney General Thomas F. Reilly, September 16, 2002.*

Rutland – ***None Posted***

Paxton – ***None Posted***

Holden

Chapter 7.1 Section 8 Parking and Loading Regulations EXCERPTS

No commercially licensed vehicle, in excess of 10,000 pounds gross vehicle weight except school buses or a farm vehicle on a farm and construction equipment (during actual construction on the site) shall be parked overnight in the R-M, R-10, R-2 and R-1 districts.

OFF-STREET LOADING STANDARDS

Use	Number of Loading Spaces Per Unit
Retail trade, manufacturing, and hospital establishment with over 5,000 sq. ft. of net floor area	One per 20,000 sq. ft. or fraction thereof of net floor area up to two spaces, one additional space for each 60,000 sq. ft. or fraction thereof
Business services, other services, community facility (school, church, town building, recreation, etc.) or public utility establishment with over 5,000 sq. ft. of new floor area	One per 75,000 sq. ft. or fraction thereof of net floor area up to two spaces one additional space for each additional 200,000 sq. ft. or fraction thereof

Princeton – ***None Posted***

West Boylston

Article 36 – Traffic

Operation of Vehicles

Section 10 – Vehicle Weight Exclusion

- When official signs are posted specifying weight exclusion for vehicles, no commercial vehicle exceeding the posted authorized carrying capacity shall be permitted upon such posted street.
- An exception to Section 10(a) is made for delivery and pickup of materials to and from premises abutting upon posted streets which specify weight exclusions or to adjacent streets which cannot be reached by other public ways. This section shall not apply to emergency vehicles as herein defined, or to buses.
- Any person violating this section shall be punished by a fine of one hundred dollars ($100.00)

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 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 *North Subregion Highway Freight Accommodation Study* details the primary focus network of State Numbered Routes owned and maintained by either MassDOT or the host communities. Those highways eligible for federal-aid improvement funding through the CMMPO's Transportation Improvement Program (TIP). Currently programmed TIP projects in the subregion are 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 listed, all State Numbered Routes eligible for federal-aid improvement funding in the North subregion are the primary focus of the study effort. Other federal-aid town-owned & maintained highway segments were also included, often serving as connectors between the State Numbered Routes. Again, the following ten (10) State Numbered Routes in the North subregion are the focus of this analysis: Route 12, Route 32, Route 62, Route 67, Route 68, Route 110, Route 122, Route 122A, Route 140 and Route 148. Segments of these highways that were previously designated by the CMMPO as Critical Freight Corridors are also identified.

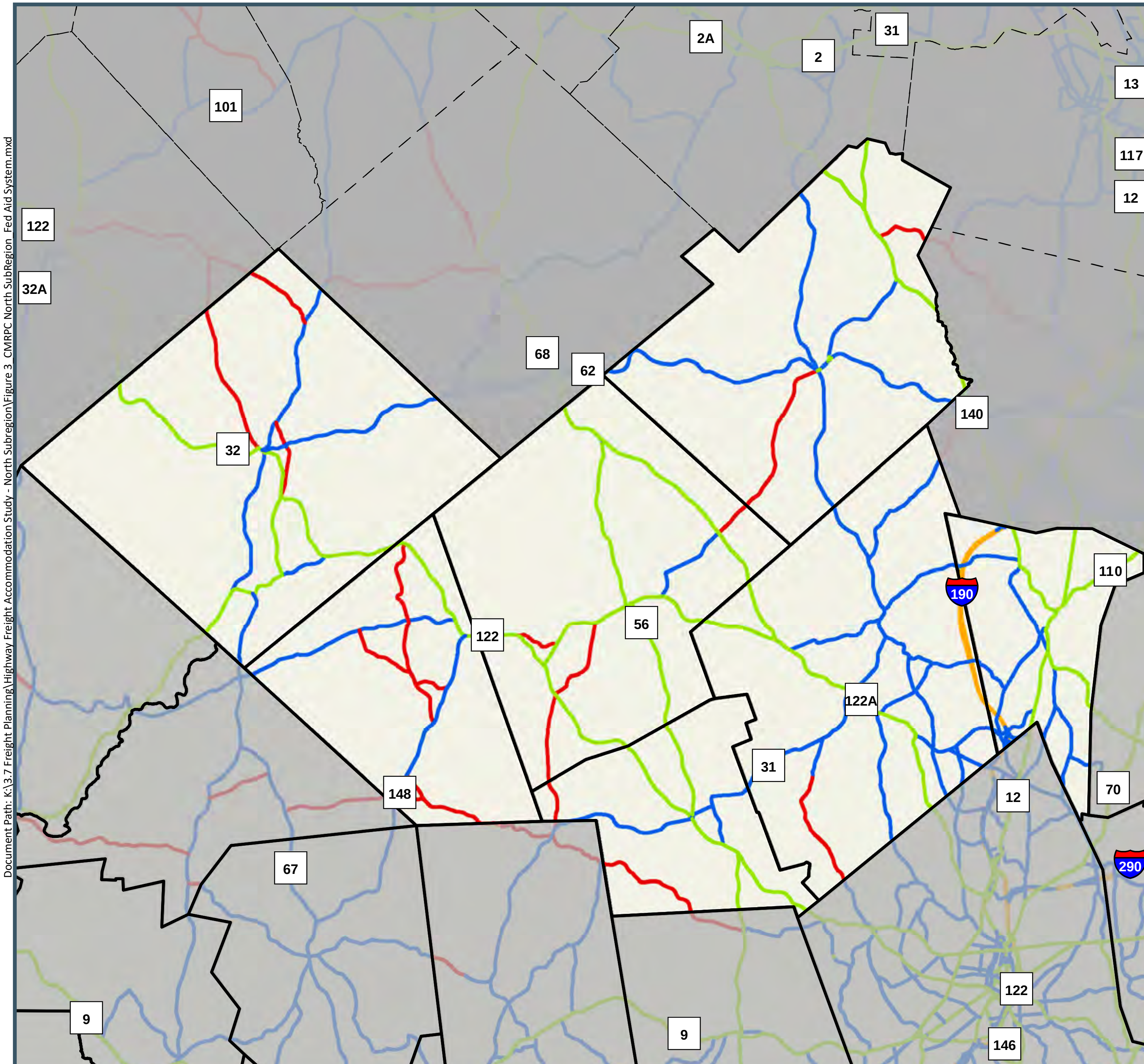
Federal-Aid Eligible Road Classifications & Highway Ownership

Figure 3 shows the federal-aid eligible highways in the North subregion. Funds are allocated from the Federal Highway Administration (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 National Highway System (NHS) categories and two 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 call "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 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 North transportation planning subregion, Interstate 190, which is located in Holden and West Boylston. Other NHS roadways include Routes 12, 32, 56, 68, 110, 122, 122A and 140. The remaining state-numbered routes included in this accommodation assessment study are STP-eligible and include Routes 31. 62, 67 and 148. It should be noted that a segment of Route 31 in Princeton, near the Westminster town line, is categorized as NHS. Other major roadways within the North subregion shown on the figure are classified as either STP-eligible or STP – C15.

Further, **Figure 4** shows the highway ownership for the state-numbered routes and other major roadways in the North subregion. As can been seen in the figure, the majority of the highways are owned, and thus maintained, by the seven (7) host communities. Interstate 190, Route 12, Route 110, Route 122, Route 122A, and Routes 122/32 are the major highways owned and maintained by MassDOT.



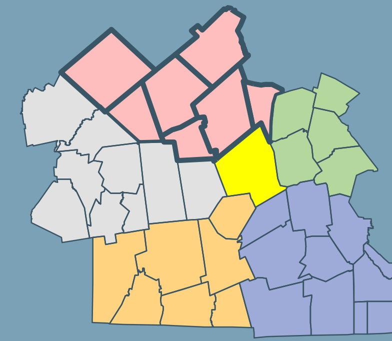


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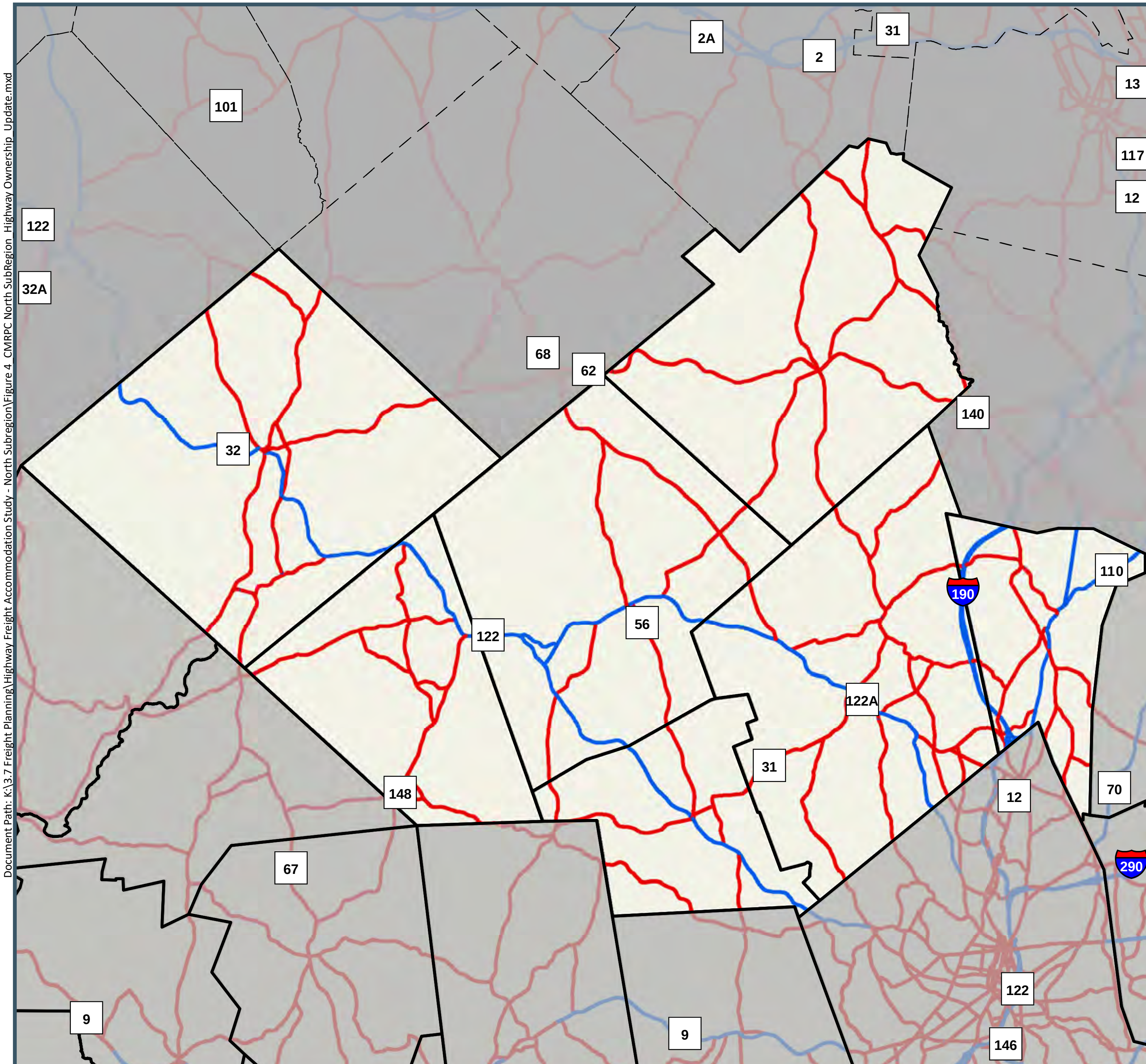
FIGURE 3 - NORTH SUBREGION FEDERAL-AID ELIGIBLE ROAD CLASSIFICATIONS



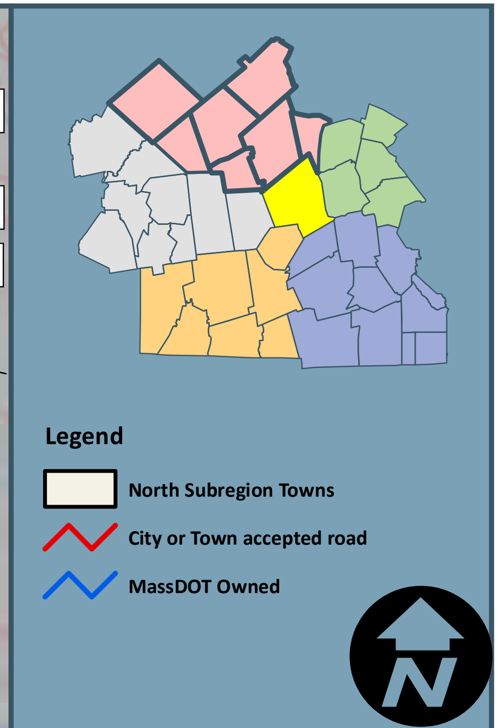


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FIGURE 4 - NORTH SUBREGION ROADWAY OWNERSHIP

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Critical Freight Corridors

As part of the development of the state's 2017 *Massachusetts Freight Plan*, the CMMPO staff took an active role, as requested by MassDOT-OTP, in designating "Critical Rural & Urban Freight Corridors". This exercise defined both existing and new major highway freight routes in the region connecting to the National Highway System (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 OTP-allocated mileage guidance criteria 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 5**, there are two Critical Rural Freight Corridors within the North subregion. They are located within the communities of Rutland, Oakham and Barre. The first Critical Rural Freight Corridor designated by the CMMPO is Route 122 and Route 32, between Route 122A in Rutland to the Petersham town line. The second Critical Rural Freight Corridor is along Route 67 and Route 32, from Ravine Road in New Braintree to Route 122 in Barre. The Phoenix Plaza intermodal site is strategically located in South Barre adjacent to the Route 32 intersection with Vernon Avenue.

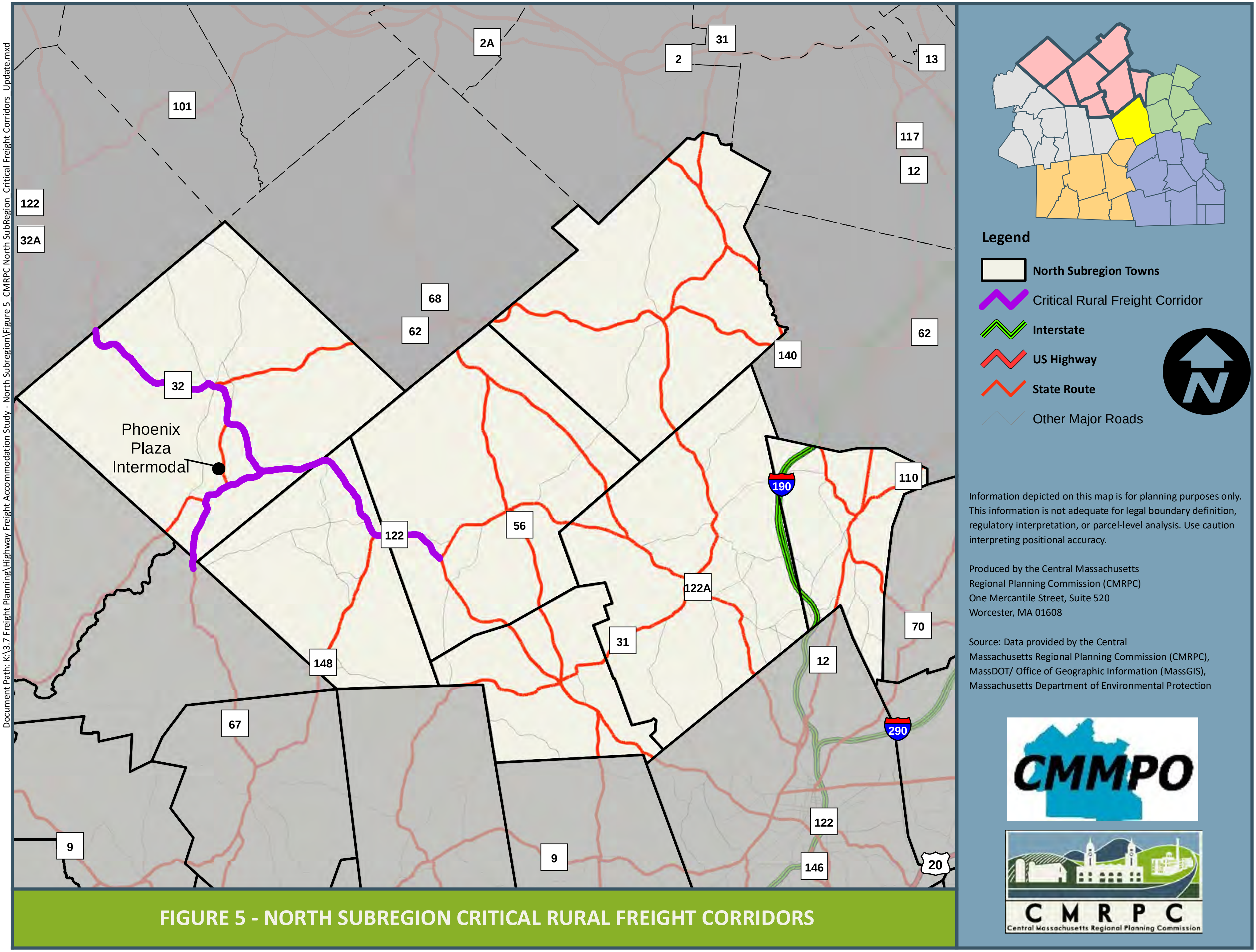

FIGURE 5 - NORTH SUBREGION CRITICAL RURAL FREIGHT CORRIDORS

2.2 Transportation Improvement Projects (TIP)

The Transportation Improvement Program (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 also listed 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 the MassDOT's Office of Transportation Planning (OTP).

Table 3 lists the North subregion TIP projects programmed in the federal fiscal years 2021 – 2025. As can be seen in the figure, there are three (3) projects programmed for federal-aid funding in the North subregion. In FFY 2022, there is a project in the town of Rutland to reconstruct a portion of Route 56 (Pommogussett Road) as well as a project in the town of Holden to resurface a portion of Route 122A. In FFY 2024, there is another TIP project in Holden for the rehabilitation of pavement on Main Street, Shrewsbury Street and Doyle Road. This project also includes a range of intersection improvements and features measures for increased bicycle and pedestrian accommodation.

Table 3
Current North Subregion TIP Projects

Central Mass Region Program

STIP: 2021 - 2025 (D)

Program	MassDOT Project ID	MPO	Municipality	MassDOT Project Description	District	Funding Source	Total Programmed Funds	Federal Funds	Non-Federal Funds
Federal Fiscal Year 2022									
Roadway Reconstruction	608432	Central Mass	Rutland	RUTLAND- RECONSTRUCTION OF ROUTE 56 (POMMOGUSSETT ROAD)	3	STBG	$6,483,870	$5,187,096	$1,296,774
Non-Interstate Pavement	608815	Central Mass	Holden	HOLDEN- RESURFACING AND RELATED WORK ON ROUTE 122A	3	NHPP	$3,097,150	$2,477,720	$619,430
Federal Fiscal Year 2024									
Roadway Reconstruction	609219	Central Mass	Holden	HOLDEN- PAVEMENT REHABILITATION ON MAIN STREET, SHREWSBURY STREET AND DOYLE ROAD, FROM STATE POLICE BARRACKS TO BRATTLE STREET	3	CMAQ	$1,314,001	$1,051,201	$262,800
Roadway Reconstruction	609219	Central Mass	Holden	HOLDEN- PAVEMENT REHABILITATION ON MAIN STREET, SHREWSBURY STREET AND DOYLE ROAD, FROM STATE POLICE BARRACKS TO BRATTLE STREET	3	STBG	$8,071,717	$6,457,374	$1,614,343

2.3 Traffic Volumes & Truck Percentages

CMRPC conducts mechanical traffic counts on numerous federal-aid highways within the Central Massachusetts planning region. These 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 2019. As such, some of the federal-aid highways monitored by the planning staff will have no vehicle classification data. The most current 24-hour data available on the federal-aid highways in the North subregion are shown on the following maps.

Figure 6 shows the traffic volumes on the federal-aid highways within the North subregion. The majority of roadways consist of volumes below 7,500 vehicles per day (VPD). Interstate 190 is the only roadway that carries more than 30,000 (VPD). Various segments of Route 12, Route 122, and Route 122A have more than 15,000 VPD. Multiple segments of Route 12, Route 31, Route 122, Route 122A and Route 140 and a few other major roadways are above 7,5000 VPD.

Figure 7 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 122A in the towns of Holden and Rutland as well as a portion of Route 12 in the town of West Boylston have heavy vehicle volumes over 1,000 VPD. Similar to the previous figure, **Figures 8 and 9** 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 the volume totals. In addition to volumes, **Figure 10** shows heavy vehicle volume percentages in the North subregion. Percentages are also separated into four categories, with the color red being the highest (>14%). The majority of highways that have classification data range between 5% and 14% heavy vehicles. There are no roadways in the North subregion that accommodate more than 14% heavy vehicles on a daily basis.

