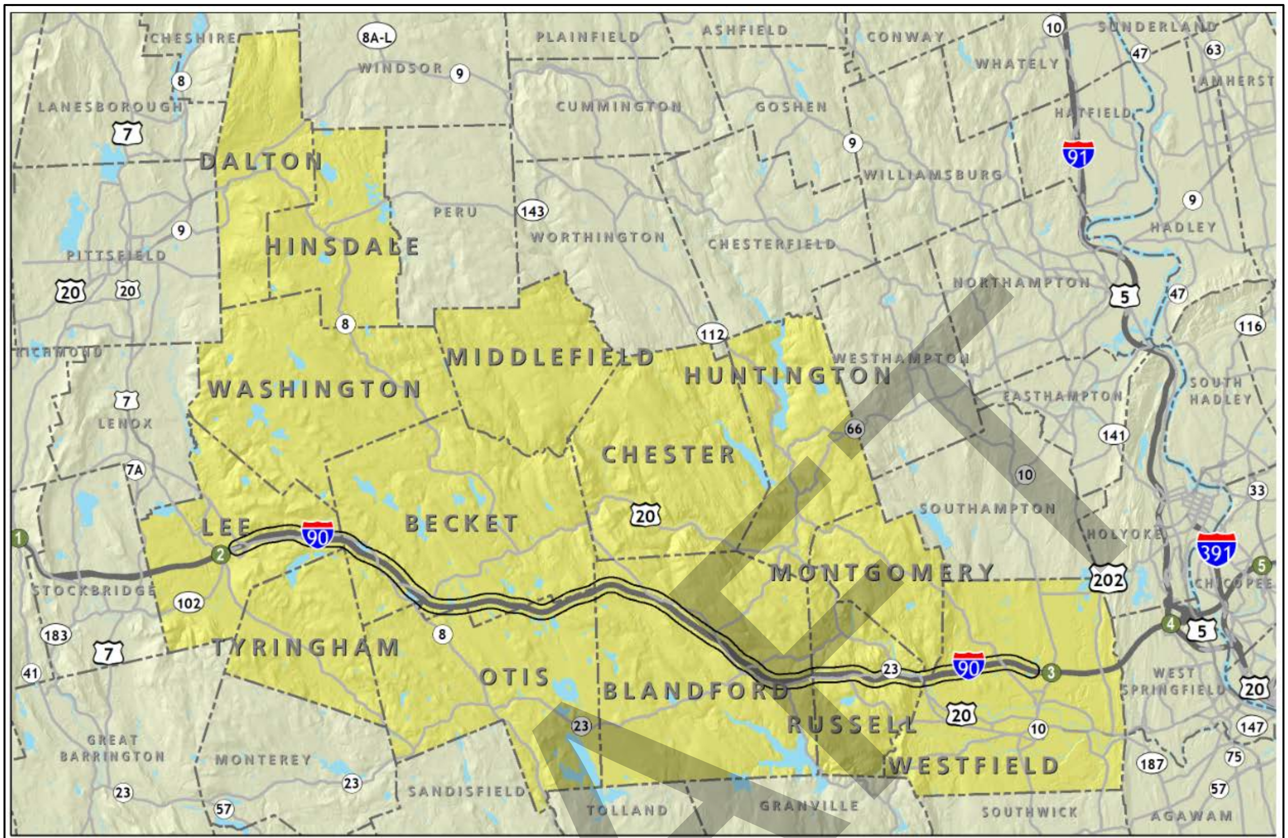

I-90 Interchange Study

Draft Report

massDOT
Massachusetts Department of Transportation

December 2019

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APPENDICES

Chapter 1: Introduction

The I-90 Interchange Study is a conceptual planning study **examining the feasibility of a new interchange between Exit 2 in Lee and Exit 3 in Westfield on Interstate 90,** also known as I-90 or the Mass Pike, in western Massachusetts.

MassDOT was commissioned to conduct the I-90 Interchange Study ("the study") by the Massachusetts Legislature, as excerpted below from the 2017 amended budget:

"Lee/Westfield Turnpike Interchange Study

SECTION 139. (a) The Massachusetts Department of Transportation shall conduct a feasibility study relative to the establishment of an interchange on interstate highway route 90 between the existing interchanges located in the city of Westfield and the town of Lee."