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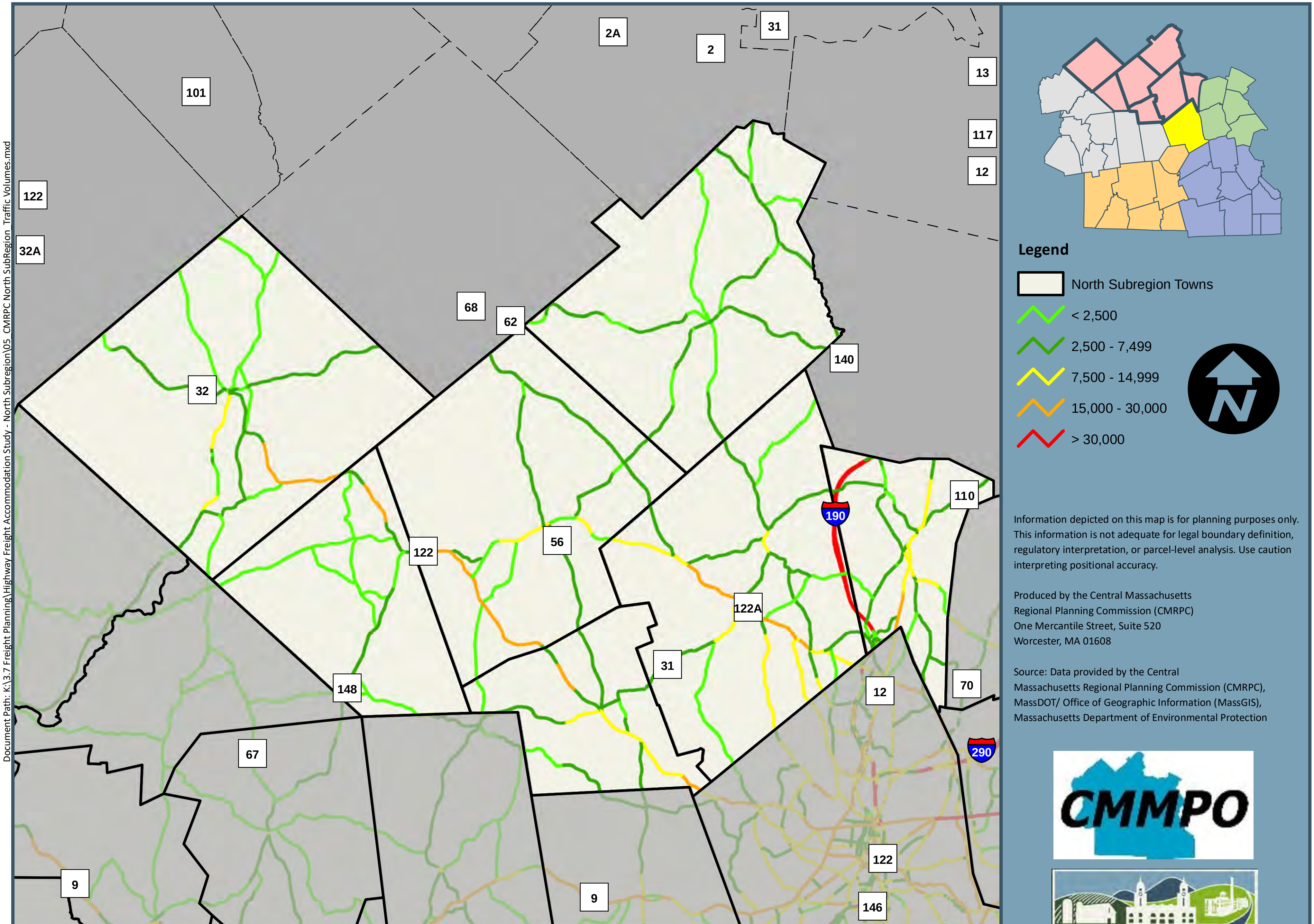
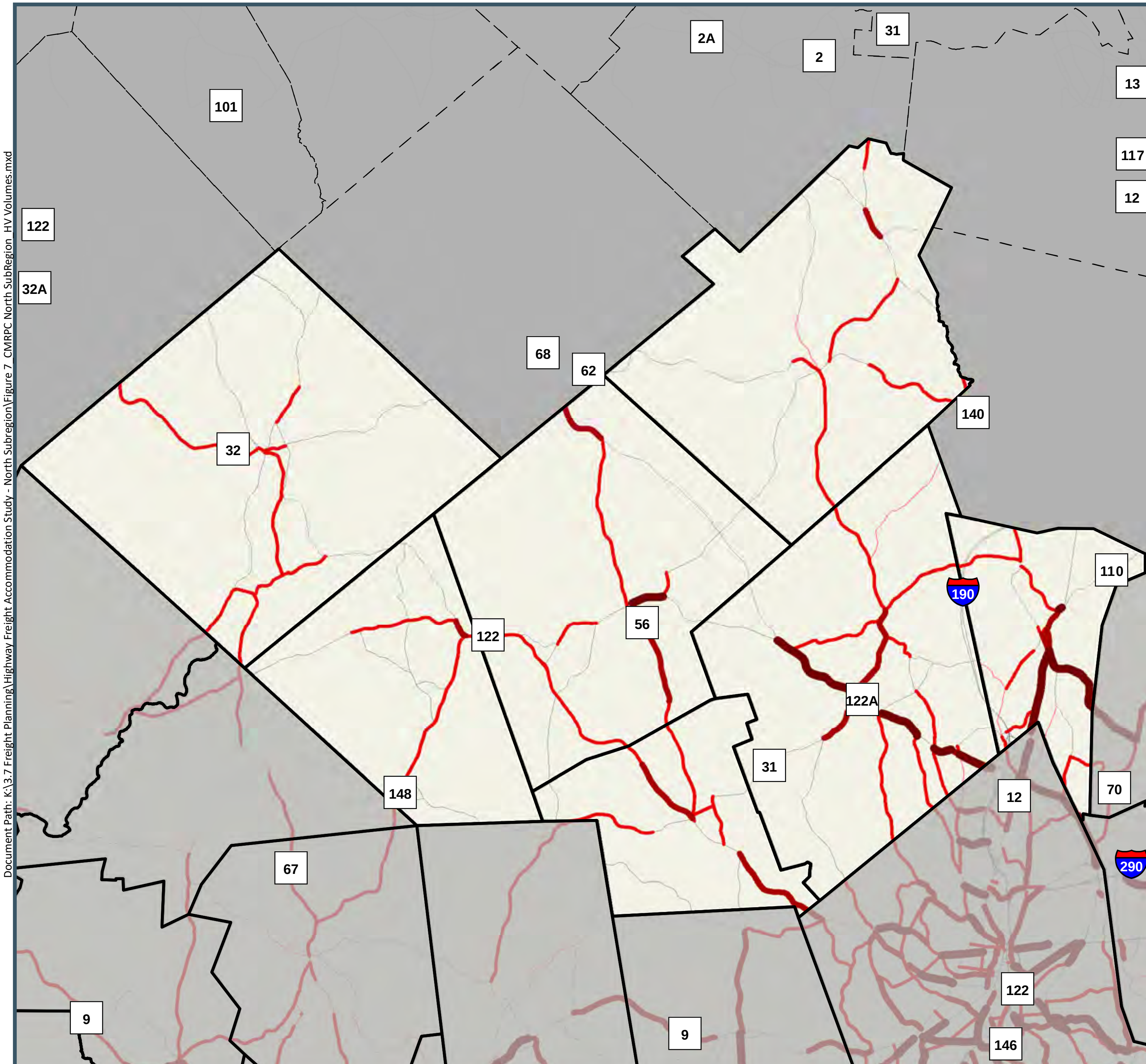
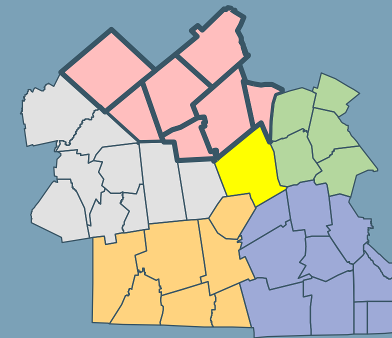


FIGURE 6 - NORTH SUBREGION TRAFFIC VOLUMES





Legend

North Subregion Towns

19 - 100

101 - 500

501 - 1,000

1,001 - 5,000

No Data

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Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 7 CMRPC North SubRegion HV Volumes.mxd

FIGURE 7 - NORTH SUBREGION HEAVY VEHICLE VOLUMES

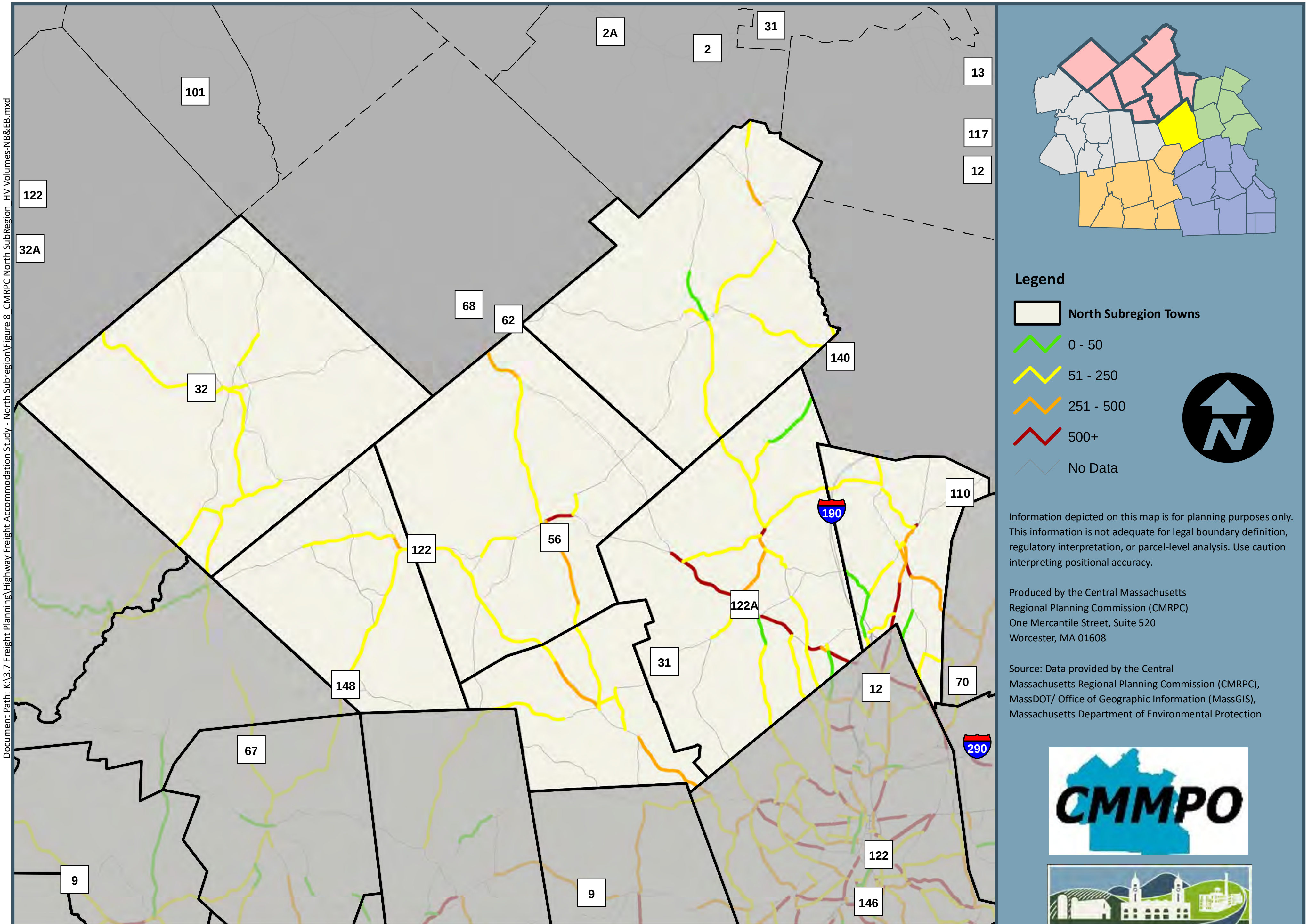
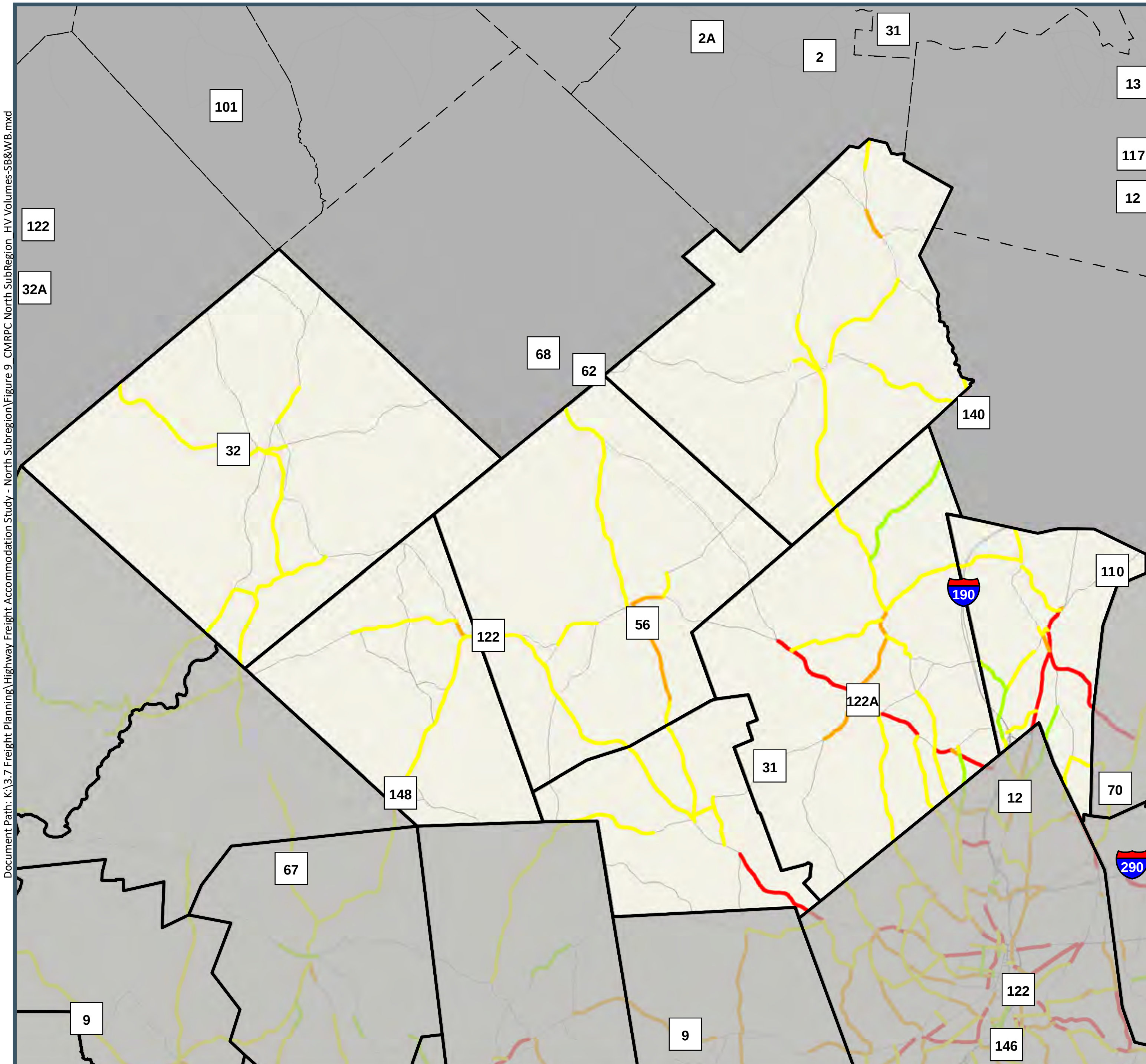
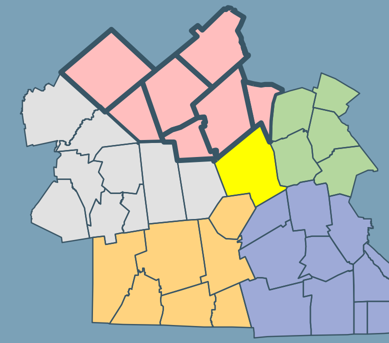


FIGURE 8 - NORTH SUBREGION HEAVY VEHICLE VOLUMES, NB/EB





Legend

- North Subregion Towns
- 0 - 50
- 51 - 250
- 251 - 500
- 500+
- No Data

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Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 9 CMRPC North SubRegion HV Volumes-SB&WB.mxd

FIGURE 9 - NORTH SUBREGION HEAVY VEHICLE VOLUMES, SB/WB

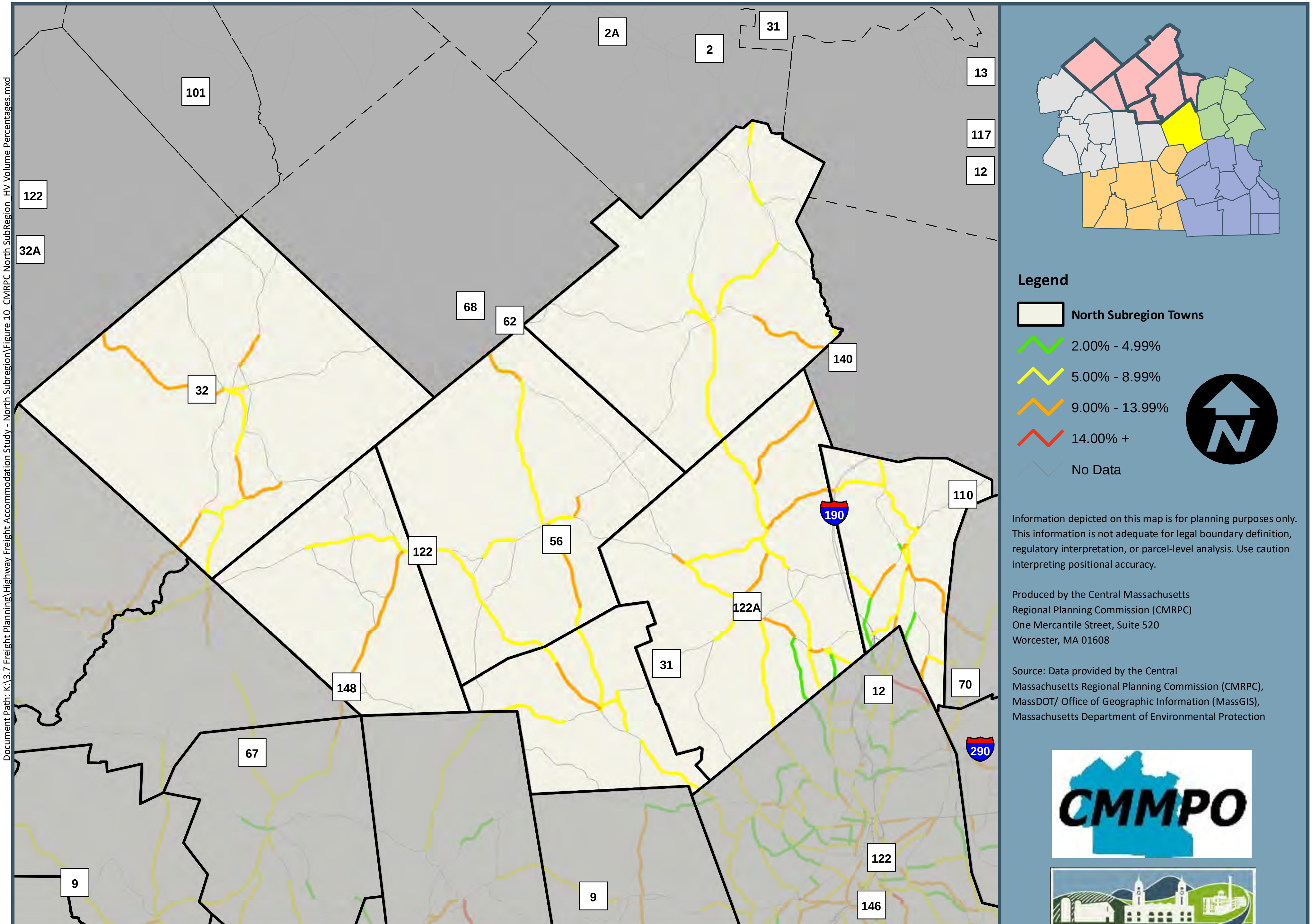

FIGURE 10 - NORTH SUBREGION HEAVY VEHICLE VOLUME PERCENTAGES

3.0 Host Community Management Systems Information

This section discusses the Management Systems data 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 collected separately, but are also analyzed together within a data integration summary, shown at the end of the section. Knowing those highways that have multiple identified deficiencies greatly assists in the decision-making process concerning which segments to improve first while also simultaneously addressing a range of identified issues.

3.1 Congestion Management Process (CMP)

A Congestion Management Process (CMP) is a systematic and accepted approach for managing congestion that provides accurate, up-to-date 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 region's CMP should provide for safe and effective integrated management and operation of the multimodal transportation system. There are eight actions taken within a CMP. They are 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 data included in this section are from Travel Time and 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 and 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 and 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, a test vehicle travels according to the driver’s judgement of the average speed of existing traffic flows. A Global Positioning System (GPS) device is used to collect the travel time data.

The following two maps, **Figures 11 and 12**, show average travel speeds for the North subregion in the AM and PM peak hours. Travel speeds are separated into six categories and are assigned different colors. The travel speeds are shown for both directions. Travel time data was available for the host communities of Paxton, Holden, and West Boylston. No data was available for Barre, Oakham, Princeton or Rutland at this time. In Paxton, Route 122, Route 31, and part of Route 56 was studied. Route 122A and the southern portion of Route 31 were analyzed in Holden while Routes 12 and 140 were studied in West Boylston. As shown in both maps, most of the observed travel speeds are between 30 MPH and 49 MPH. In the AM peak period, Route 122A in Holden has the lowest observed average speeds, 10 MPH – 18 MPH, traveling southbound.

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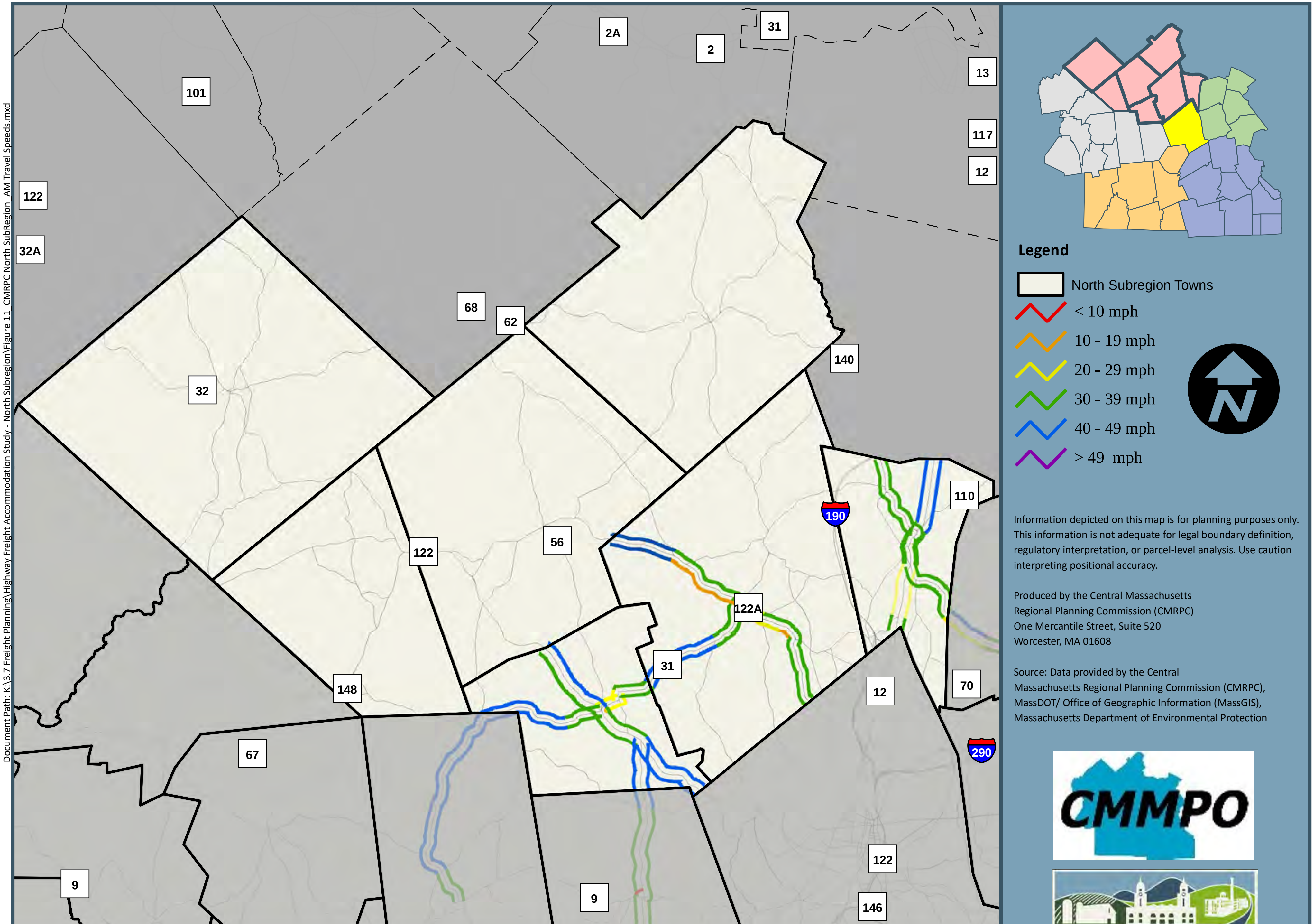


FIGURE 11 - NORTH SUBREGION OBSERVED AM PEAK HOUR TRAVEL SPEEDS

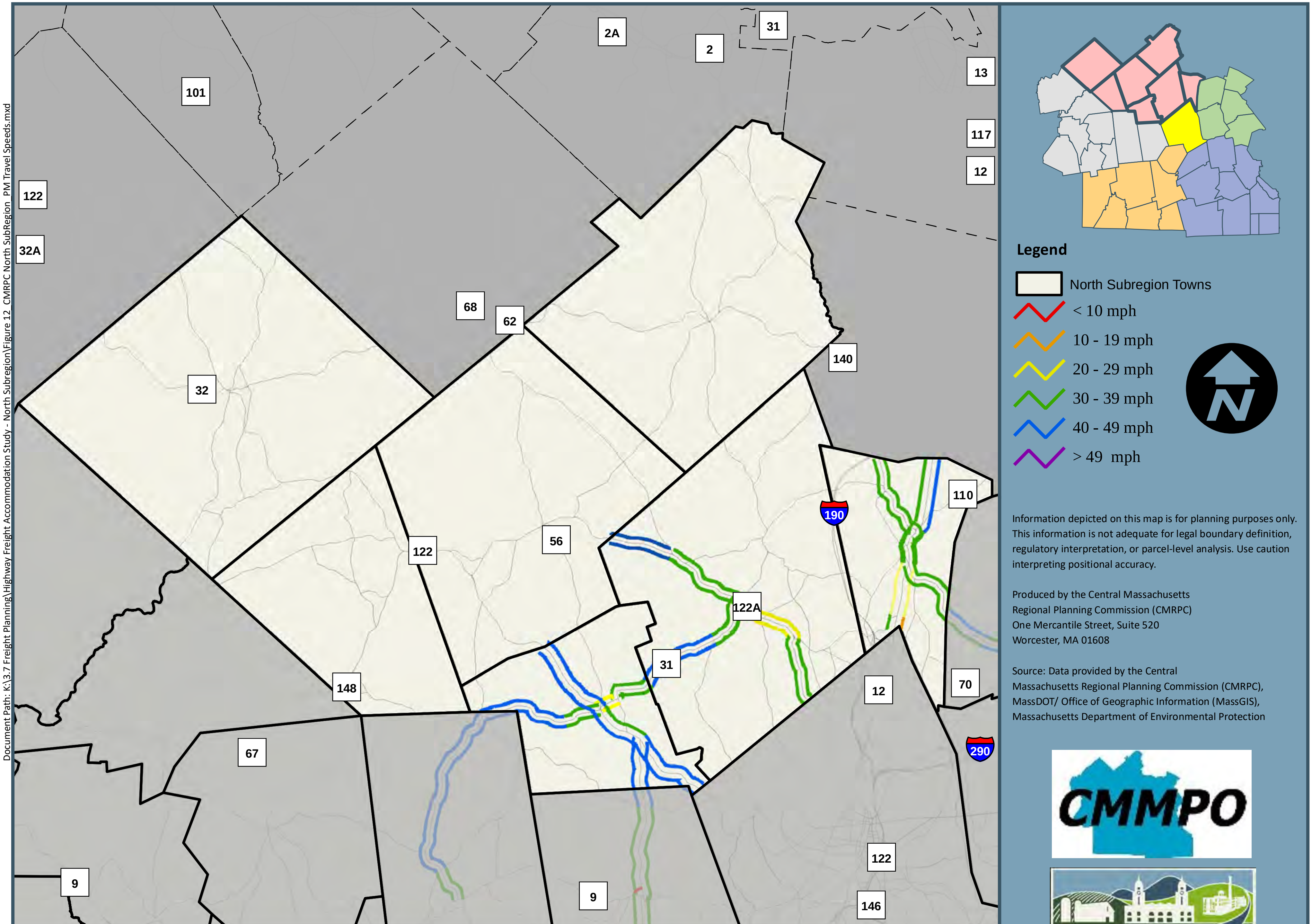


FIGURE 12 - NORTH SUBREGION OBSERVED PM PEAK HOUR TRAVEL SPEEDS

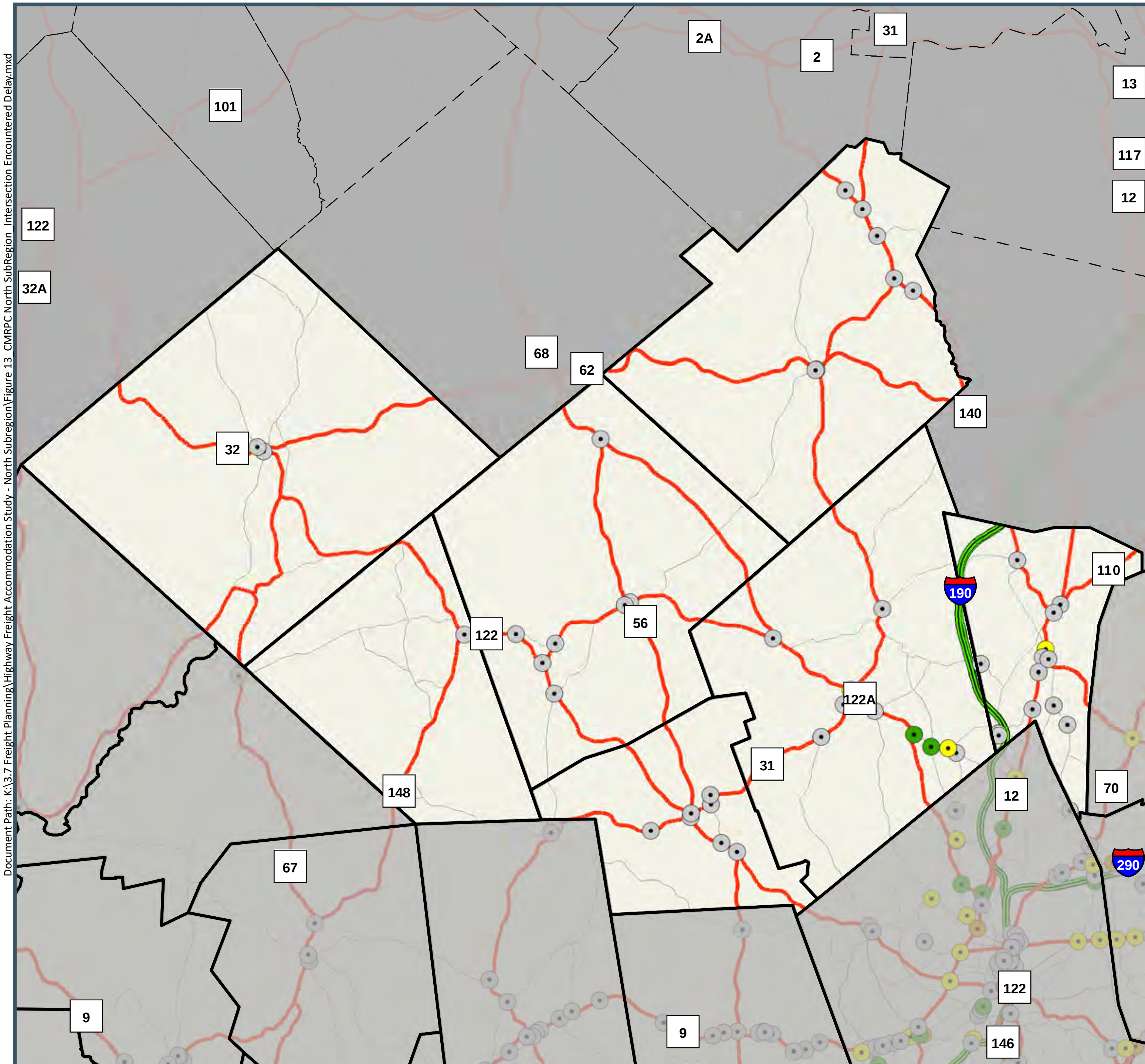
Intersection Encountered Delays

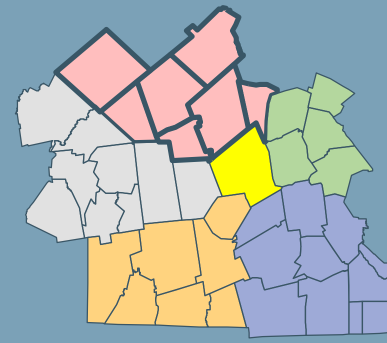
For all intersections where Turning Movement Counts are obtained, it is possible to analyze the total delay encountered during the examined peak hour travel periods. A byproduct of the process that results in intersection Level-of-Service (LOS) ratings is the "average delay encountered for entering vehicles". 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 delays of varying levels in all directions and this is accounted for. "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, but a busy stop-controlled location (that may not presently meet the warrants for signalization) can have substantial delays if volumes on the minor approaches 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 traffic signal operations are optimized, then geometric improvements are potentially considered, such as roadway widening or additional travel lanes.

All of the North subregion communities have at least one critical intersection that was analyzed. Data was collected for these intersections between 2010 and 2019. If a location was counted multiple years, then the most recent data was used. **Figure 13** shows the North subregion's critical intersections in five categories. Most of the intersections are within the lowest category. There are also a number of intersections located in the towns of Holden and West Boylston that are in the second and third delay categories.

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 13_CMRPC North SubRegion_Intersection Encountered Delay.mxd





Legend

North 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 13 - NORTH SUBREGION ENCOUNTERED DELAY AT CRITICAL INTERSECTIONS

3.2 Safety Management System (SMS)

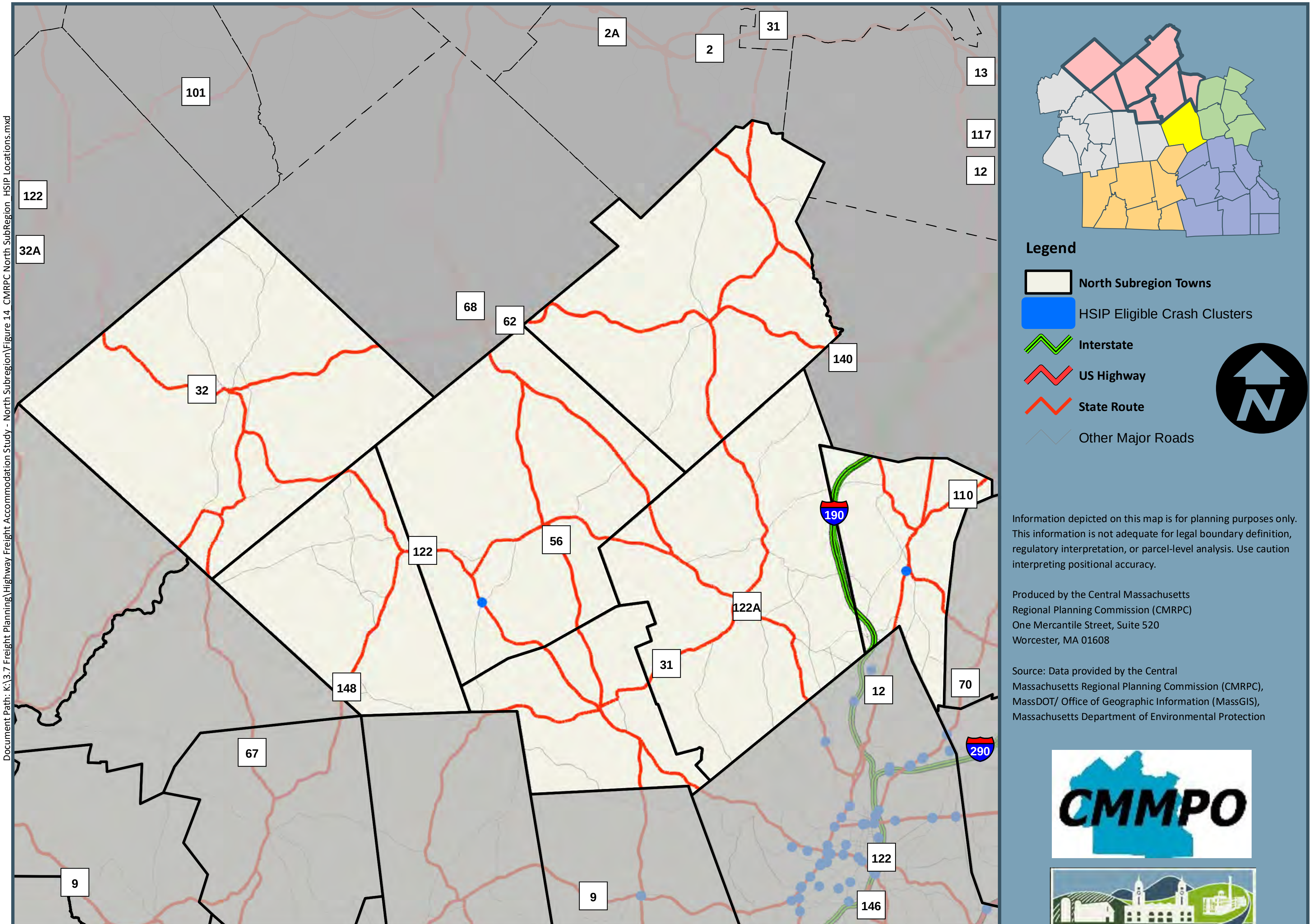
The CMMPO staff obtains vehicle crash data from MassDOT. On a yearly basis, the Registry of Motor Vehicles (RMV) branch of MassDOT produces a statewide vehicle crash summary. Before the data is released to the public, a quality control analysis is conducted on the crash records. MassDOT then releases the three (3) most recent years of data. The crash information used for this study is from the three-year period between 2015 and 2017. Besides individual crashes, "crash clusters" are also identified for vehicles, bicycles and pedestrians.

<u>HSIP Locations</u>

The purpose of the Highway Safety Improvement Program (HSIP) is to reduce the number of fatal and serious injury 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 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 road 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 with the severity of 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. Starting in 2016, the weighting factors were updated so that fatal and injury crashes are worth 21 and a property damage-only crash is worth 1.

As shown in **Figure 14**, there are only two (2) HSIP crash clusters in the North subregion. The first cluster is located in the town of Rutland at the intersection of Route 122 & Pleasantdale Road. This cluster had a total of 27 crashes between 2015 – 2017. Of the 27 crashes, 19 caused property damage-only, seven (7) caused injuries, and there was one (1) fatality. The total EPDO for this cluster is 187. The second cluster is located at the intersection of Route 12 & Franklin Street in the town of West Boylston. There was a total of 27 crashes within this cluster. Of the 27 crashes, 20 caused property damage-only, six (6) caused injuries, and there was one (1) fatality. The total EPDO for this cluster is 167.



Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 14 CMRPC North SubRegion HSIP Locations.mxd

FIGURE 14 - NORTH 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 Pavement Management System (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 its pavement management program to assess overall pavement condition in the region.

Pavement data was collected on all federal-aid eligible roadways by conducting "windshield surveys." A team of two CMRPC representatives inspect each roadway, 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 a 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 pavement condition.