The directive specifies that the study examine and evaluate the costs and opportunities related to the interchange, including projected capital and operating costs; use levels; environmental and community impacts; potential funding sources; and economic, social and cultural benefits that could be observed by surrounding communities.

1.1 Study Goals and Objectives

While the study's purpose is to examine the feasibility of a new interchange, the development of goals and objectives was an important early step for guiding alternatives development and analysis. Discussions with the study's convened Working Group and input from the public made it clear that interest in studying a new interchange originated largely from the nearly 30-mile distance between Exits 2 and 3. The distance presents a mobility challenge for residents and emergency personnel who must travel long distances on local roads to reach destinations that could perhaps be reached quicker with access to I-90. The distance between exits has also been cited as a concern for travelers who may miss their intended exit and have to travel nearly 30 miles to reverse direction.

Moreover, interest in a new interchange has also been sparked by the idea that traffic conditions could be improved at local intersections at and around Exits 2 and 3 if some I-90 travelers could utilize a new exit to reach their destination. With this understanding, the following goals for a potential new interchange were identified at the outset of the study after consultation with the study's Working Group:

- Primary goal: Improve access to and from I-90 in the center of the regional study area; and
- Secondary goal: Mitigate I-90-bound traffic to and from Lee and Westfield.

Issues identified by the Working Group and the public served to inform the development of underlying objectives that would help satisfy each goal. Those objectives are identified on the following page:

Primary Goal: Improve access to and from I-90 in the center of the regional study area

- Identify logical connections between I-90 and existing local roadways
  - Connect to existing infrastructure rather than create new alignments
- Identify communities which could benefit from improved access to I-90
  - In addition to the host community of a potential new interchange, surrounding communities that could benefit from improved I-90 access were acknowledged
- Balance access opportunities and impacts to local communities
  - It is important to weigh the benefits of improved access with potential impacts to affected communities. Consideration was given to the areas in the immediate vicinity of potential interchange locations, the ability of connecting roadways to accommodate new traffic volumes, and the ability of bridges to accommodate passenger vehicle and truck traffic
- Minimize environmental impacts
  - Minimize or mitigate environmental impacts whenever feasible
- Identify potential economic impacts associated with improved access to I-90
  - A new interchange could change the economic landscape of local communities

Secondary Goal: Mitigate I-90-bound traffic to and from Lee and Westfield

- Reduce traffic on local roadways connecting I-90 to Lee and Westfield
  - The placement of a new interchange between Exits 2 and 3 could result in the diversion of traffic away from the existing interchanges and adjacent intersections in Lee and Westfield
- Reduce vehicle miles travelled (VMT) and vehicle hours travelled (VHT) on the regional roadway network
  - Travelers within reasonable proximity to a new interchange could experience a reduction in VMT and VHT in their trips by accessing I-90 faster
- Provide an alternative route(s) for commercial vehicles currently using local roadways
  - A new interchange could reduce the need for commercial vehicles to complete their trips exclusively on local roads
- Balance benefits to Lee and Westfield with potential impacts to adjacent communities
  - Ensure that changes in traffic conditions at Exits 2 and 3 would not be at the expense of other study area communities

1.2 Mission Statement

The mission statement of the study, based on the project's primary and secondary goals and developed in coordination with the study Working Group, is as follows:

> *"The purpose of the I-90 Interchange Study is to identify feasible potential locations for a new interchange that will provide improved access and mobility for residents and businesses in the regional study area. These locations must acknowledge the gap in access of nearly 30 miles between Exits 2 and 3, and the safety and access issues created by that distance. Interchange locations will be evaluated based on their ability to avoid or minimize impacts to environmental resources and abutting properties. The study will identify improvements to connecting roadways that are necessary to accommodate changes in passenger vehicle and truck traffic and will identify the effects of that traffic on affected communities. The ability for improved access to serve as a benefit to economic development will be evaluated, as will the ability for communities to maintain their existing land use patterns and character. Potential interchange locations will be expected to provide benefits to health and air quality by providing an alternative that allows residents and businesses to reduce their travel times and miles traveled by providing improved access, resulting in reduced fuel consumption and emissions and less traffic at adjacent I-90 interchanges."*

1.3 Public Involvement Plan

Fully aligned with MassDOT's Accessible Meeting Policy Directive, a Public Involvement Plan (PIP) was developed to guide citizen engagement during this study. The full PIP can be found in Appendix A. The PIP emphasizes the following principles:

Public Engagement

The study offered different methods for the public to learn about the study or participate in its development. This includes public informational meetings, Working Group Meetings, a study website, and media outreach. The public and Working Group members received advance notice of meetings, and MassDOT worked to hold meetings at convenient times in accessible locations. Meeting notices appeared on the project website, in email correspondence, and in several local newspapers.