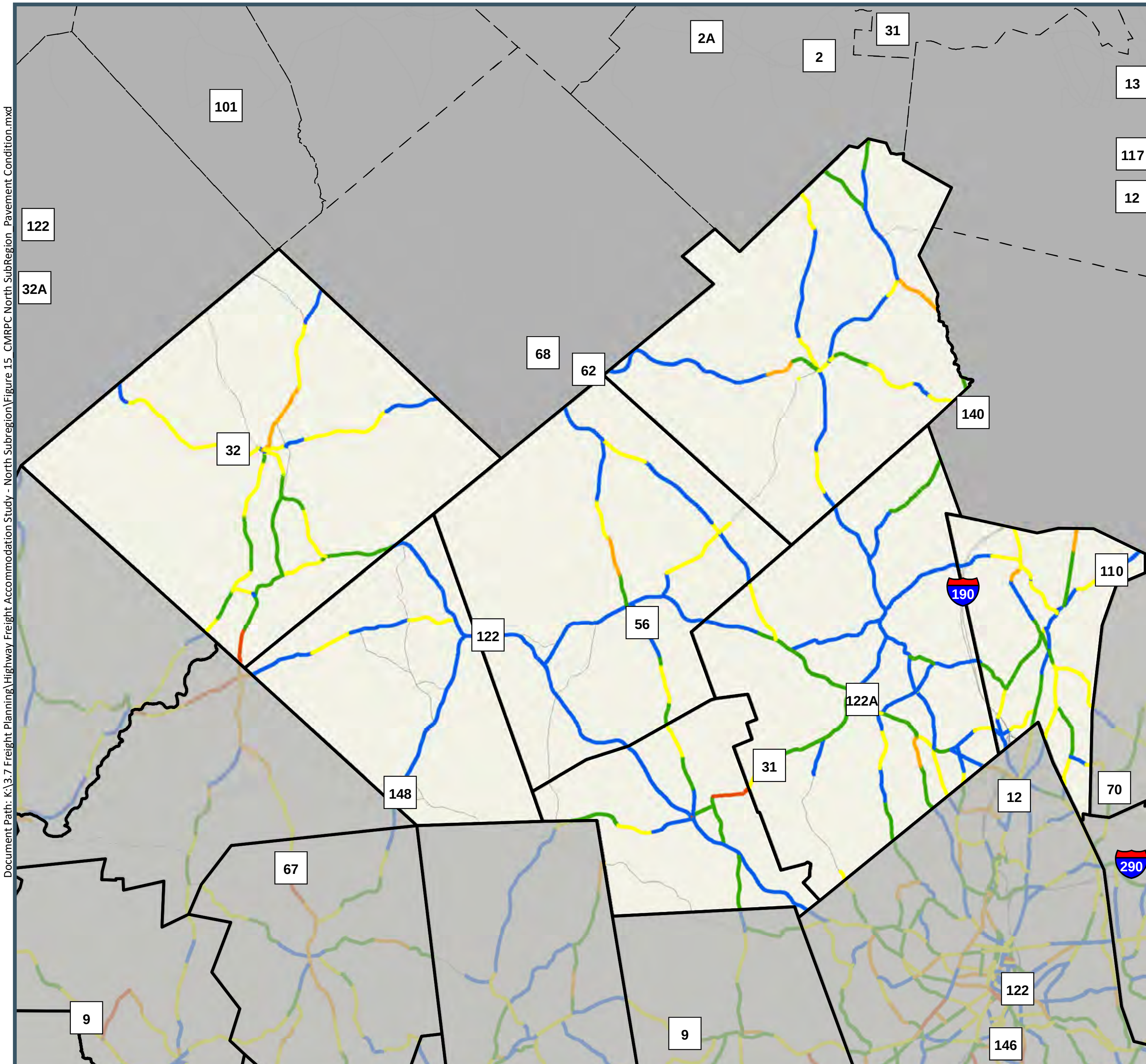
Depending on the OCI score, *Cartegraph's* recommended action category definitions are as follows:

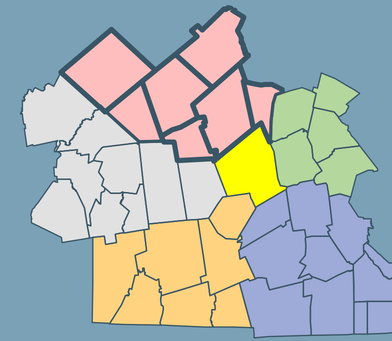
- Do Nothing (OCI 100 – 88) – used when a road is in relatively perfect condition and prescribes no maintenance.

- 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 15 shows the pavement condition on the federal-aid roadways in the North subregion. As shown on the map, there are some roadways that have no data at this time. Of all the roadway segments analyzed, there are very few segments that are in "poor" or "very poor" condition. Most of the roadways are in "fair" condition or better.

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North SubRegion\Figure 15 CMRPC North SubRegion Pavement Condition.mxd





Legend

North Subregion Towns
Excellent
Good
Fair
Poor
Very Poor
No Data

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FIGURE 15 - NORTH SUBREGION PAVEMENT CONDITION

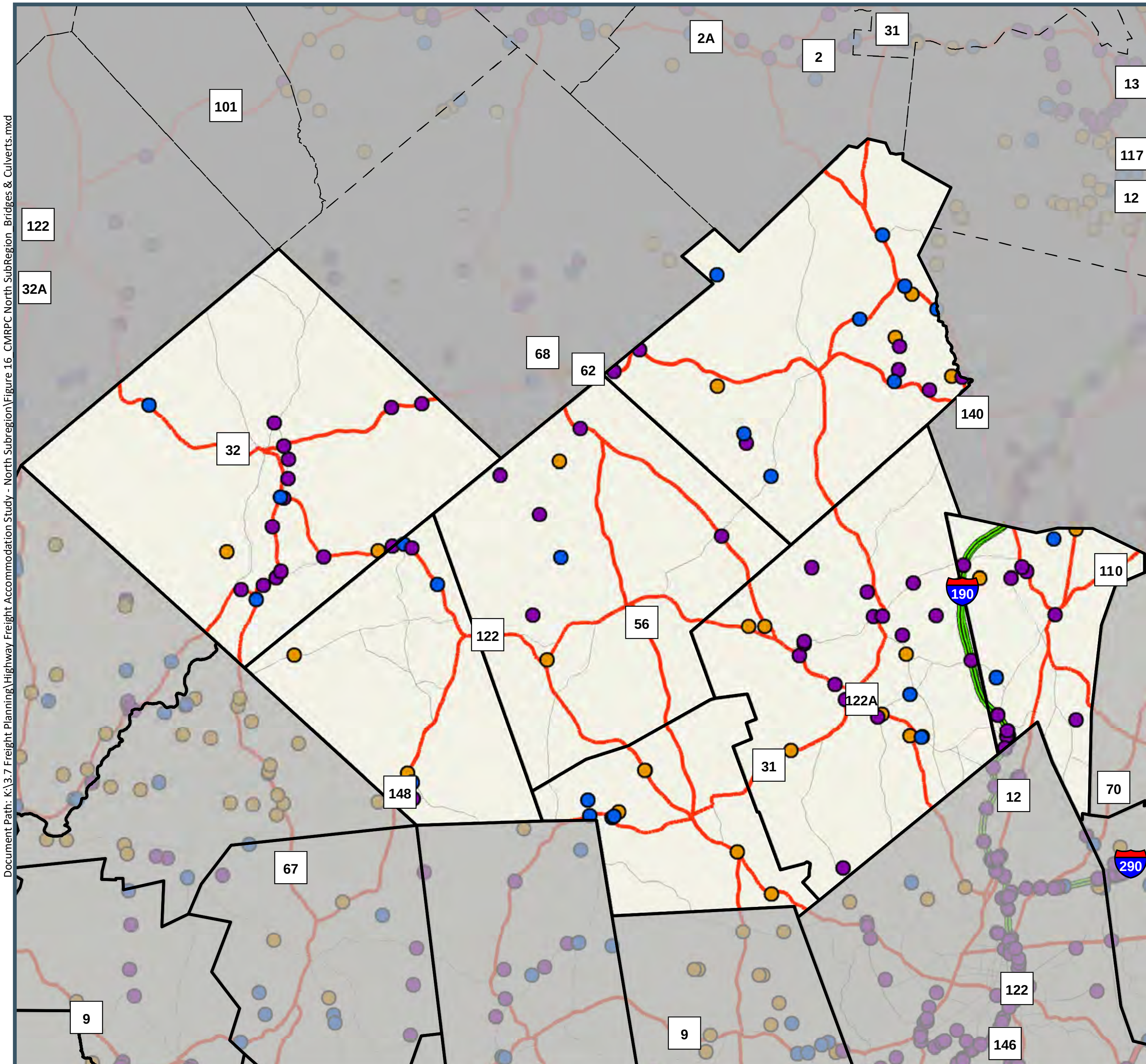
3.4 Bridge Management System (BMS) and Culverts

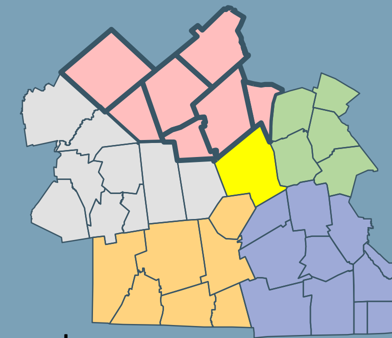
Figure 16 contains bridge data from the MassDOT – Highway Division Bridge Inspection Management System (BIMS). The types of structures included in the BIMS are:

- 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 111 bridges and culverts in the North planning subregion. 45 of the total bridges and culverts are on State Numbered Routes. There are 14 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 community of Holden has the most structures with a total of 29, with nice (9) on State Numbered Routes. The community that has the second most structures is the town of West Boylston with a total of 21, four (4) on State Numbered Routes.

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 16_CMRPC North SubRegion_Bridges & Culverts.mxd





Legend

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

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FIGURE 16 - NORTH SUBREGION BRIDGES AND CULVERTS

3.5 Management Systems Data Integration

Priorities for the North subregion have been screened through 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 following 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 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 North 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	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
		<1,525 Minutes of Total Delay	1 point

Management System	Type of Data Used	Scoring Criteria	Points
Bridges	MassDOT Bridge Data	Segment has a Structurally Deficient or Weight-Restricted Posted Bridge	3 points

Based on the above scoring criteria, **Figure 17** shows the highway segment 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 North subregion. Corresponding to the map, Tier 2 roadway segments scores are listed in **Table 5**. There are a total of 15 Tier 2 highway segments in the North planning subregion. The majority of the Tier 2 segments are in the communities of Holden and West Boylston. Further, 11 of the 15 identified segments are on State Numbered Routes.

Table 5 – Management Systems Tier 2 Roadway Segments

Community	Roadway	From	To	Total Points
Holden	Doyle Rd	Shrewsbury St	Worcester CL	20
West Boylston	West Boylston St (12)	Central St	Wal-Mart Entrance	20
Holden	Main St (122A)	Highland St	Kendall Rd	19
West Boylston	Worcester St (140)	Church St	Maple St	19
West Boylston	West Boylston St (12)	Worcester CL	Woodland St	18
Holden	Main St (122A)	Shrewsbury St	Malden St	17
Holden	Main St (122A)	Malden St	Highland St	16
Holden	Highland St (31)	Union St	Main St	15
West Boylston	Central St	Crescent St	West Boylston St	15
Holden	Salisbury St	Main St	Dawson Circle	14
Holden	Shrewsbury St	Doyle Rd	Holden St	14
Paxton	Holden Rd (31)	Grove St	Holden TL	13
Paxton	Pleasant St (122)	Davis Hill Rd	West St	13
Rutland	Maple Ave (56)	Main St	Prescott St	13
West Boylston	Worcester St (12/140)	Lancaster St	Goodale St	13

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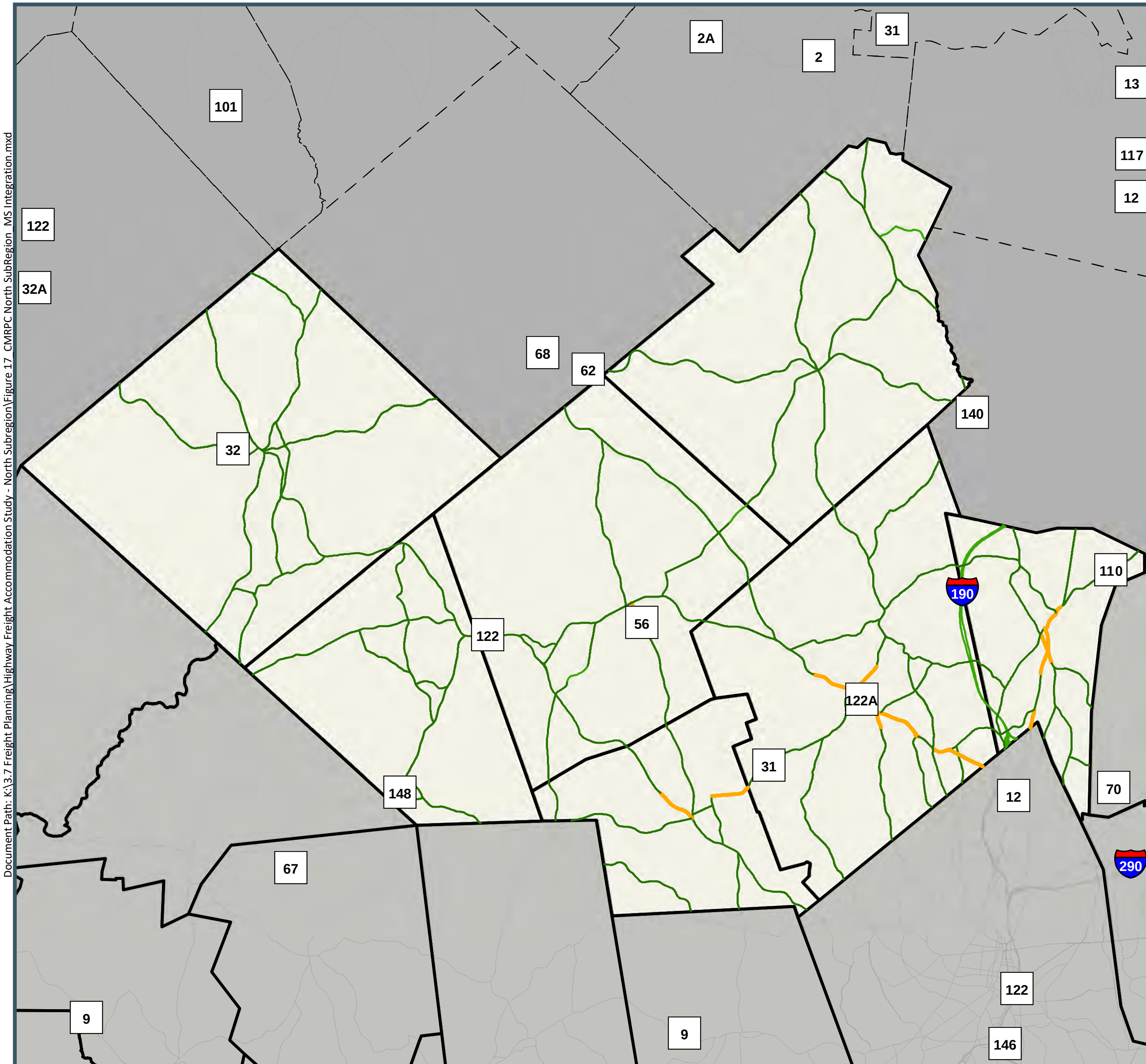

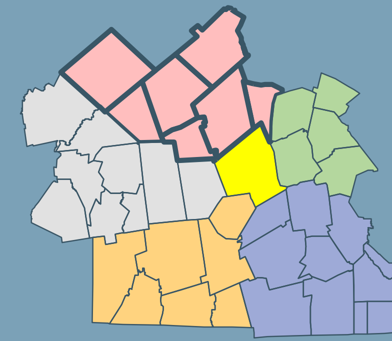

Legend

Tier 1 = 25 – 36 points

Tier 2 = 13 – 24 points

Tier 3 = 1 – 12 points

North Subregion Towns

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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 17 - NORTH SUBREGION MANAGEMENT SYSTEMS DATA INTEGRATION

4.0 Other Major Considerations

This section of the *North 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 highway 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 North 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 North 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 planning and programming processes. 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. 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 products 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 18**)
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 18

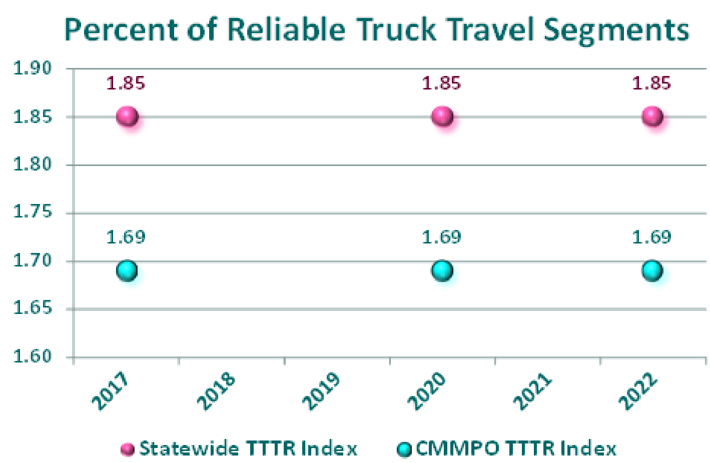
Level of Truck Travel Time Reliability (TTTR) ***(Single Segment, Interstate Highway System)***		
Monday - Friday	6am – 10am	$\text{TTTR} = \frac{55\text{ sec}}{35\text{ sec}} = 1.57$
	10am – 4pm	TTTR = 1.25
	4pm – 8pm	**TTTR = 2.52**
Weekends	6am – 8pm	TTTR = 1.2
All Days	8pm – 6am	TTTR = 1.05

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.

Figure 19 shows the statewide TTTR targets for Interstate compared with the percent of reliable segments in the CMMPO region, which include I-90 (MassPike), I-190, I-290 and I-395. I-190 passes through the North subregion communities of Holden and West Boylston.

Figure 19



4.2 Environmental Consultation

Major features of the natural environment in the North planning subregion were also identified as part of this assessment study. 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 North 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 communities of Barre, Oakham and Rutland as well as several other areas in the North subregion study area. In addition, the map also shows conservation and recreational areas.

Figure 21 shows wetland areas within the North 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 West Boylston is the Wachusett 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 definitely far more potential vernal pools than there are certified vernal pools in the North planning subregion. Further, each of the seven 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 North subregion. The majority of flood zones in the North subregion are 100-year while the community of Princeton has a number of 500-year flood zones.

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 20_CMRPC North SubRegion_DCR Map.mxd

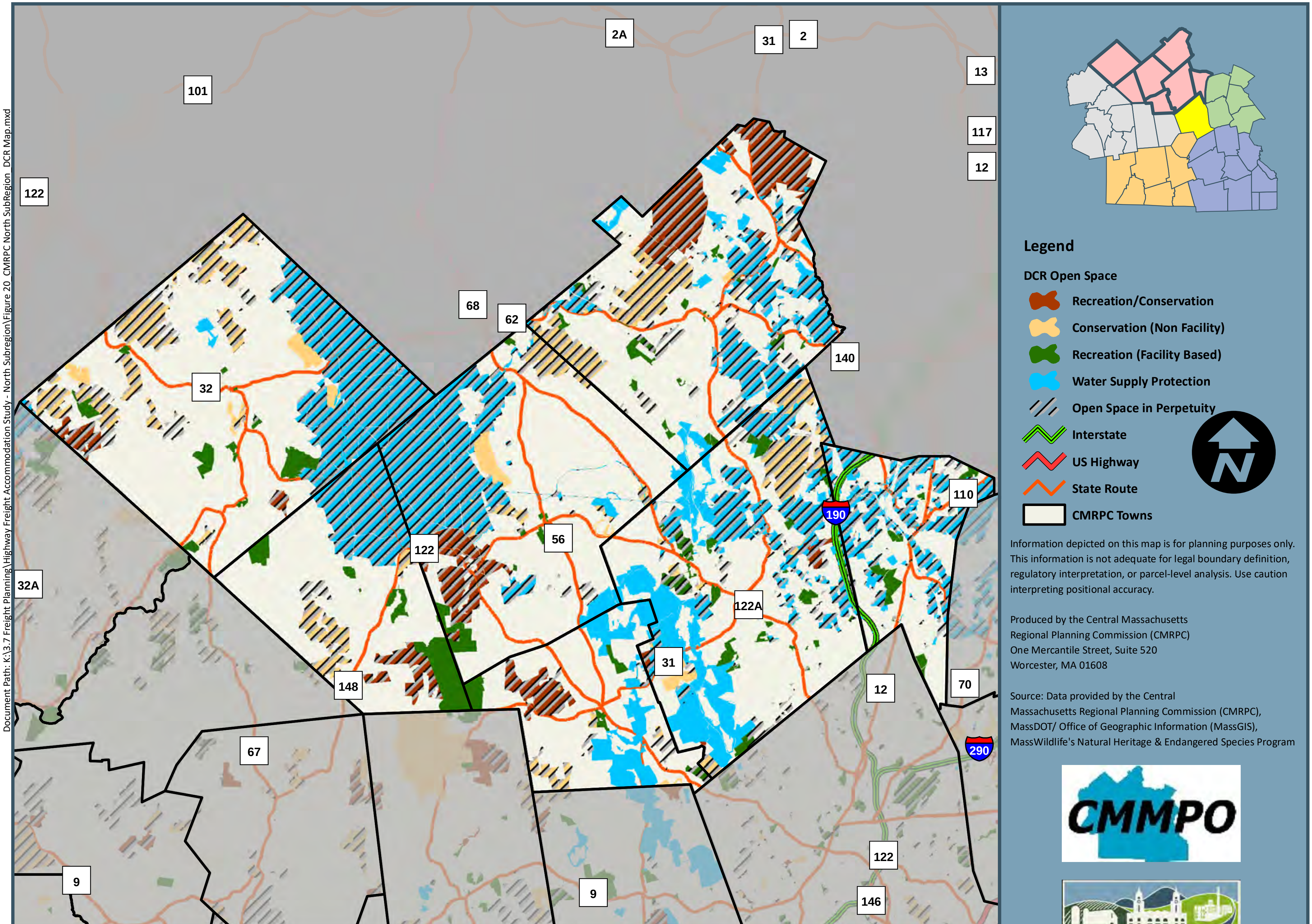


FIGURE 20 - NORTH SUBREGION GENERAL LAND USE (DCR)

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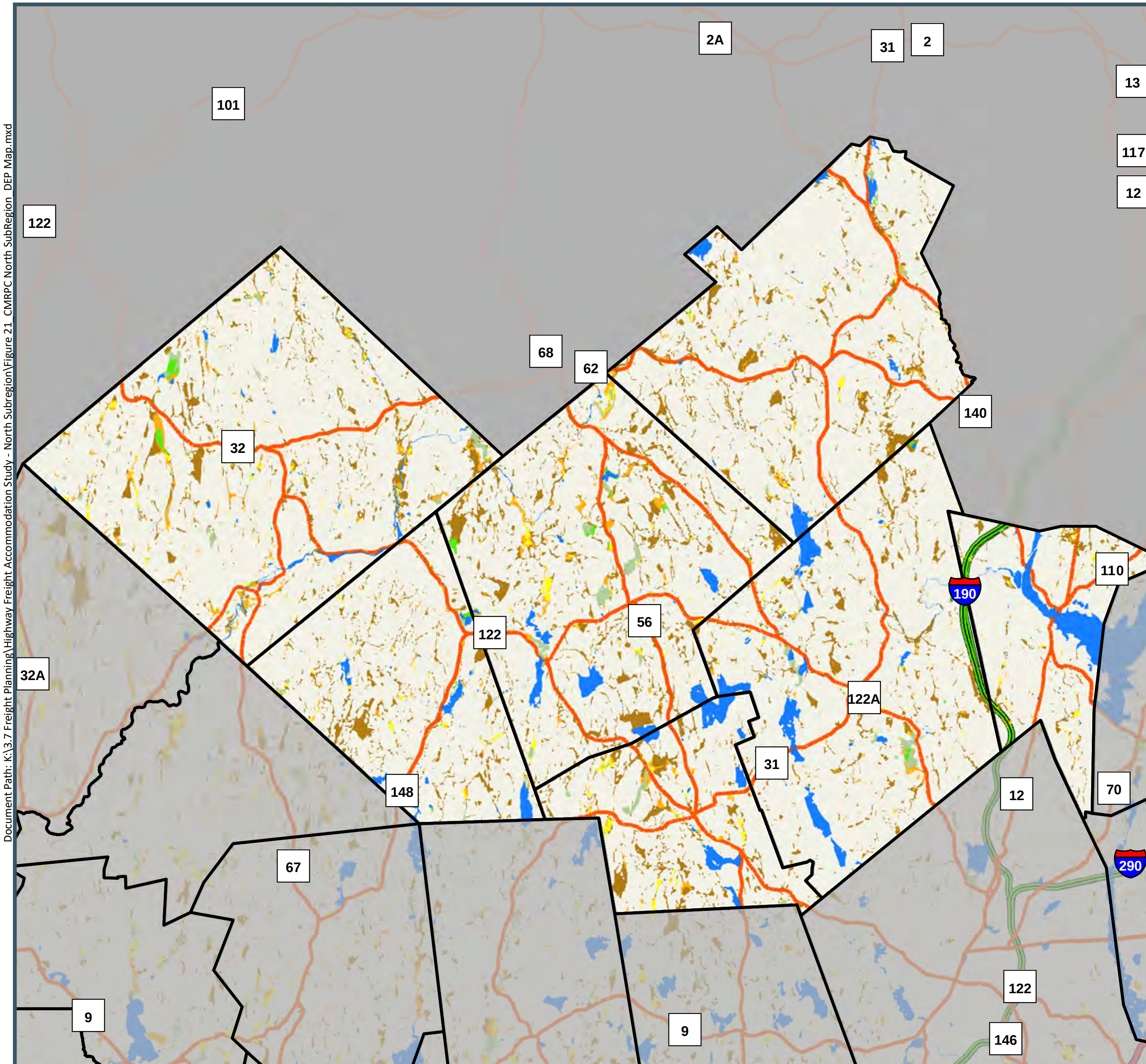

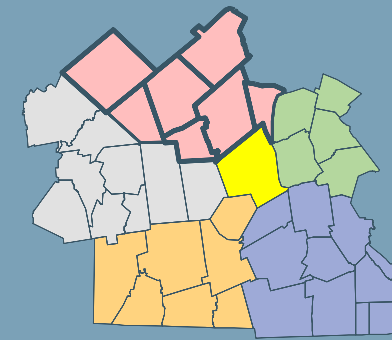

Legend

MassDEP Wetlands

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

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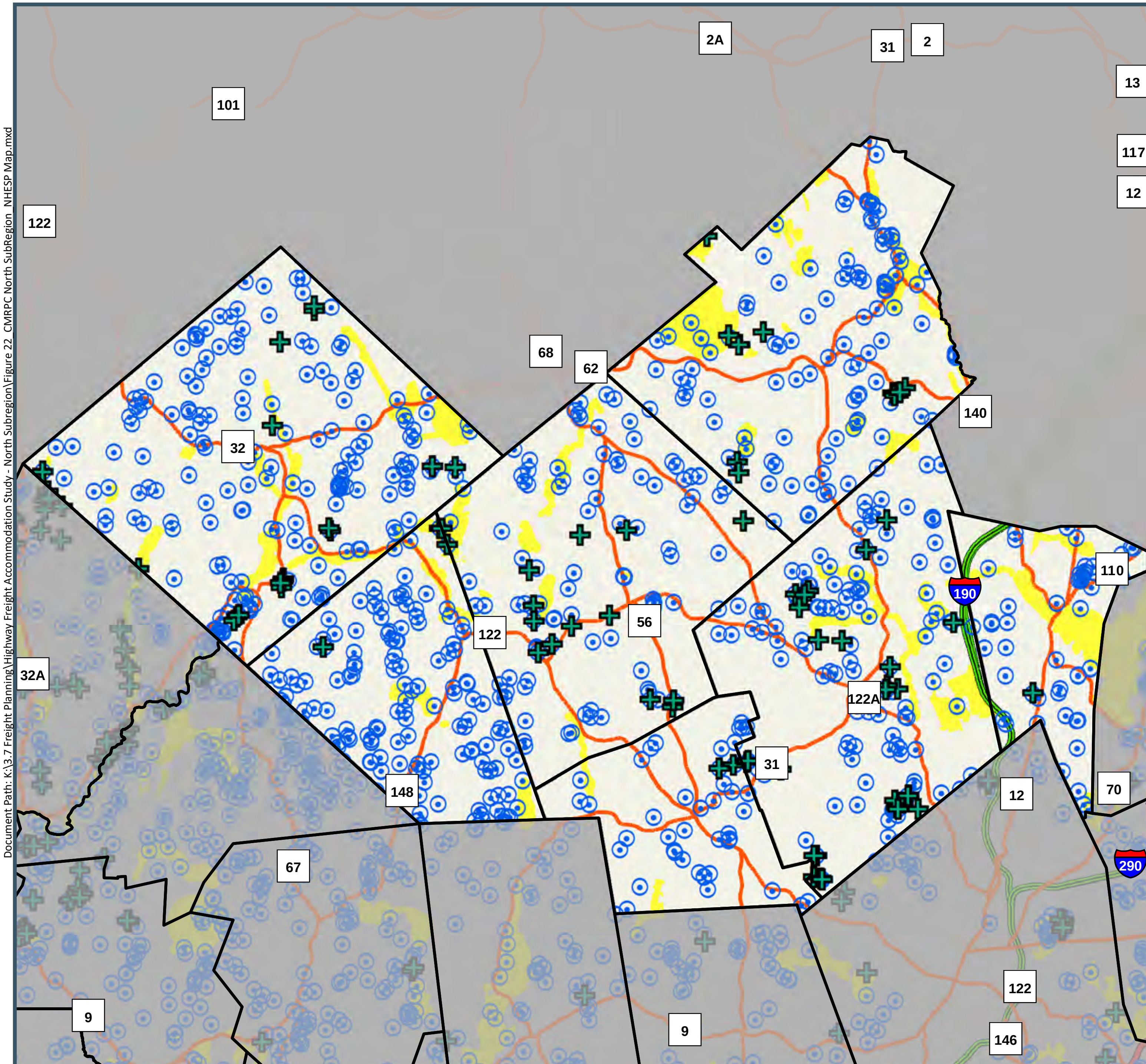
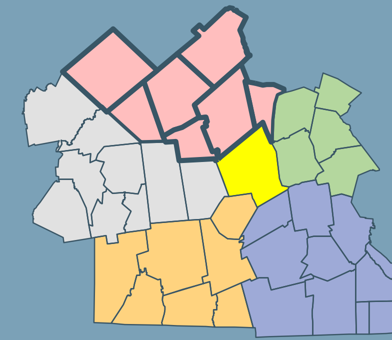
Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/ Office of Geographic Information (MassGIS), MassWildlife's Natural Heritage & Endangered Species Program

FIGURE 21 - NORTH SUBREGION WETLANDS (DEP)

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





Legend

- NHESP Certified Vernal Pools (2017)
- NHESP Potential Vernal Pools (2017)
- NHESP Priority Habitats of Rare Species
- Interstate
- US Highway
- State Route
- CMRPC Towns

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Source: Data provided by the Central Massachusetts Regional Planning Commission (CMRPC), MassDOT/ Office of Geographic Information (MassGIS), MassWildlife's Natural Heritage & Endangered Species Program

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FIGURE 22 - NORTH SUBREGION VERNAL POOLS & RARE SPECIES HABITATS

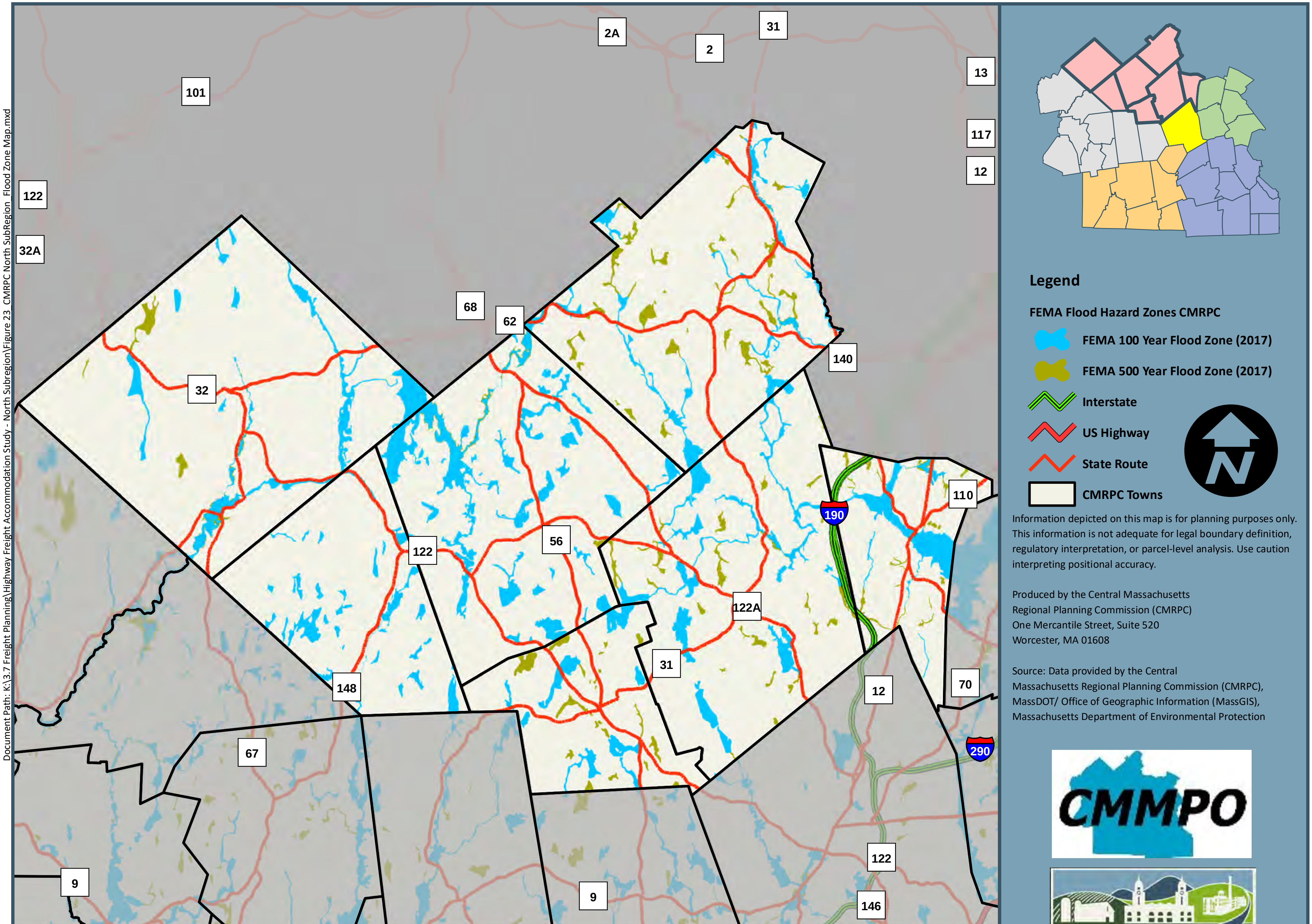

FIGURE 23 - NORTH SUBREGION 100/500 YEAR FLOOD ZONES (FEMA)

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 23_CMRPC North SubRegion_Flood Zone Map.mxd

4.3 Municipal Vulnerability Preparedness (MVP)

The state's Municipal Vulnerability Preparedness (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 North 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 another 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 Barre and Holden each have multiple High Hazard dams. A few of the dams are located near a State Numbered Route, both Route 122 in Barre and Route 122A in Holden. The towns of Oakham, Paxton, and Princeton have minimal hazardous dams while the town of West Boylston has none.

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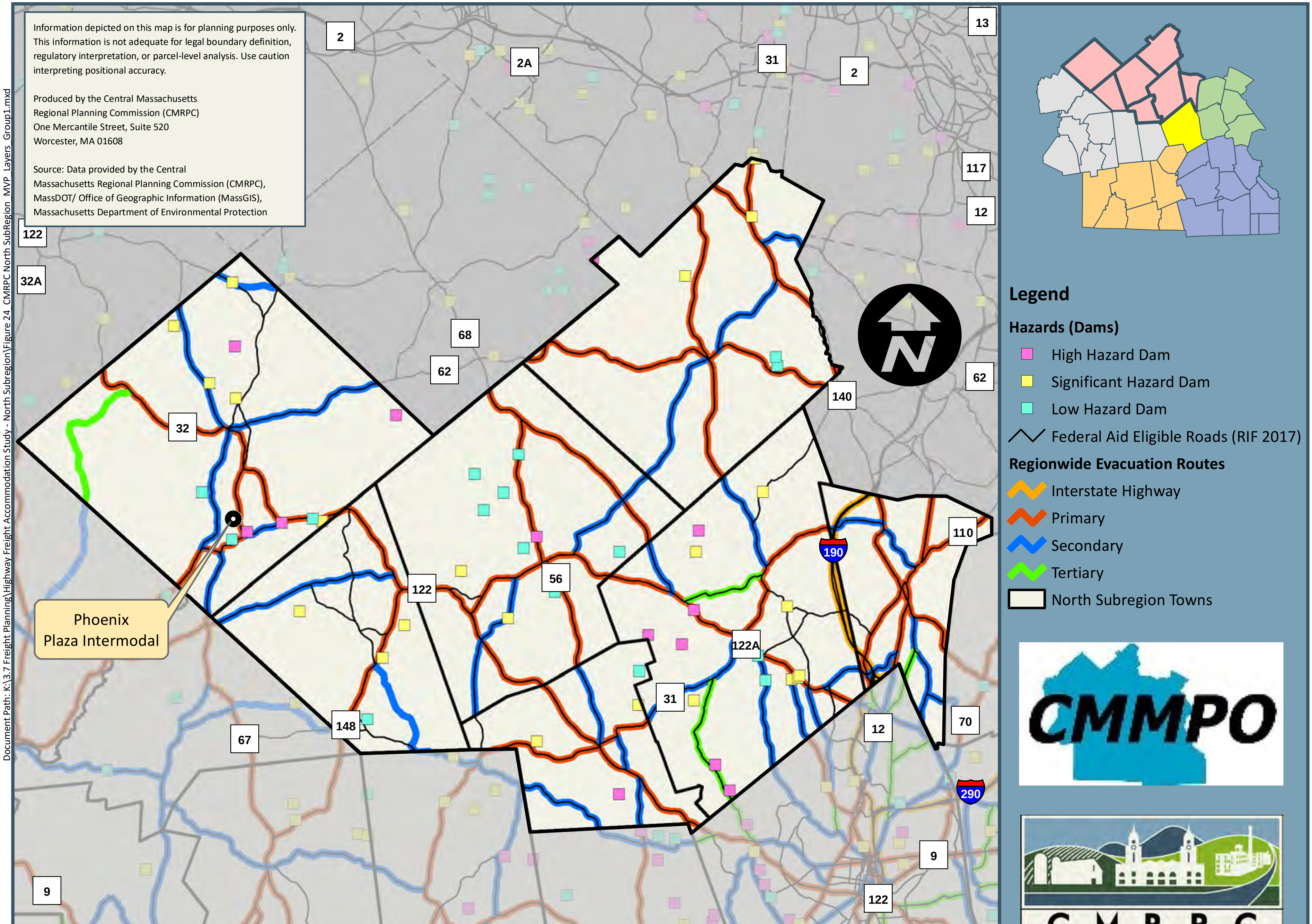


FIGURE 24 - NORTH SUBREGION MVP LAYERS: HAZARDOUS DAMS & REGIONAL EVACUATION ROUTES

Figure 25 shows locally-identified vulnerable critical infrastructure and hazards within the North subregion communities. The types of vulnerable critical infrastructure can be different 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 DPW garages. The town of Barre considers all the State Numbered Routes in the town as critical infrastructure and the town of Holden lists Route 122A as the same. The towns of Rutland and West Boylston both considered the police stations, fire stations, and DPW garages as critical infrastructure. The town of Paxton shows no identified critical infrastructure, but does show numerous potential hazards. In fact, each town in the North subregion shows numerous hazards. These hazards include dams, flooding issues (past & present), and areas for potential fires. These is a substantial potential fire hazard in the western portion of Rutland that continues into both Barre and Oakham. Another potential fire hazard is around Wachusett Mountain in Princeton. Flooding is identified as a hazard on one or more roadways in most of the North subregion communities.

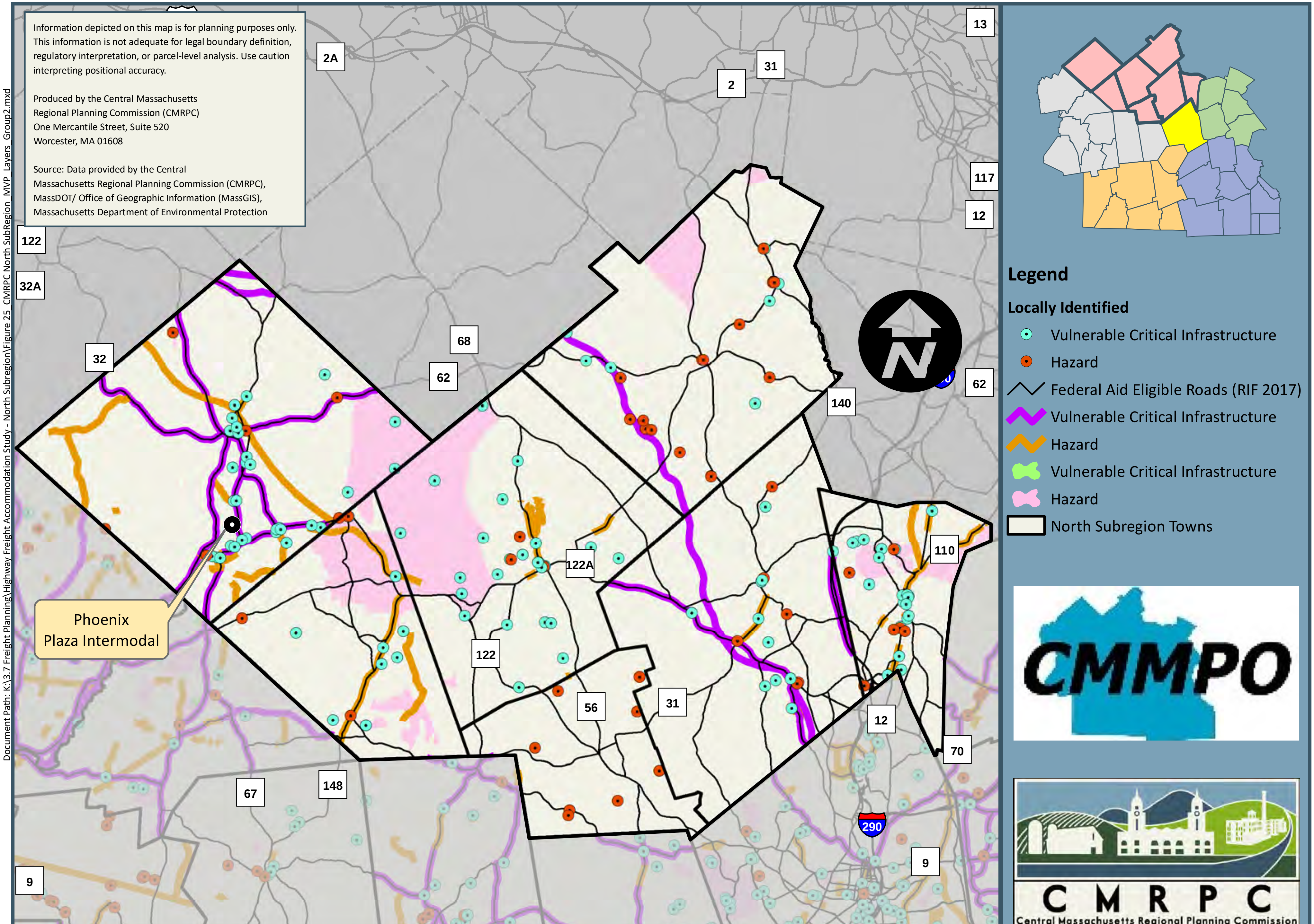


FIGURE 25 - NORTH SUBREGION MVP LAYERS: LOCALLY IDENTIFIED HAZARDS & CRITICAL INFRASTRUCTURE

4.4 Travel Demand Model

Introduction

In this first installment in a 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 North planning subregion. Potential future year land development impacting the North 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 has also been summarized for each host community in the North 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 all Model analyses do not reflect the known/unknown impacts of the Covid-19 crisis of 2020/2021.)*

Truck Type Groupings

The Model results provide truck VMT estimates within three (3) broad groupings of the Federal Highway Administration's (FHWA) Vehicle Classifications. Shown in **Table 6** 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 6
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 North planning subregion are summarized in **Tables 7, 8, & 9** for each defined truck type grouping. **Table 7** includes the estimated truck VMT for the 2018 existing case, **Table 8** includes the projected truck VMT for the future year 2030, and **Table 9** 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.