Public Participation

There were several opportunities for the public to participate in the study. The study team kept record of all questions and comments received from the public and Working Group, whether raised in person, by email, or by letter. All public comments provided to the study team can be found in Appendix B. Moreover, the study team coordinated and encouraged collaboration between agencies and community organizations with the aim of providing members of the public with the most accurate and up-to-date information as possible.

Project Website

MassDOT created and maintained a study website, found at https://www.mass.gov/i-90-interchange-study. The website provides information about the study, including a study overview, contact information, meeting information, and study documents. The study website also allows users to sign up to receive study updates via email.

Access to Study Information

At all times, the public had access to all available information about the study through the study website. Posted information includes all public meeting and Working Group meeting details, presentations, agendas, handouts, and minutes. The study team also developed a mailing list for distributing study updates and information via email. All Working Group members were on the mailing list, and members of the public were invited to join the mailing list through the website and through interaction with the study team at public meetings. Meeting notices and website updates were announced using this distribution list.

<u>Accessible Documents</u>

All information and documents posted on the study website in electronic format are accessible to people with disabilities in compliance with Section 508 of the U.S. Rehabilitation Act of 1973, The Massachusetts General Law Chapter 272 Section 98/98A, and Web Content Accessibility Guidelines.

<u>Clear Information</u>

All information provided to the public, including technical terms and regulatory procedures, was presented in a clear and concise manner.

1.4 Working Group

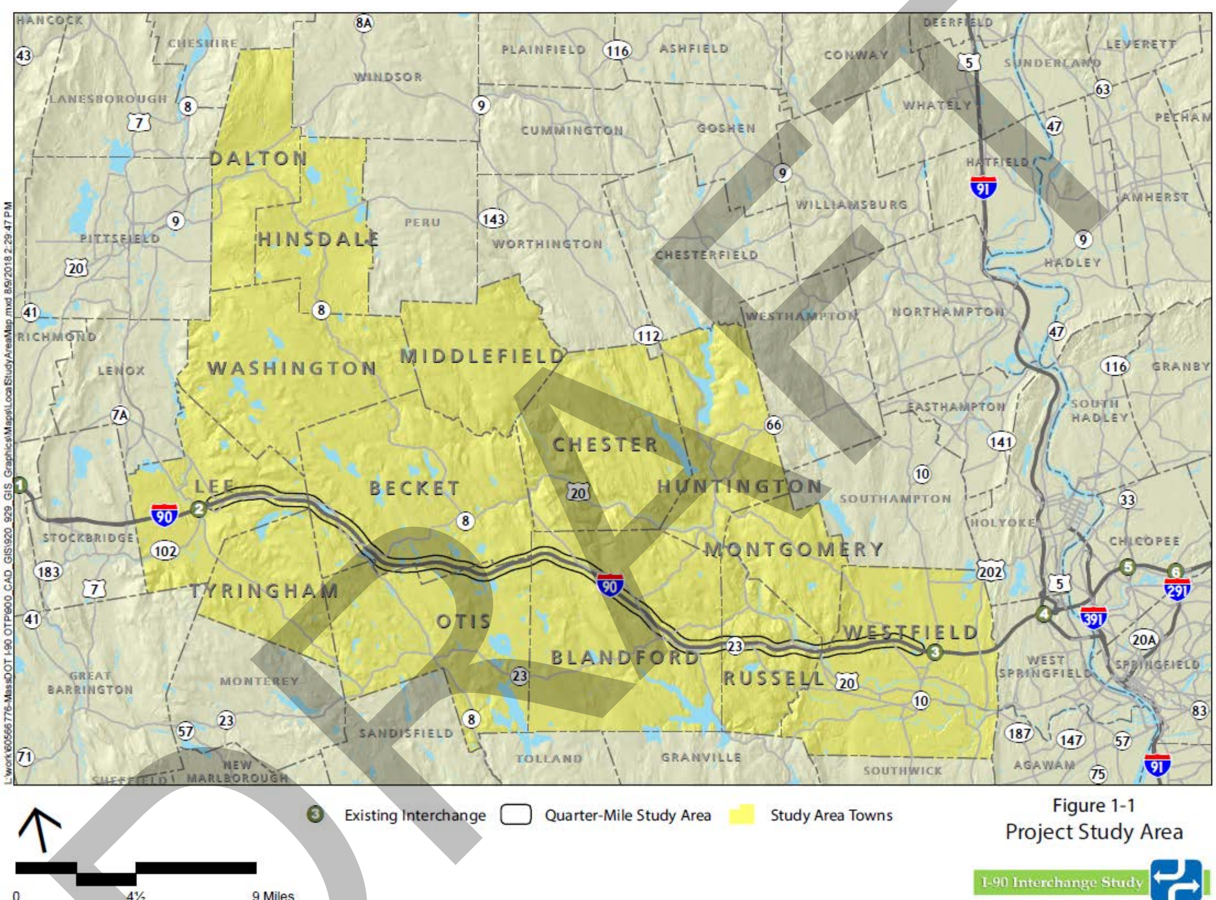
Central to the study was the establishment of a Working Group consisting of MassDOT representatives, community representatives, regional planning agencies, and elected officials. The Working Group serves to advise on local issues and concerns, represent and report back to their respective organizations, and provide feedback on MassDOT's materials at key milestones. The Working Group meetings were open to the public and time was allotted in each meeting to receiving public comments and questions. Local, regional, and statewide representatives were invited to join the I-90 Interchange Study Working Group, including:

- State and Local Elected Official
- Berkshire Regional Planning Commission
- MassDOT Highway Operations
- Berkshire Community Action Council
- Lee Chamber of Commerce
- Federal Highway Administration
- Massachusetts Smart Growth Alliance
- Gateway Hilltowns
- MassDevelopment
- Berkshire Regional Transit Authority Westfield Traffic Commission
- Pioneer Valley Planning Commission
- Westfield Redevelopment Authority
- MassDOT Highway Design
- The Greater Westfield Chamber of Commerce
- Pioneer Valley Regional Transit Authority
- Southern Berkshire Chamber of Commerce
- Massachusetts Division of Fisheries & Wildlife
- Massachusetts Executive Office of Housing and Development
- Representatives from Blandford, Becket, Chester, Huntington, Lee, Middlefield, Montgomery, Otis, Russell, Tyringham, and Westfield

1.5 Study Area

The study area was defined at the local and regional level, with boundaries established for each based on the specific tasks and goals of the project. The local study area was identified as the one-quarter mile buffer surrounding I-90 where the footprint of a new interchange would be present. The regional study area extended from Town of Lee and City of Westfield, including all communities between the existing I-90 Exits 2 and 3 and the segment of I-90 between them along with all nearby roads, environmental resources, and right-of-way in this area. Figure 1-1 illustrates the local and regional study area.

Figure 1-1. Local and Regional Study Area



The study area is relatively large given the 30-mile distance between the two existing exits. It was necessary to consider this large geographic area when assessing the overall impacts that an interchange could have on the surrounding communities and transportation network. After deliberation with the Working Group at the commencement of the study, the regional study area included the following communities:

- Blandford
- Russell
- Otis
- Chester
- Lee
- Dalton
- Huntington
- Westfield
- Hinsdale
- Middlefield
- Becket
- Montgomery
- Tyringham

1.6 Evaluation Criteria

Evaluation criteria are specific considerations, or measures of effectiveness, used to assess benefits and impacts of alternatives developed during the study. The evaluation criteria were based on the defined objectives and, must support the ultimate goals of study. Such criteria commonly include, but are not limited to, those that fall in the following categories:

- System preservation, including contributing to a state of good repair on the transportation system;
- Mobility and accessibility in all major transportation modes;
- Cost and cost effectiveness, including both capital and operating cost;
- Economic and land use impact;
- Safety;
- Social equity and fairness;
- Environmental effects, including air quality and greenhouse gas impacts;
- Health effects, including promotion of healthy transportation options as well as other public health factors, such as air quality and noise; and
- Support of policy, including local, regional, or state policies not addressed by other criteria.