<u>Truck Vehicle Miles of Travel (VMT) Observations</u>

As can be seen in **Table 7**, truck Vehicle Miles of Travel (VMT) under the existing 2018 case are significant in the town of Holden, with a total estimated daily truck VMT in excess of 17,800 miles, in large part due to I-190, the heavily utilized Route 122A corridor and Route 68. In West Boylston, total daily truck VMT in excess of 11,800 miles utilize the major highway network in that community which includes I-190, the essentially parallel Route 12, as well as Route 140. The towns of Paxton, Princeton and Rutland accommodate more modest total daily truck VMT estimates ranging from over 4,300 miles to nearly 4, 900 miles. The town of Barre accommodates over 3,400 miles on the town's highway network. The town of Oakham has the lowest total daily truck VMT in the vicinity of 1,300 miles.

Table 7
Existing Truck Vehicle Miles of Travel (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
Barre	521	75	184	709	102	250	599	86	212	467	67	165	3,437
Holden	2,889	343	811	3,942	471	1,113	3,333	398	941	2,592	308	729	17,869
Oakham	187	34	83	254	46	113	215	39	96	167	30	74	1,340
Paxton	742	93	212	1,011	128	290	855	108	246	665	84	190	4,623
Princeton	577	114	299	787	157	413	665	133	350	517	102	267	4,381
Rutland	727	112	271	990	153	370	837	129	313	651	100	243	4,897
West Boylston	1,774	261	644	2,427	361	893	2,050	306	755	1,590	234	577	11,873
Totals	7,416	1,033	2,504	10,121	1,418	3,443	8,554	1,199	2,911	6,650	926	2,244	48,418

Shown in **Table 8**, under anticipated 2030 conditions, total daily estimated truck VMT remains highest in the town of Holden with over 19,200 miles projected by the Model. Similar to the existing case, the town of West Boylston will likely accommodate over 12,700 miles. In the case of both communities, the high truck VMT demonstrates the importance of the I-190 corridor. This is also indicative of measurable increases on the State Numbered Routes in both towns: Route 12, Route 31, Route 68, Route 122A and Route 140. Elsewhere, in the towns of Paxton, Princeton, and Rutland, estimated truck VMT are anticipated to increase under projected 2030 conditions. Truck totals in excess of 5,000 miles are projected in Paxton and Rutland while a total daily truck VMT of over 4,600 miles is projected for the town of Princeton. The town of Barre will likely see an increase resulting in a total daily truck VMT of nearly 3,700 miles. The town of Oakham will continue to accommodate the least number of trucks in the North planning subregion, with over 1,400 miles anticipated for the 2030 benchmark year.

Table 8
Projected Truck Vehicle Miles of Travel (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
Barre	560	81	198	763	110	269	645	93	228	502	72	177	3,698
Holden	3,117	368	866	4,254	505	1,189	3,599	427	1,008	2,798	330	779	19,239
Oakham	205	37	91	279	51	124	236	43	105	184	33	81	1,471
Paxton	804	103	234	1,096	141	319	927	119	271	720	92	209	5,034
Princeton	614	123	323	837	169	446	707	143	377	550	110	288	4,686
Rutland	825	126	305	1,124	172	416	950	145	351	740	113	272	5,539
West Boylston	1,929	276	680	2,638	383	942	2,228	324	799	1,727	247	608	12,782
Totals	8,054	1,114	2,696	10,991	1,531	3,707	9,291	1,295	3,137	7,221	998	2,415	52,450

Looking to the 2040 future benchmark year, as shown in **Table 9**, overall truck VMT estimates are projected to further grow in these same North subregion host communities, although, based on currently available information, at a more limited rate than projected between 2018 & 2030. Total daily truck VMT will remain highest in the towns of Holden and West Boylston due largely to the I-190 corridor. Similar to the prior decade, total daily estimated truck VMT in the towns of Paxton, Princeton and Rutland will continue to increase under projected 2040 conditions, although at a lesser rate. Modest increases in total daily truck VMT are anticipated in both the towns of Barre and Oakham.

Table 9
Projected Truck Vehicle Miles of Travel (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
Barre	584	84	205	795	114	279	672	97	236	523	75	183	3,846
Holden	3,221	377	891	4,395	518	1,225	3,721	440	1,042	2,891	339	801	19,862
Oakham	210	39	94	287	53	129	242	44	109	189	35	84	1,514
Paxton	830	107	243	1,131	145	332	957	123	281	744	95	218	5,207
Princeton	629	125	328	857	172	454	724	146	384	563	112	293	4,788
Rutland	854	131	316	1,163	178	431	983	151	365	766	117	283	5,738
West Boylston	1,971	280	692	2,696	388	958	2,277	328	812	1,765	251	618	13,035
Totals	8,299	1,142	2,770	11,324	1,568	3,808	9,576	1,329	3,229	7,440	1,023	2,481	53,989

The corresponding percentage increases in projected truck VMT in the North transportation planning subregion are provided in **Tables 10 & 11. Table 10** summarizes the percentage increases anticipated in the 12-year period between 2018 and 2030. Corresponding anticipated percentage increases in excess of 10% are likely in the towns of Paxton and Rutland. In the town of Oakham increases of nearly 10% are projected, however, this community continues to have the lowest VMT of heavy vehicles in the North subregion. Further, the highest projected truck VMT increases between 2018 and 2030 are in the "Light Truck" category for each daily time period at a level of 8.9%.

Table 10
Projected Truck Vehicle Miles of Travel (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
Barre	7.6%	7.7%	7.5%	7.6%	7.7%	7.5%	7.6%	7.7%	7.5%	7.6%	7.7%	7.5%
Holden	7.9%	7.2%	6.9%	7.9%	7.2%	6.9%	8.0%	7.4%	7.1%	7.9%	7.2%	6.8%
Oakham	9.9%	9.8%	9.5%	9.9%	10.0%	9.7%	9.9%	9.8%	9.4%	9.9%	9.8%	9.4%
Paxton	8.4%	10.1%	10.2%	8.4%	10.0%	10.2%	8.4%	10.1%	10.1%	8.4%	10.0%	10.1%
Princeton	6.3%	7.9%	8.0%	6.3%	7.9%	8.0%	6.3%	7.8%	7.9%	6.3%	7.9%	8.0%
Rutland	13.5%	12.7%	12.2%	13.5%	12.7%	12.3%	13.5%	12.6%	12.2%	13.5%	12.6%	12.1%
West Boylston	8.7%	5.9%	5.5%	8.7%	5.9%	5.6%	8.7%	6.1%	5.8%	8.6%	5.8%	5.4%
Averages	8.9%	8.7%	8.5%	8.9%	8.8%	8.6%	8.9%	8.8%	8.6%	8.9%	8.7%	8.5%

Similarly, **Table 11** 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 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 2.8-3.2% range. During this decade, the percentage increase of both "Light" and "Heavy" trucks is anticipated to outpace the growth in "Medium" trucks.

Table 11
Projected Truck Vehicle Miles of Travel (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
Barre	4.2%	3.6%	3.7%	4.2%	3.7%	3.7%	4.2%	3.6%	3.7%	4.2%	3.6%	3.7%
Holden	3.3%	2.6%	2.9%	3.3%	2.7%	3.0%	3.4%	3.0%	3.4%	3.3%	2.6%	2.8%
Oakham	2.6%	3.1%	3.6%	2.6%	3.1%	3.4%	2.6%	3.1%	3.6%	2.6%	3.2%	3.7%
Paxton	3.2%	3.5%	4.2%	3.2%	3.3%	3.9%	3.3%	3.6%	3.9%	3.2%	3.8%	4.5%
Princeton	2.5%	1.7%	1.8%	2.4%	1.7%	1.8%	2.5%	1.8%	1.9%	2.4%	1.7%	1.8%
Rutland	3.5%	3.5%	3.8%	3.5%	3.5%	3.8%	3.5%	3.6%	3.9%	3.5%	3.6%	3.9%
West Boylston	2.2%	1.3%	1.7%	2.2%	1.3%	1.7%	2.2%	1.3%	1.7%	2.2%	1.3%	1.7%
Averages	3.1%	2.8%	3.1%	3.1%	2.8%	3.0%	3.1%	2.9%	3.2%	3.1%	2.8%	3.1%

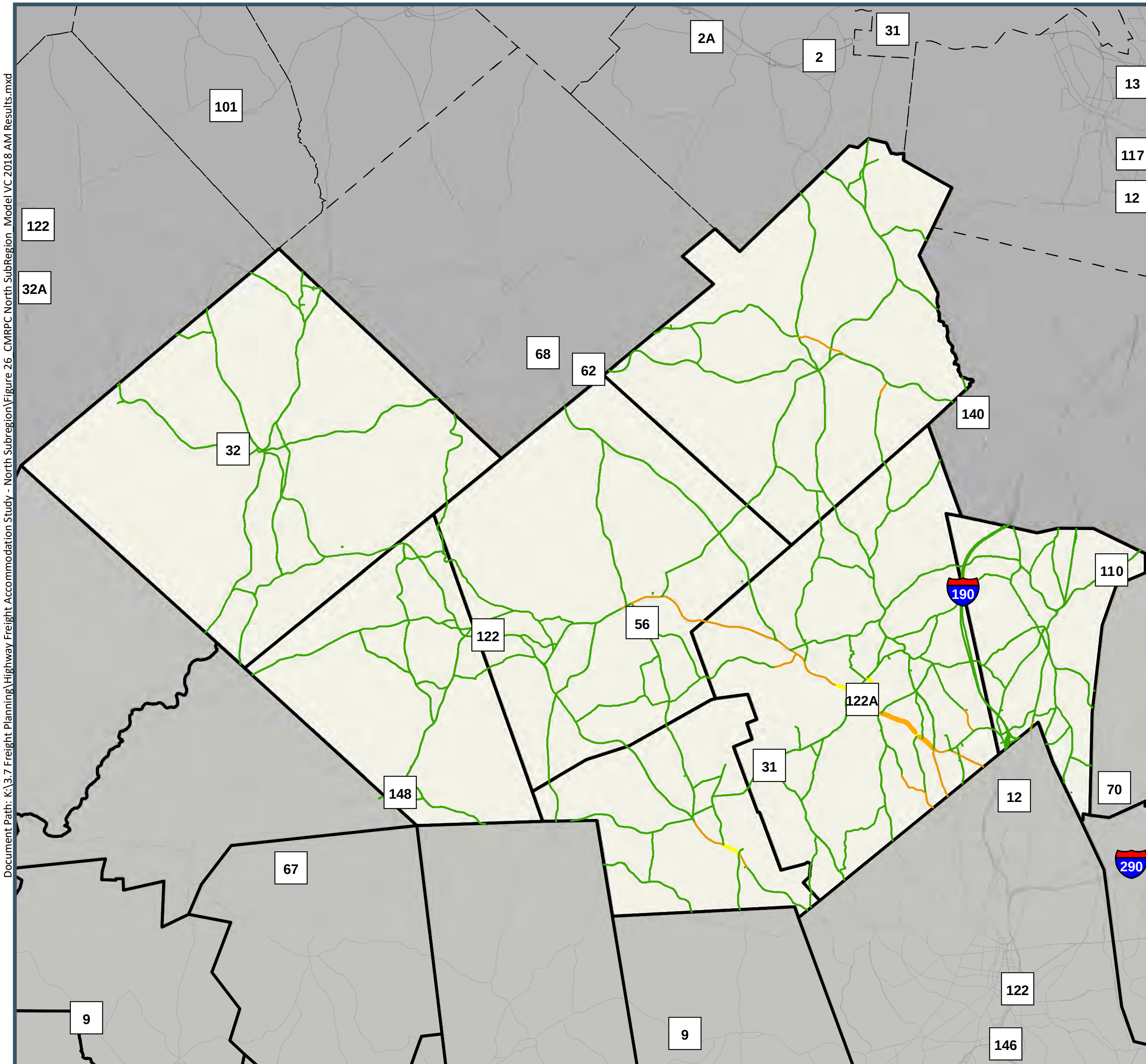
Rural Congestion in the North Subregion

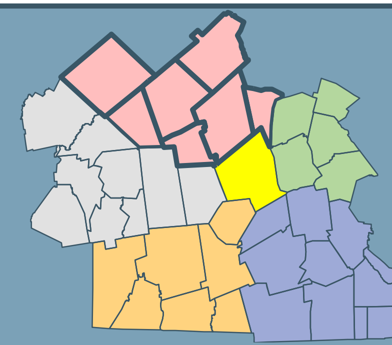
In an effort to detect existing rural congestion and its potential future year spread, the Model was used to calculate Volume-to-Capacity ("V/C") ratio data ranges for the host communities in the North planning subregion. The higher the V/C ratio, the more indicative of heavy travel. travel. Where the 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, sections of Holden's Route 122A corridor as well as a Paxton section of Route 122 & Route 56 exhibit V/C ratios ranging between 0.60 and 0.80. During the evening peak travel period, calculated V/C ratios rise relative to increased traffic volumes throughout the highway network. This occurs particularly along Holden's Route

122A corridor 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
- 0.40 - 0.60
- 0.60 - 0.70
- 0.70 - 0.80
- > 0.80
- North Subregion Towns

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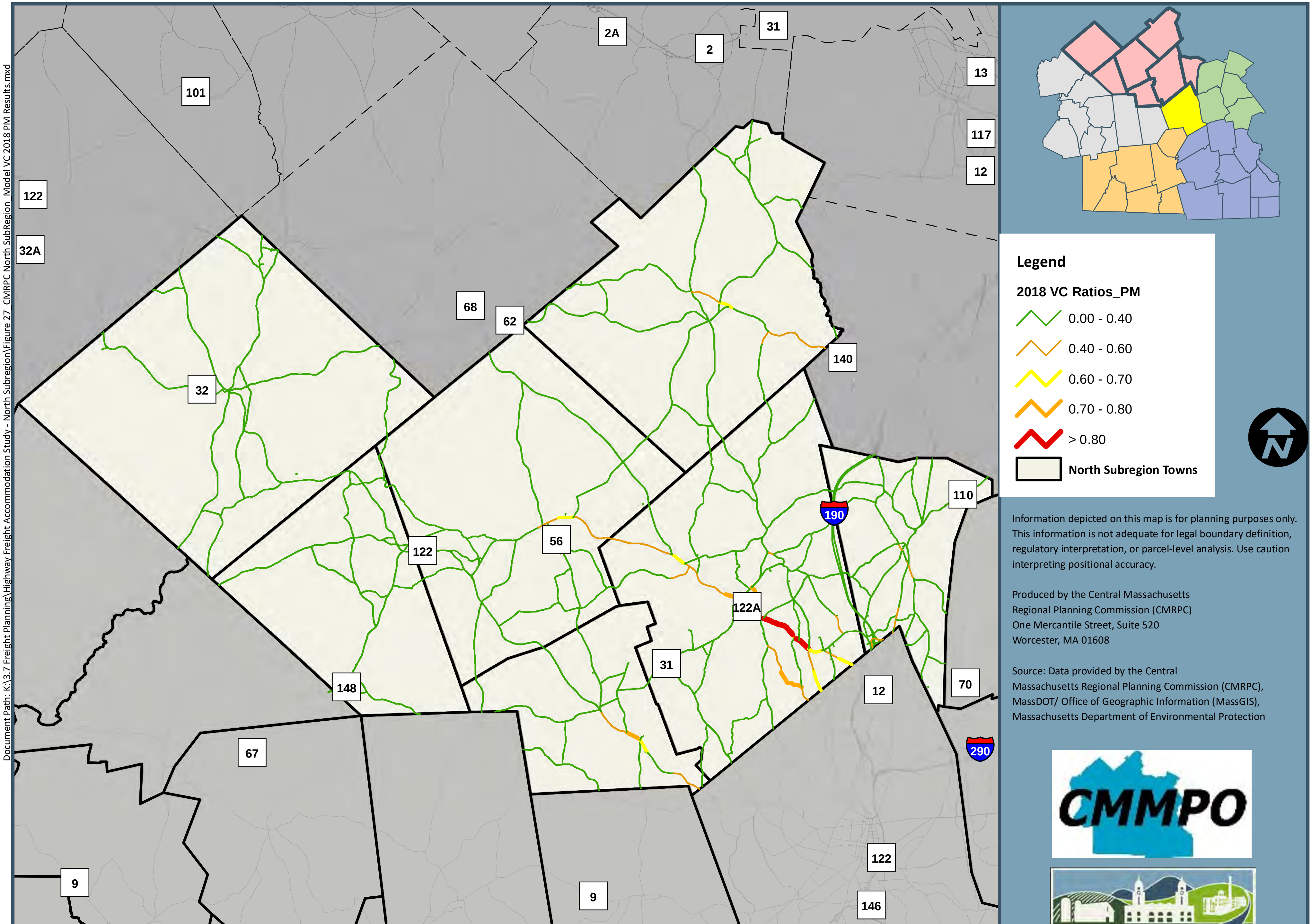
One Mercantile Street, Suite 520
Worcester, MA 01608

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

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



Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 27 CMRPC North SubRegion Model VC 2018 PM Results.mxd

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FIGURE 27 - NORTH 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 Holden's Route 122A corridor. This projected condition expands, or "spills over", during the evening peak travel period under projected 2030 conditions. Further, V/C ratios in excess of 0.80 are anticipated during the projected 2030 evening peak travel period on a Paxton section of Route 122 and Route 56. Elsewhere, during both peak travel periods in 2030, calculated V/C ratios increase relative to increased traffic volumes throughout the highway network. Examples include Princeton's Route 62 corridor and Route 122A in the host community of Rutland. The Model results also reveal potential increased usage of seemingly unattractive local roads, perhaps indicative of anticipated future year cut-through traffic.

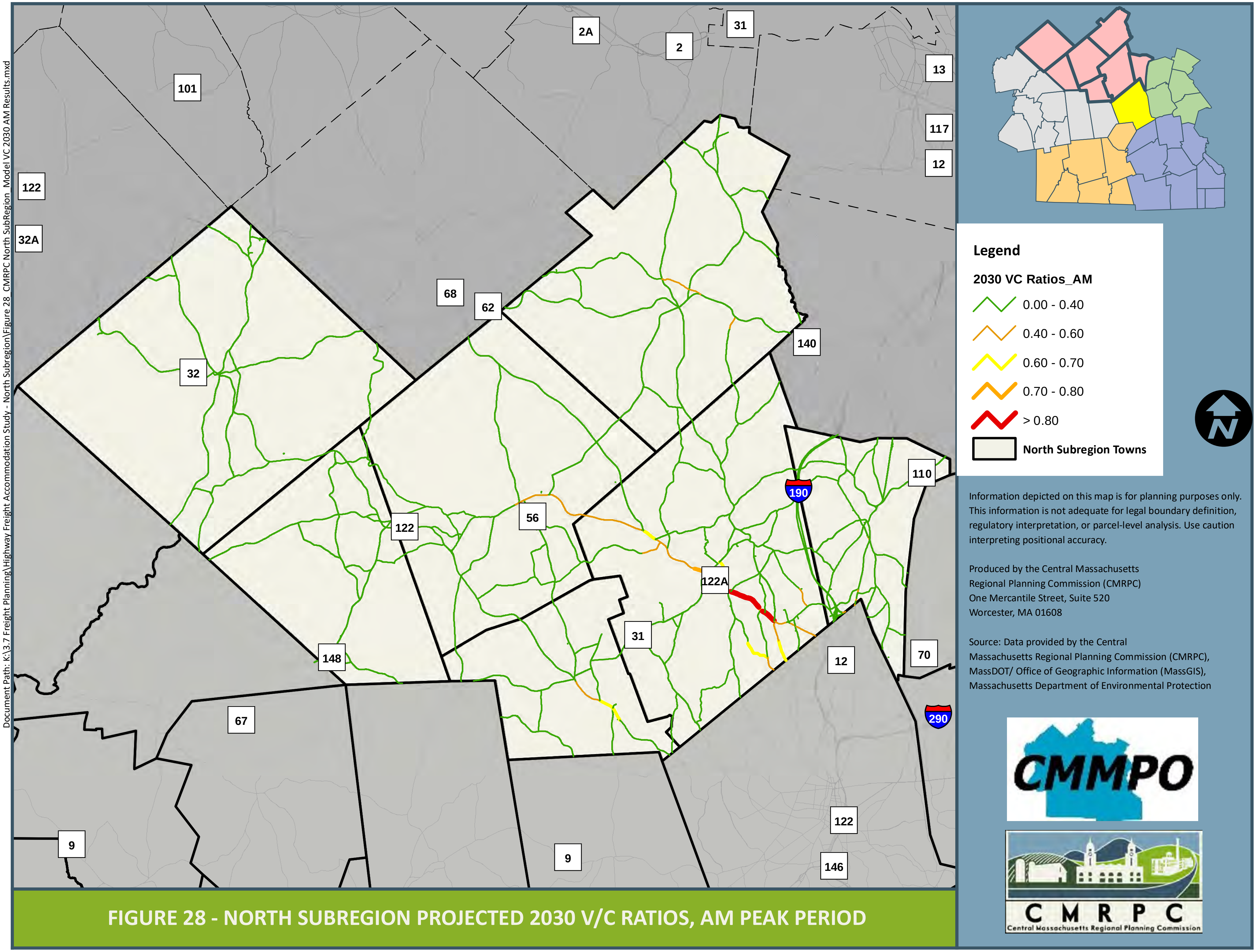


FIGURE 28 - NORTH SUBREGION PROJECTED 2030 V/C RATIOS, AM PEAK PERIOD

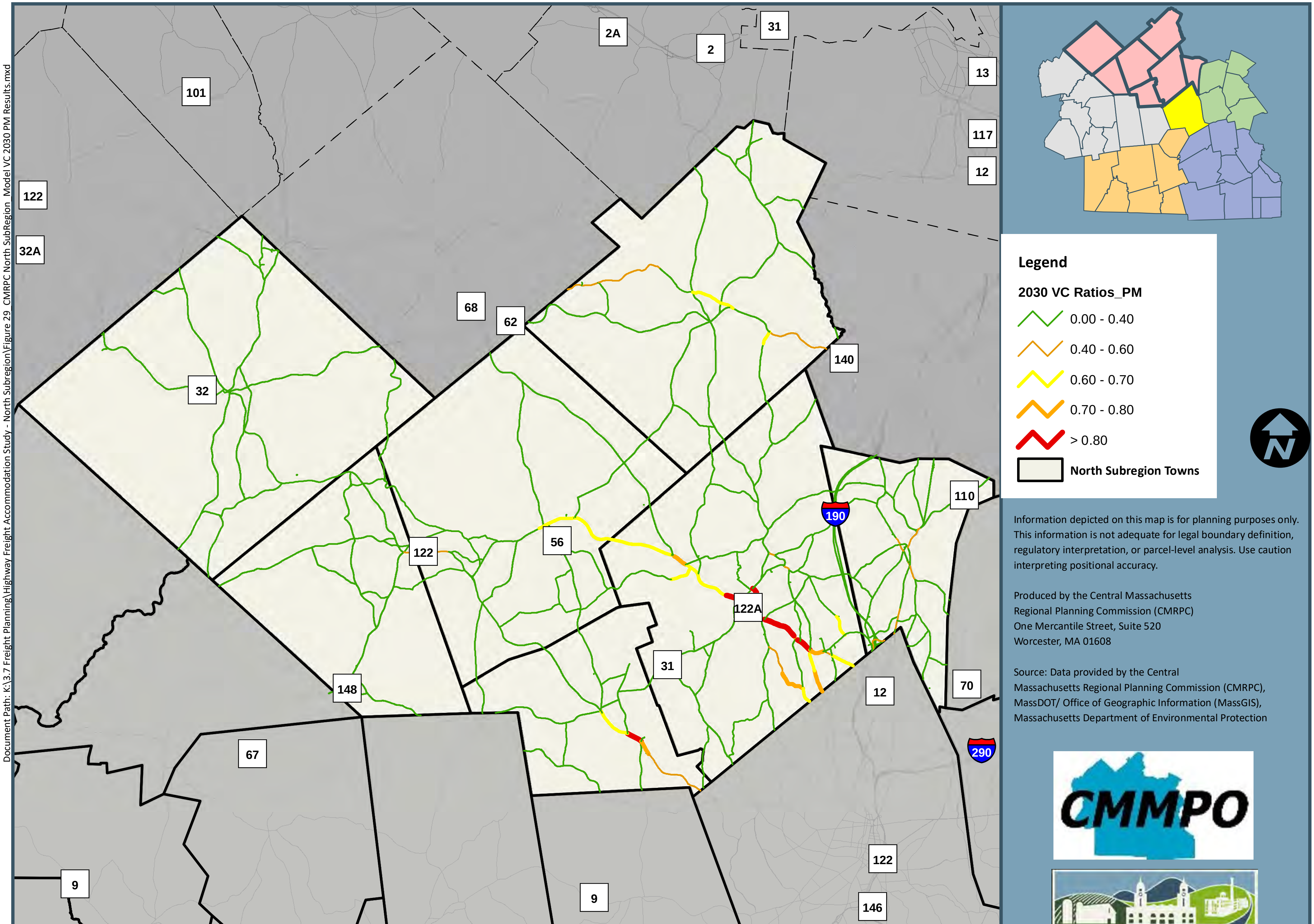
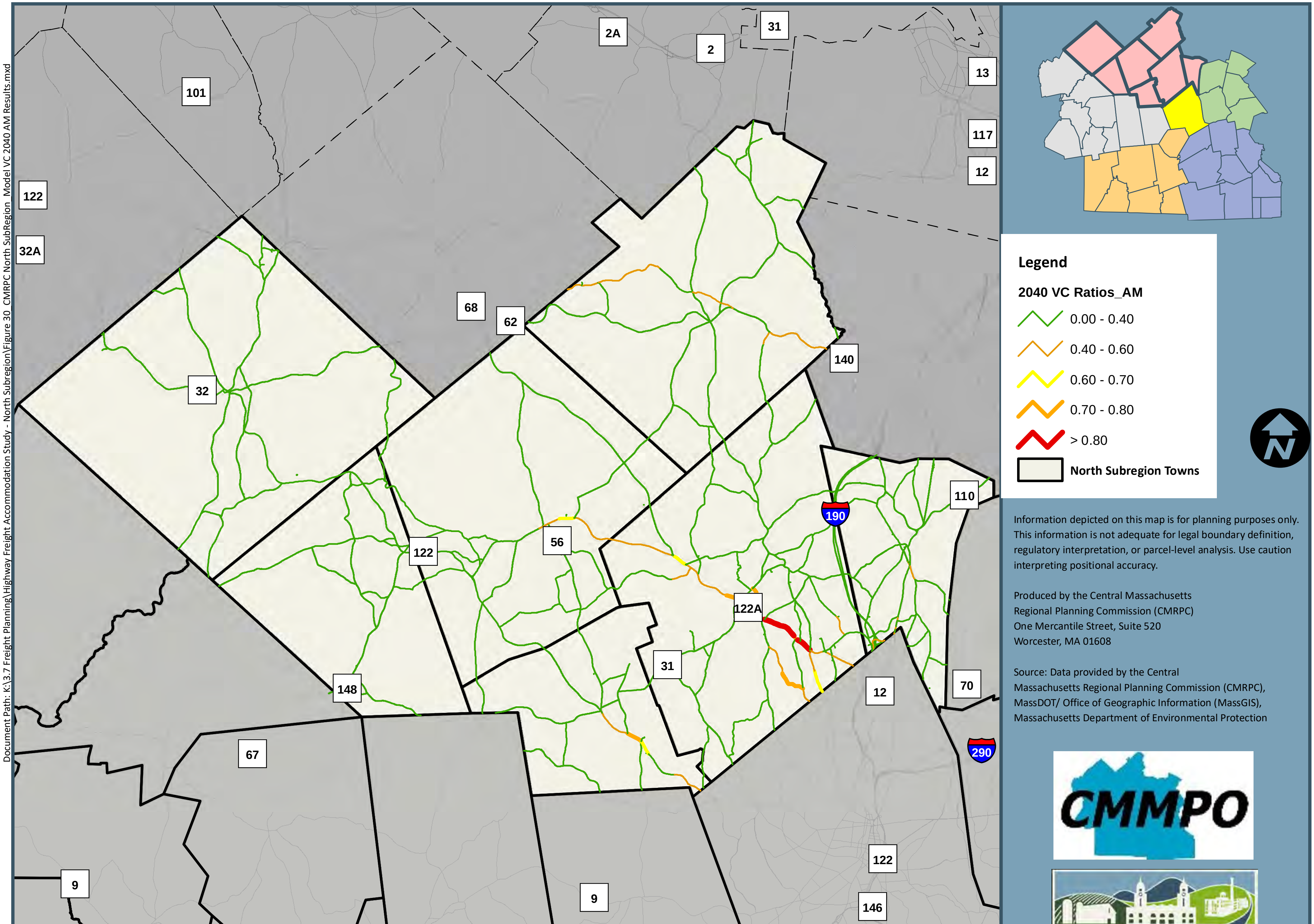


FIGURE 29 - NORTH SUBREGION PROJECTED 2030 V/C RATIOS, PM PEAK PERIOD

Under the projected 2040 scenario, shown in **Figures 30 & 31**, during the morning peak travel period, Holden continues to experience V/C ratios in excess of 0.80 along the Route 122A 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. Perhaps most dramatically, under the projected 2040 evening peak travel period, V/C ratios in excess of 0.80 are observed on an increasing number of highway segments in the town of Holden, beyond Route 122A proper, indicative of spreading congestion and travel delays. A Paxton section of Route 122 and Route 56 continues to experience V/C ratios in excess of 0.80. Additionally, the growth in projected V/C ratios is also evident in the towns of Princeton and Rutland. 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.



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Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North Subregion\Figure 30 CMRPC North SubRegion Model VC 2040 AM Results.mxd

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

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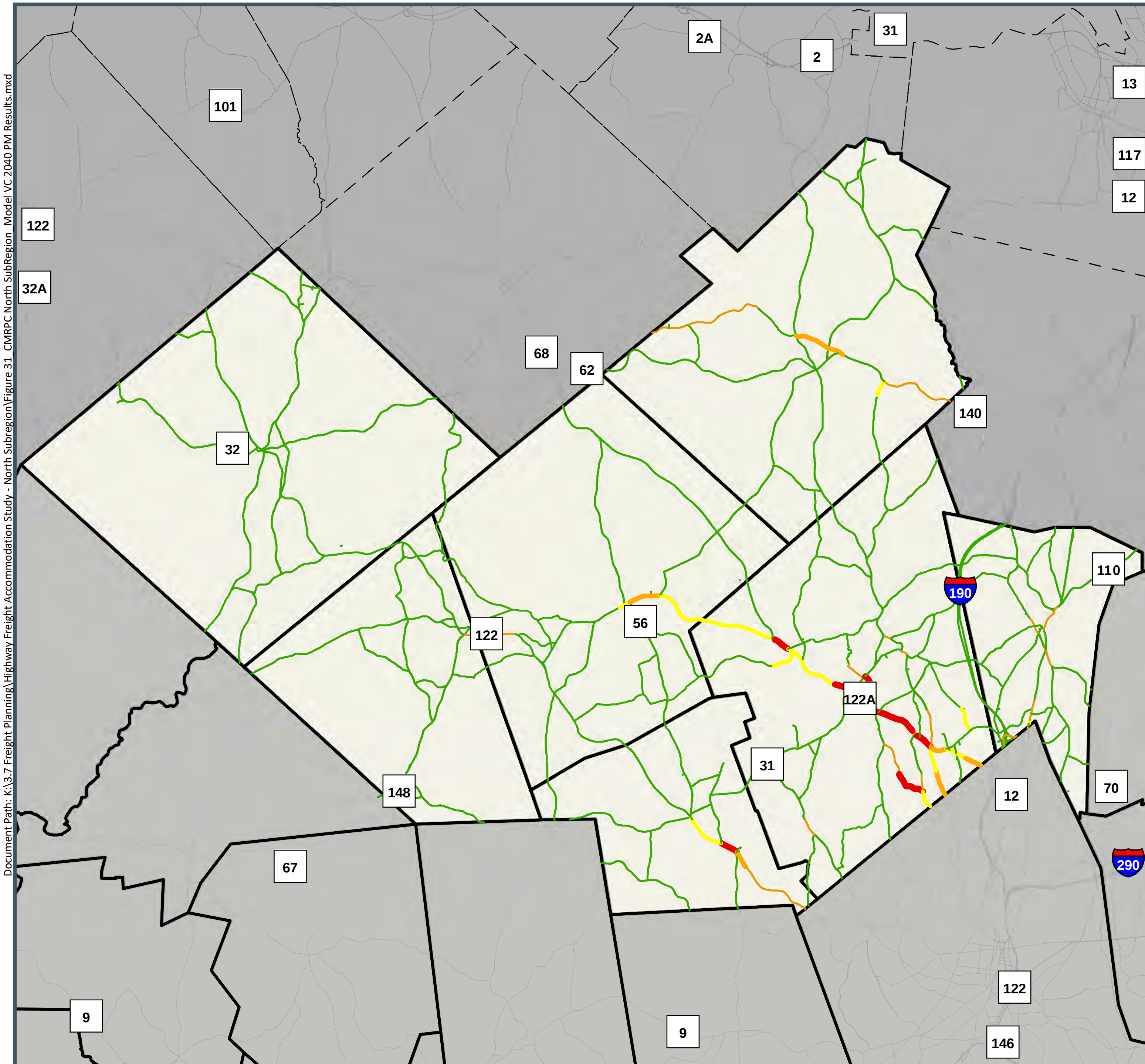

FIGURE 31 - NORTH SUBREGION PROJECTED 2040 V/C RATIOS, PM PEAK PERIOD

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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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Potential Highway "Bottleneck" Segments in the North Subregion

The Travel Demand Forecasting Model software, or "Model", was also used to identify potential "Bottleneck" segments on the North 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 Berkshire 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 North 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 North 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 North 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 North 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 Routes highlighted by the Model analysis, Routes 122 (Paxton, Rutland, Oakham, Barre), 122A (Holden) and 140 (West Boylston & Princeton), need to continue to be monitored on a 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.

Document Path: K:\3.7 Freight Planning\Highway Freight Accommodation Study - North SubRegion\Figure 32 CMRPC North SubRegion Model Bottleneck Results.mxd

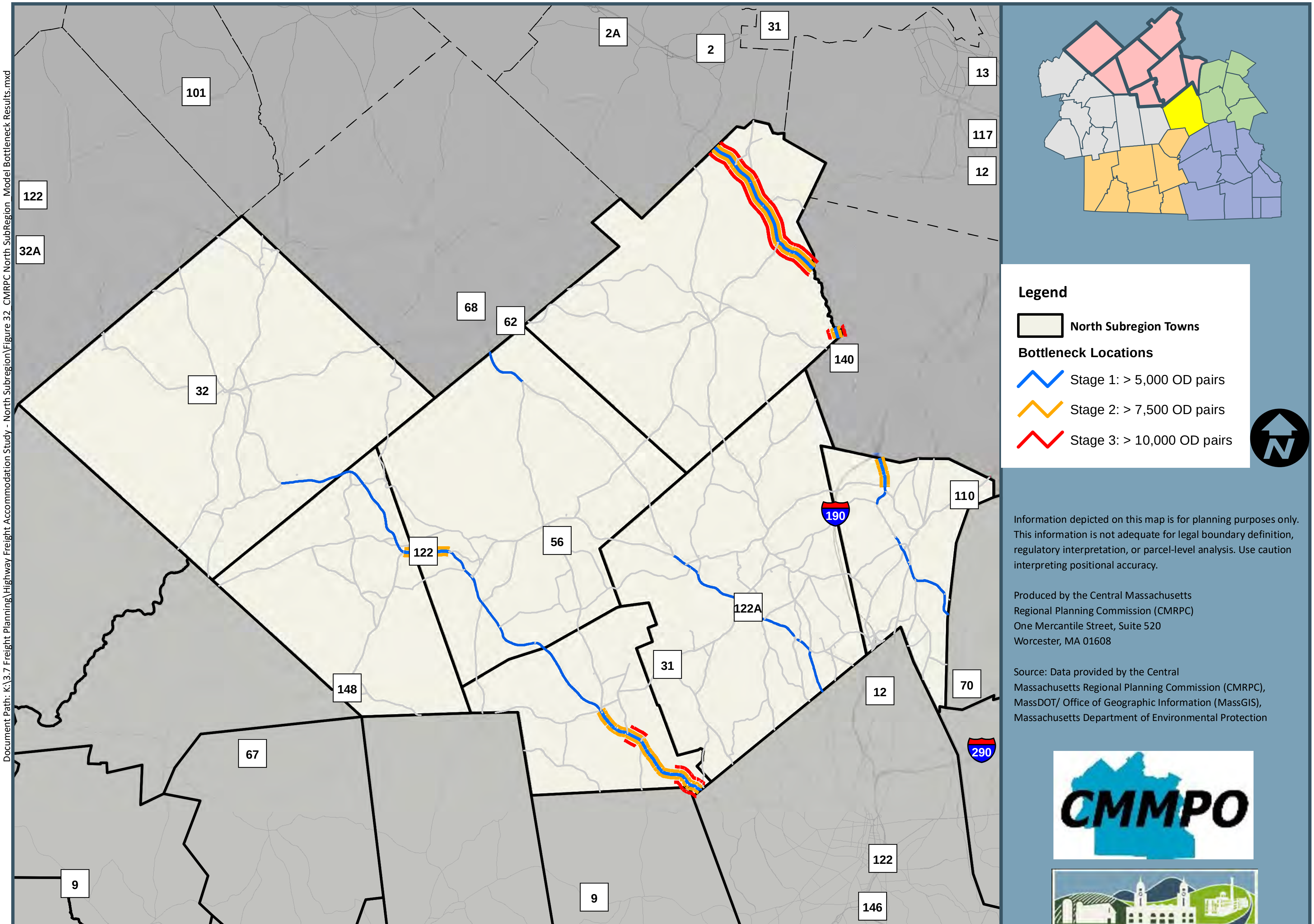

FIGURE 32 - POTENTIAL HIGHWAY "BOTTLENECK" SEGMENTS IN THE NORTH SUBREGION

5.0 Summary of Findings

Table 12 contains a summary of the findings that was previously shown on the range of maps presented earlier in this highway freight accommodation study. The information is summarized by North subregion host community and then by each State Numbered Route within the community. For some of the columns there was no data yet available. Further, some of the columns have multiple findings listed while other columns contain a range of findings such as traffic and heavy vehicle volumes. The information within this table includes:

- Highway federal-aid eligibility
- Highway Ownership
- 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
- Congested intersections
- Highway Safety Improvement Program (HSIP) crash clusters
- Pavement condition
- Bridges and culverts
- Management Systems data integration
- Environmental Profiles
- Evacuation route
- Dams
- Locally-identified hazards and vulnerable infrastructure

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

Barre

State Numbered Routes 32, 62, 67, and 122 are located in the town of Barre. They are all considered critical freight corridors with the exception of Route 62. The highest traffic volumes are observed on Route 122 while the other listed routes have daily traffic volumes between

1,700 and 2,900 VPD. Additionally, heavy vehicles range between 7% and 12%. There are no known congested intersections or HSIP crash clusters. In regards to pavement condition, most of the routes are at least in fair condition while only Route 67 has a portion of very poor pavement at this time. There are five (5) bridges along Route 32 of which two (2) are considered structurally deficient. There is also one (1) structurally deficient bridge on Route 62. High hazard dams are also located near Route 32 and Route 122. Lastly, all routes have locally-identified nearby vulnerable critical infrastructure.

Holden

State Numbered Routes 31, 68, and 122A are located in the town of Holden. There is a currently programmed TIP resurfacing project for a portion of Route 122A. The highest daily traffic volumes and heavy vehicle percentages are on Route 122A. Currently, the intersection of Route 31 & Route 122A is considered a congested location. Most of the pavement has been observed to be at least in fair condition, with only a small segment of Route 122A in poor condition. There is one (1) bridge along Route 31 that is rated structurally deficient. Resulting from the Management Systems integration exercise, there are "Tier 2" rated segments on both Route 31 and Route 122A. Near Route 122A, there is a high hazard dam located just south of Mt. Pleasant Avenue. Additionally, locally-identified vulnerable critical infrastructure is located near both Routes 31 and 122A.

Oakham

In the town of Oakham, the State Numbered Routes are Route 122 and Route 148. Route 122 is considered a critical freight corridor. Route 122 has the highest volumes, however Route 148 has the highest heavy vehicle percentages. Pavement condition is excellent for both highways. There is one (1) short span bridge on Route 122 that is rated as structurally deficient. There are also two (2) significant hazard dams along Route 148 while both highways have nearby vulnerable critical infrastructure identified by the community.

Paxton

State Numbered Routes 31, 56, and 122 are located in the town of Paxton. The highest observed traffic volumes are on Route 122. Heavy vehicles percentages range between 6% and 10% for all three highways. Overall, pavement is in fair to excellent condition except for a few very poor segments of pavement on Route 31. Resulting from the Management Systems integration exercise, there are "Tier 2" segments identified on both Route 31 and Route 122. Further, Route 31 is the only highway with any hazardous dams or any other locally-identified nearby hazards.

Princeton

In the town of Princeton, the State Numbered Routes include Routes 31, 62, and 140. Route 140 has the highest daily traffic volumes with up to 7,200 VPD while heavy vehicle usage for all routes is between 5% and 8%. Besides a portion of Route 62 and Route 140 observed to be in poor condition, the pavement on the remainder of the town's highway segments are at least in fair condition. Both Route 31 and Route 140 each have one (1) structurally deficient short span bridge. In regards to dams, there is one (1) that is considered a significant hazard in the northern part of the community, near the Route 31/140 intersection. Additionally, there are locally-identified hazards and vulnerable critical infrastructure situated near all three highways.