The following evaluation criteria were also identified at the outset of the study with input from the Working Group:

1.6.1 Design and Operations

- Proximity to Adjacent Interchanges: Evaluate each potential interchange location for its distance from Exits 2 and 3;
- Local Road Connections: Evaluate the condition and capability of local roadways to accommodate potential on- and off-ramps, as well as potential intersection operations and necessary traffic control;
- Impact on Adjacent Interchanges: Consider the magnitude of traffic diversion to each potential interchange, as well as the effect of that diversion on capacity and congestion at ramp and intersection elements of the interchanges at Exits 2 and 3;
- Safety Improvements: Analyze the ability of each potential interchange to address regional and local safety issues, and divert vehicles away from high crash locations; and
- Truck Traffic: Evaluate the ability of each potential interchange to reduce truck traffic on local roadways, and the impacts that truck traffic may have on local roadways serving those potential interchange locations, as well as the ability of the new interchange ramps to accommodate truck traffic.

1.6.2 Environmental Resources

- Wetlands: Approximate impacts to wetland resources at each potential interchange location based upon existing wetland resource mapping;
- Water Resources: Approximate impacts to water resources (floodplain, floodway, riverfront area, water supply protection zones) at each potential interchange location based upon existing resource mapping;
- Protected Species Habitat: Approximate impacts to mapped habitat areas for protected species at each potential interchange location based upon existing resource mapping;
- Steep Slopes/Topography: Identify the existence of steep slopes and topographic constraints at each potential interchange location, and qualitatively assess its ability to impede construction. The influence of steep slopes and topographic constraints are also reflected under other criteria such as cost and constructability;
- Public Open Space/Article 97 Land: Approximate impacts to adjacent protected open space at each potential interchange location based upon existing resource mapping;
- Cultural Resources: Identify impacts to adjacent cultural resources at each potential interchange location based upon a review of the Massachusetts Historical Commission (MHC) Massachusetts Cultural Resource Information System (MACRIS) database, as well as outreach to the MassDOT Cultural Resource Unit and local historic commissions, as necessary;
- Air Quality: Evaluated changes in vehicle miles travelled (VMT) and vehicle hours travelled (VHT) attributable to each potential interchange location as a surrogate for air quality benefits or impacts; and
- Hazardous Materials: Acknowledge proximity to known hazardous waste sites or release locations based upon MassGIS reporting from MassDEP at each potential interchange location.

1.6.3 Socioeconomic Effects

- Noise: Identify sensitive receptors adjacent to each potential interchange location, based upon activity categories contained in the Massachusetts Department of Transportation Type I and Type II Noise Abatement Policy and Procedures;
- Neighborhood Impacts: Provide a qualitative assessment of potential impacts to neighborhoods as a result of increased access and mobility;
- Right-of-Way Impacts: Identify areas where interchange design requirements extend beyond the available highway layout/roadway right-of-way;
- Environmental Justice: Review demographic data within the study area to determine whether or not potential interchange locations will have disproportionate and adverse effects on minority and low-income populations as identified by the Commonwealth of Massachusetts and US Census Bureau;
- Economic Benefit: Assess the ability for each potential interchange location to provide economic benefits to the local and regional study area by providing improved access to developable properties or improved mobility to residents and businesses; and
- Public Health: Assess each potential interchange location for its ability to improve healthy transportation options, provide access to isolated populations, reduce emissions and improve conditions near sensitive receptors.

1.6.4 Financial and Regulatory

- Construction Cost: Provide order of magnitude cost estimates for each of the potential interchange alternatives, using current MassDOT guidelines. Right-of-way costs are not included in these estimates;
- Constructability: Provide a qualitative assessment of the ease (or difficulty) of construction at each of the potential interchange locations, based on engineering judgment, constraints and construction staging elements;
- Property Takings: Identify locations where the standard interchange footprint (without design exceptions) would infringe on adjacent properties;
- Need to Upgrade Connecting Roadways: Based on available information, provide an assessment of right-of-way availability, capacity needs, bridge conditions and other elements of the roadways connecting to potential interchange locations; and
- Mitigation Requirements: Provide a qualitative assessment of the extent of mitigation measures expected at each of the potential interchange locations.

Chapter 2: Existing Conditions

This chapter provides an understanding of the background conditions that characterize the study area. A comprehensive understanding of existing conditions is essential for developing interchange alternatives, assessing alternatives using the predetermined evaluation criteria, and evaluating project impacts. Various environmental resources are mapped. Detailed traffic volume data is summarized. Land use, zoning and real estate market trends are analyzed. Demographic and socioeconomic data are presented, as well as journey-to-work patterns for residents of study area communities. Public health indicators, pedestrian and bicycle facilities and study area transit service are identified. Finally, interchange and intersection capacity analyses are conducted to determine existing traffic operations throughout the study area.