Rutland

State Numbered Routes 56, 68, 122, and 122A are located in the town of Rutland. Route 122 is considered a critical regional freight corridor. There is a TIP project programmed for a portion of Route 56, just north of Route 122A, that will result in the reconstruction of a one (1) mile section of this highway that also includes bicycle and pedestrian accommodation. The highest observed traffic volumes are on Route 122A while the highest percentage of heavy vehicles are on Route 56 and Route 68, ranging between 5% and 14%. Of the two (2) identified HSIP intersections in the North subregion, one is located in Rutland at the intersection of Route 122 & Pleasantdale Road. Most of the highway pavement is at least in good condition except for a small segment on Route 56 that is rated as poor. However, the programmed TIP project for the reconstruction of Route 56 is expected to improve this segment within the project limits. Resulting from the Management Systems data integration exercise, a small section of Route 56, just south of Route 122A, is considered "Tier 2". There is also a high hazard dam located near Route 56 while other locally-identified hazards are nearby all of the community's State Numbered Routes.

West Boylston

In the town of West Boylston, the State Numbered Routes include Routes 12, 110, and 140. Routes 12 and 140 both exceed daily traffic volumes of 10,000 VPD while Route 110 carries about 5,000 VPD. Route 12 and Route 140 average between 6% and 12% heavy vehicles. There is one (1) known congested location at the signalized Route 12/Route 140/Central Street intersection. Further, the second HSIP location in the North subregion is in West Boylston at the intersection of Route 12 and Franklin Street. Most of the pavement is in fair condition or better except for a small segment of poor condition observed on Route 12 in the northern part of the community. According to the results of the Management Systems integration exercise, there are multiple "Tier 2" segments on both Route 12 and Route 140. Lastly, there are locally-identified hazards or vulnerable critical infrastructure nearby all three highways.

Table 12 - Summary of Findings

Host Community	Route #	Fed-Aid Eligible	Highway Ownership	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)	Congested Intersections	HSIP Crash Clusters	Pavement Condition	Bridges & Culverts	Management Systems Data Integration	Environmental Profiles	Evacuation Route	Dams	Locally Identified Hazards & Vulnerable Infrastructure
Barre	122	Yes	MassDOT	Yes	No	4,700 - 4,800	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No	Fair / Good	2 Bridges, 1 Culvert	Tier 3	Nearby potential vernal pools & rare species habitat, 100 year flood zones, wetlands, water supply & recreation area	Primary	Nearby Low, Significant & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	32	Yes	Town	Yes	No	2,400 - 2,900	225 - 325	100 - 150	100 - 175	7% - 12%	No Data	No Data	No Data	No	Fair / Good	5 Bridges (2SD), 1 Short Span Bridge	Tier 3	Nearby vernal pools, potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, recreation area	Primary	Nearby Low & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	122/32	Yes	MassDOT	Yes	No	1,900 - 4,800	200 - 425	100 - 225	100 - 200	7% - 11%	No Data	No Data	No	No	Fair / Good / Excellent	1 Short Span Bridge	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation & recreation area	Primary	None	Nearby Vulnerable Critical Infrastructure
	62	Yes	Town	No	No	1,700 - 2,700	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No	Good / Excellent	3 Bridges (1SD)	Tier 3	Nearby potential vernal pools & rare species habitat, 100 year flood zones, wetlands, water supply & conservation area	Secondary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	67	Yes	Town	Yes	No	1,700	150	75	75	8%	No Data	No Data	No Data	No	Very Poor / Fair	1 Short Span Bridge	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, no open space	Secondary	None	Nearby Hazards & Vulnerable Critical Infrastructure
Holden	122A	Yes	MassDOT	No	Yes	7,600 - 20,900	300 - 2,450	150 - 1,250	150 - 1,225	4% - 12%	18 - 45 MPH	22 - 44 MPH	Yes	No	Poor / Fair / Excellent	2 Bridges, 3 Culverts	Tiers 2 &3	Nearby potential vernal pools, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary & Secondary	Nearby Low, Significant & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	31	Yes	Town	No	No	5,000 - 12,500	175 - 850	75 - 525	100 - 450	6 - 10%	30 - 40 MPH	33 - 42 MPH	Yes	No	Fair / Good / Excellent	2 Bridges (1SD), 1 Culvert	Tiers 2 &3	Nearby vernal pools, potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary & Secondary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	68	Yes	Town	No	No	3,800	No Data	No Data	No Data	No Data	No Data	No Data	No	No	Good	1 Culvert	Tier 3	Nearby potential vernal pools, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Secondary	None	None
Oakham	122	Yes	MassDOT	Yes	No	4,500 - 7,800	500 - 525	225 - 275	250	6% - 7%	No Data	No Data	No Data	No	Excellent	1 Bridge, 1 Short Span Bridge (SD)	Tier 3	Nearby potential vernal pools & rare species habitat, 100 year flood zones, wetlands, Conservation & water supply area	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	148	Yes	Town	No	No	1,900 - 2,300	225 - 325	125 - 200	75 - 125	9% - 13%	No Data	No Data	No Data	No	Excellent	1 Culvert	Tier 3	Nearby potential vernal pools & rare species habitat, 100 year flood zones, wetlands, conservation, recreation & water supply area	Primary	Nearby Significant Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
Paxton	122	Yes	MassDOT	No	No	4.900 - 12,700	300 - 975	150 - 425	150 - 550	6% - 10%	37 - 42 MPH	39 - 45 MPH	No	No	Excellent	3 Culverts	Tiers 2 &3	Nearby potential vernal pools, 100&500 year flood zones, wetlands, open space	Primary	None	None
	31	Yes	Town	No	No	4,300 - 7,700	350 - 475	200 - 225	150 - 250	6% - 8%	26 - 45 MPH	12 - 44 MPH	No	No	Very Poor / Fair / Good / Excellent	2 Short Span Bridges	Tiers 2 &3	Nearby potential vernal pools, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary	Nearby Significant Hazard Dam	Nearby Hazard
	56	Yes	Town	No	No	3,400 - 4,500	200 - 300	75 - 175	100 - 125	5% - 7%	40 - 45 MPH	40 - 43 MPH	No	No	Fair / Good / Excellent	None	Tier 3	100&500 year flood zones, wetlands, water supply area	Secondary	None	None
	122/56	Yes	MassDOT	No	No	12,000 - 12,900	No Data	No Data	No Data	No Data	35 - 38 MPH	33 - 42 MPH	No	No	Excellent	1 Culvert	Tier 3	Nearby potential vernal pools, 500 year flood zone, wetlands, recreation & water supply area	Primary	None	None
	31/56	Yes	Town	No	No	3,700	400	150	250	9%	15 - 22 MPH	12 - 23 MPH	No	No	Very Poor	None		None	Primary	None	None

Table 12 - Summary of Findings

Host Community	Route #	Fed-Aid Eligible	Highway Ownership	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)	Congested Intersections	HSIP Crash Clusters	Pavement Condition	Bridges & Culverts	Management Systems Data Integration	Environmental Profiles	Evacuation Route	Dams	Locally Identified Hazards & Vulnerable Infrastructure
Princeton	140	Yes	Town	No	No	4,700 - 6,100	375	200	175	6%	No Data	No Data	No	No	Poor / Fair	1 Bridge, 2 Short Span Bridges (1SD), 1 Culvert	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary	None	None
	31	Yes	Town	No	No	1,100 - 3,300	115 - 200	50 - 100	50 - 100	5% - 7%	No Data	No Data	No	No	Fair / Good / Excellent	1 Short Span Bridge (SD)	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary & Secondary	Nearby Significant Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
	62	Yes	Town	No	No	1,200 - 3,500	150	75	75	6%	No Data	No Data	No	No	Poor / Fair / Good / Excellent	1 Bridge	Tier 3	Nearby vernal pools, potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary	Nearby Low Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	31/62	Yes	Town	No	No	3,800	No Data	No Data	No Data	No Data	No Data	No Data	No	No	Good	None	Tier 3	Nearby potential vernal pool,	Primary	None	None
	140/31	Yes	Town	No	No	7,200	575	325	250	8%	No Data	No Data	No	No	Excellent	None	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation, recreation & water supply area	Primary	Nearby Significant Hazard Dam	Nearby Hazards & Vulnerable Critical Infrastructure
Rutland	122	Yes	MassDOT	Yes	No	4,900 - 7,800	300 - 500	150 - 250	150 - 250	6%	No Data	No Data	No	Yes	Excellent	None	Tier 3	Nearby vernal pools, potential vernal pools & rare species habitat, 100 year flood zones, wetlands, conservation & recreation area	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	122A	Yes	MassDOT	No	No	2,100 - 10,700	300 - 1,125	150 - 700	150 - 450	6% - 9%	No Data	No Data	No	No	Excellent	1 Culvert	Tier 3	Nearby vernal pools & potential vernal pools, 500 year flood zone, wetlands, conservation & recreation area	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	56	Yes	Town	No	Yes	2,400 - 6,100	200 - 625	100 - 350	100 - 275	5% - 13%	No Data	No Data	No	No	Poor / Fair / Good / Excellent	None	Tiers 2 &3	Nearby vernal pools, potential vernal pools & rare species habitat, 100 year flood zones, wetlands, water supply area	Primary	Nearby Low & High Hazard Dams	Nearby Hazards & Vulnerable Critical Infrastructure
	122A/56	Yes	MassDOT	No	No	11,200	No Data	No Data	No Data	No Data	No Data	No Data	No	No	Excellent	None	Tier 3	None	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	68	Yes	Town	No	No	3,800 - 4,200	500	300	200	14%	No Data	No Data	No	No	Good / Excellent	2 Bridges	Tier 3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation & water supply area	Primary	None	Nearby Hazard
West Boylston	12	Yes	MassDOT	No	No	4,600 - 16,900	1,115 - 1,575	425 - 425	425 - 925	7% - 9%	26 - 40 MPH	13 - 43 MPH	Yes	Yes	Poor / Fair / Excellent	1 Culvert	Tiers 2 &3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, conservation & water supply area	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	110	Yes	MassDOT	No	No	5,000	No Data	No Data	No Data	No Data	No Data	No Data	No	No	Good / Excellent	None	Tier 3	Nearby potential vernal pools, 500 year flood zones, wetlands, water supply area	Primary	None	Nearby Hazards
	140	Yes	Town	No	No	3,300 - 13,600	275 - 1,250	125 - 600	150 - 650	6% - 12%	30 - 37 MPH	33 - 38 MPH	Yes	No	Fair / Good	2 Bridges	Tiers 2 &3	Nearby potential vernal pools & rare species habitat, 100&500 year flood zones, wetlands, water supply area	Primary	None	Nearby Hazards & Vulnerable Critical Infrastructure
	12/140	Yes	MassDOT	No	No	13,500	975	450	525	8%	32 - 35 MPH	30 - 35 MPH	Yes	No	Excellent	1 Bridge	Tiers 2 &3	Nearby rare species habitat, 100 year flood zone, wetlands, water supply area	Primary	None	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 seven (7) host communities in the North subregion. The following **Figure 33** shows the suggested priority infrastructure improvements for each of the towns. Those highway segments on the federal-aid network are eligible for potential future-year funding through the CMMPO's Transportation Improvement Program (TIP). Other applicable funding sources also have the potential to be applied, such as various grant opportunities and state-provided Chapter 90 funds.

6.1 North Subregion-Wide Improvement Options

- In the spirit of Jason's Law, contemplate revised local policy and strongly consider truck parking-friendly bylaws 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 identified hazardous highway curves.
- Check and optimize signal timing & phasing at high-volume signalized intersections.
- Address HSIP identified locations in Rutland at Route 122 & Pleasantdale Road and in West Boylston at Route 12 & Franklin Street.
- Maintain all pavement to a condition of "Good" or above. Especially 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 North 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 located in the North subregion.

6.2 North Subregion Host Community Improvement Options

Barre

- Improve the very poor pavement segment on Route 67, between Quinn Road and the New Braintree town line. Also, consider improving the poor segments on other federal-aid eligible roads.
- Improve the structurally deficient bridges on Route 32 (Main Street over canal and Ware canal) and Route 62 (Hubbardston Road over Canesto Brook).
- Consider improving all high and significant hazard dams in the community, specifically those near Route 32 and Route 122.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

Holden

- Check and optimize the traffic signal timing & phasing at the Route 31 & Route 122A intersection.
- Improve the poor pavement segment on Route 122A, south of Shrewsbury Street.
- Improve the structurally deficient bridge on Route 31 (over the Genesee & Wyoming Inc. P&W Railroad).
- Consider improving the Management Systems data integration analysis identified Tier 2 priority segments on Route 122A (between Kendall Road & Shrewsbury Street) and one other segment on Route 31 (between Union Street & Main Street).
- Consider improving all high and significant hazard dams in the community, specifically near Route 122A.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

Oakham

- Improve the structurally deficient short span bridge on Route 122 (over Muddy Pond Brook).
- Consider improving the significant hazard dams near Route 148.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

Paxton

- Improve the very poor pavement segments on Route 31, between Grove Street and Holden town line (already improved through a TIP project completed in 2020) and Route 31/56, between Richards Avenue and Route 122.
- Consider improving the Management Systems data integration analysis identified Tier 2 priority segments on Route 31 [between Grove Street & Holden town line (already improved through a TIP project completed in 2020)] and Route 122 (between Davis Hill Road & West Street).
- Consider improving all high and significant hazard dams in the community, specifically near Route 31.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

Princeton

- Improve the poor pavement segments on Route 62, between Goodnow Road & Calamint Hill Road and on Route 140, between Route 31 & Sterling town line.
- Improve the structurally deficient short span bridges on Route 31 (over Wachusett Brook) and Route 140 (over Keyes Brook).
- Consider improving the significant hazard dams near Route 31 and Route 140.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

Rutland

- Improve the poor pavement segments on Route 56, between Sassawanna Road & Moulton Mill Road.
- HSIP identified improvements warranted at Route 122 & Pleasantdale Road.
- Consider improving the Management Systems data integration analysis identified Tier 2 priority segment on Route 56 (between Main Street & Prescott Street).
- Consider improving all high hazard dams in the community, specifically near Route 56.
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

West Boylston

- Check and optimize the traffic signal timing & phasing at the Route 12 & Route 140 & Central Street intersection.
- HSIP identified improvements warranted at Route 12 & Franklin Street.

- Improve the poor pavement segments on the northern segment of Route 12, near the Sterling town line.
- Consider improving the Management Systems data integration analysis identified Tier 2 priority segments on Route 12 (between Worcester city line & Woodland Street and between Wal-Mart Plaza and between Lancaster Street) and Route 140 (between Church Street & Maple Street).
- Consider any nearby locally-identified hazards and vulnerable critical infrastructure that could be potentially impacted by the suggested improvement options.

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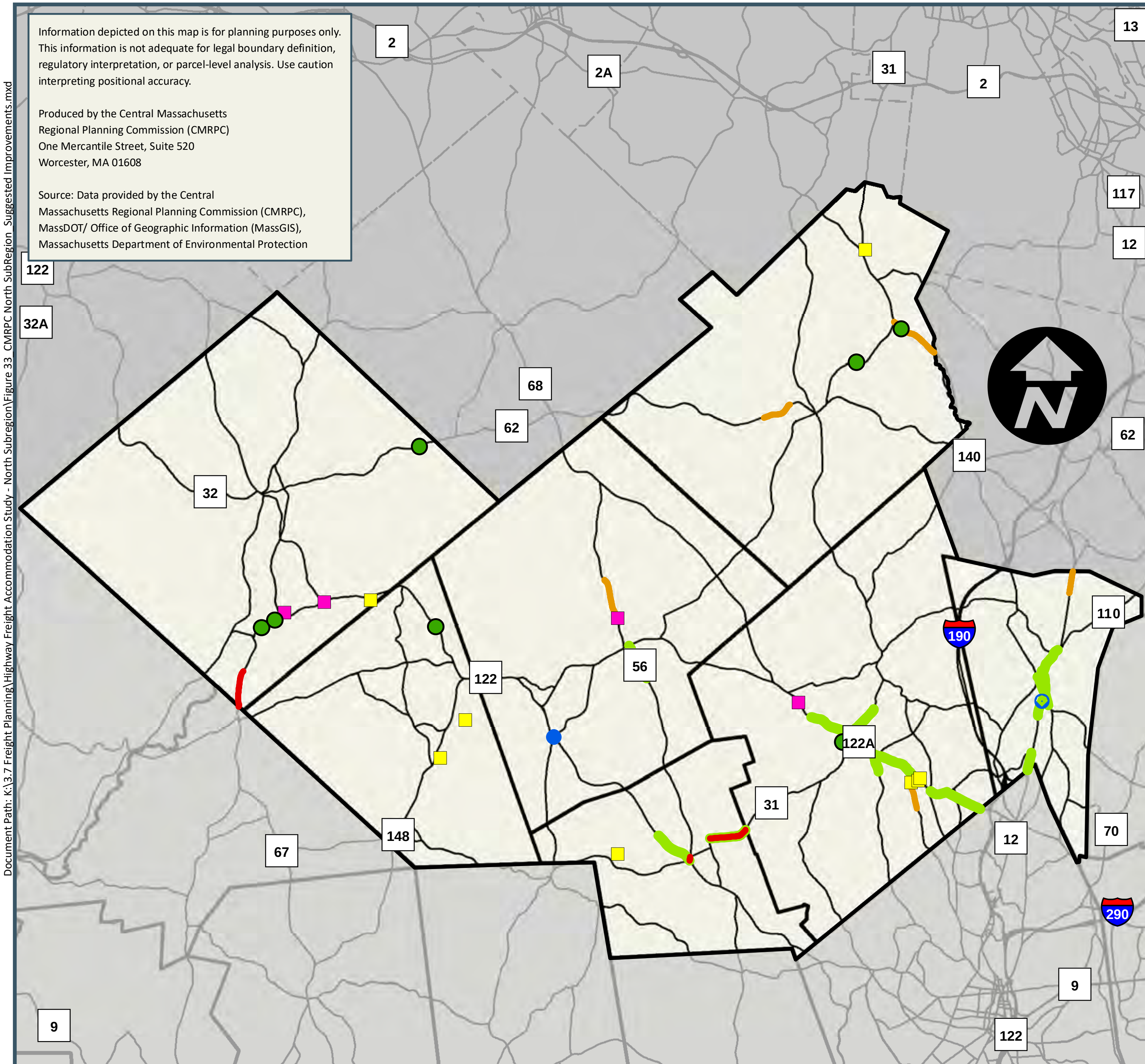
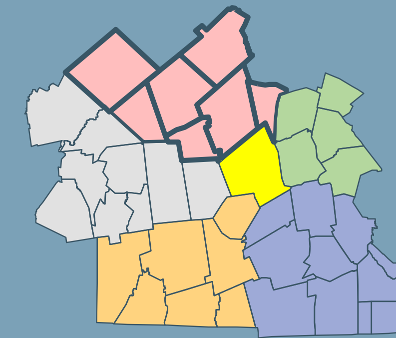




CMMPO

CMRPC
Central Massachusetts Regional Planning Commission

FIGURE 33 - NORTH SUBREGION COMMUNITY SUGGESTED PRIORITY INFRASTRUCTURE IMPROVEMENTS

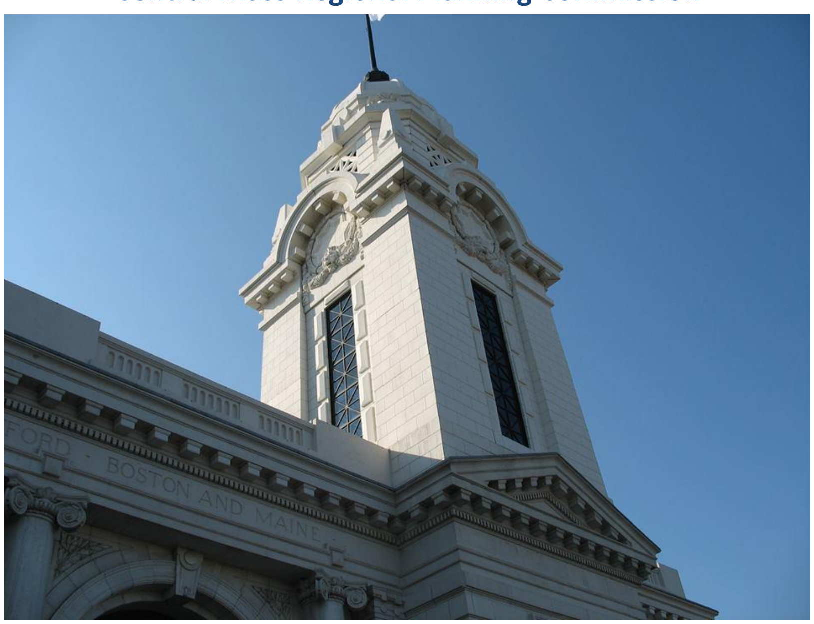
Central Massachusetts Regional Planning Commission

Member Communities

Auburn
Barre
Berlin
Blackstone
Boylston
Brookfield
Charlton
Douglas
Dudley
East Brookfield
Grafton
Hardwick
Holden
Hopedale
Leicester
Mendon
Millbury
Millville
New Braintree
North Brookfield

Northborough
Northbridge
Oakham
Oxford
Paxton
Princeton
Rutland
Shrewsbury
Southbridge
Spencer
Sturbridge
Sutton
Upton
Uxbridge
Warren
Webster
West Boylston
West Brookfield
Westborough
Worcester

Central Mass Regional Planning Commission



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