2.1 Environmental Conditions

A series of maps were developed for the entire I-90 corridor between Exits 2 and 3 in order to identify all natural and man-made resources within the study area. The following pages summarize the extent of those resources throughout the overall study area, and how their existence could influence the eventual placement of a new interchange.

2.1.1 Wetland, Water, and Wildlife Resources

Wetlands, water and wildlife resources are identified by the Massachusetts Department of Environmental Protection (MassDEP) and the Massachusetts Natural Heritage and Endangered Species Program (NHESP). As a protected and regulated resource, avoiding or minimizing impacts to wetlands would be critical to the success of identifying a viable location for a new interchange. Similarly, areas that contain protected habitat for rare species should be avoided, along with water resources such as vernal pools. Watershed or groundwater protection areas associated with these resources are substantial as well. Wetlands and protected habitats are shown in Figure 2-1, while water resources are mapped in Figure 2-2.

2.1.2 Topography, Geology, Soil

Topography, geology, and soil are each factors that influence interchange constructability and cost. Topography varies across the study area. Some areas are relatively flat, but there are many stretches of rugged and steep terrain. This applies to the land directly adjacent to I-90 as well, where a new interchange would be situated. Terrain is also important to consider for roadways that would need to accommodate higher volumes of interchange traffic. Geology is relatively consistent across the study area, with most surficial geology being bedrock. Likewise, soil is generally regular throughout the study area, though spreads of farmland soil are present in each municipality. If farmland soils were to be impacted by a new interchange, coordination with the Massachusetts Department of Agriculture would be required in order to identify working farms capable of receiving these resources if removed as part of construction.

Topography, geology and soil features are illustrated in Figures 2-3 through 2-5.

2.1.3 Protected Open Space/Article 97 Land

Protected Open Space and recreational areas are abundant throughout the study area, with Federal, state, municipal and private parks, forests, wildlife management areas and conservation areas contributing to the character and identity of the region. In Massachusetts, open space is also pursuant to Article 97. Article 97 is an article of the Commonwealth's constitution enacted in 1972 to ensure that lands acquired for conservation purposes were not easily converted to other uses. Disposition of Article 97 land requires exceptional circumstances. Avoidance of these areas would be critical to the siting of any potential new interchange. These resources are illustrated in Figure 2-6.

2.1.4 Hazardous Materials Sites

Man-made resources within the study area have the capacity to act as project constraints, or at a minimum require consideration when developing interchange designs and selecting appropriate locations. Hazardous Materials Sites are identified by MassDEP as having experienced some type of hazardous spill or release. These sites may be under active remediation, contained, or closed after successful mitigation. Detailed investigation of specific sites is a multi-phase process that occurs as a project proceeds through preliminary design. The study area contains few of these sites, and they are located away from the immediate vicinity of I-90. The exception to this is a Chapter 21E site located at the Blandford Service Plaza, as a result of the fueling operations located there. Hazardous materials locations are shown in Figure 2-7.

2.1.5 Historic and Cultural Resources, and Other Sensitive Receptors

Historic and cultural resources were also cataloged as a part of this effort, with Blandford and Becket each having one resource in the immediate vicinity of I-90. Sensitive receptors were identified as well, with several locations scattered across the study area but not in the immediate vicinity of I-90. Sensitive receptors include facilities such as hospitals, schools, daycare facilities, elderly housing and convalescent facilities. These are specific sites where the occupants are more susceptible to the adverse effects of transportation improvements. Consideration is given to the potential effects that a new interchange may have on the character of the resource, or health aspects associated with noise and air quality.

Figures 2-8 and 2-9 identify the locations of these resources and facilities.

2.1.6 Environmental Justice

Consideration of Environmental Justice populations includes the identification and assessment of disproportionately adverse effects of programs, policies, or activities on minority and low-income population groups. Environmental Justice considerations include the assessment of the relative distribution of costs and benefits from transportation investment strategies and policies among different segments of society.

Within the context of the I-90 Interchange Project, consideration of Environmental Justice populations is meant to ensure that there is no disproportionate impact to low income, minority and other disadvantaged populations. Environmental Justice (EJ) populations are census block groups that meet any of the following criteria according to the 2010 U.S. Census:

- Income: Households earn 65% or less of statewide median household income;
- Minority population: 25% or more of residents identify as a race other than white;
- English language isolation: 25% or more of households have no one over the age of 14 who speaks English only or very well.

Within the I-90 study area, EJ populations for low income (2010 median household income of $62,133 or less) were identified for census block groups in Becket, Dalton and Lee. The City of Westfield contains 11 census block groups with EJ populations meeting either the income criteria or both income and minority criteria.

Figure 2-10 illustrates the location of these Census block groups.

Figure 2-1. Wetlands and Habitat

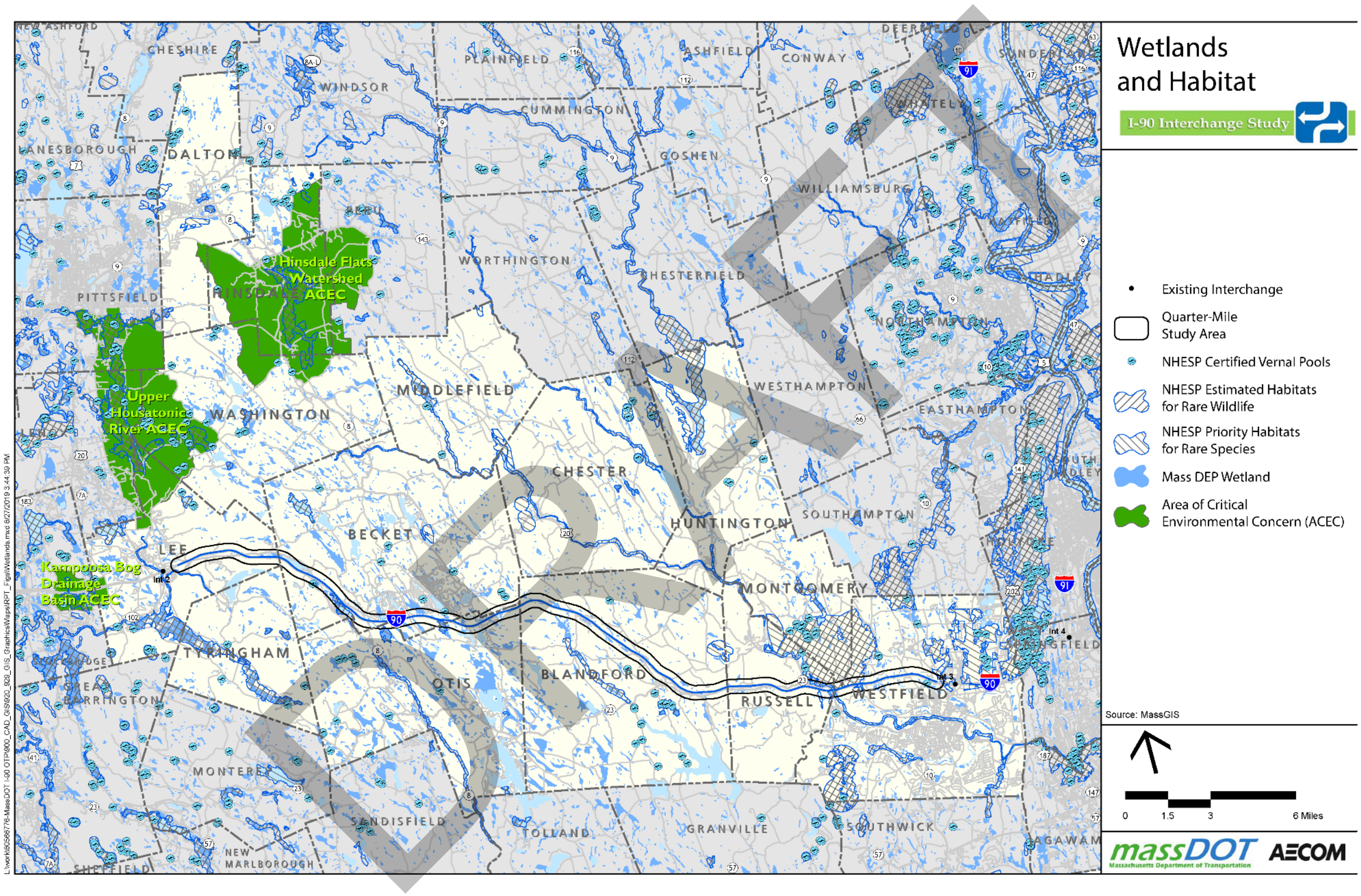


Figure 2-2. Water Resources

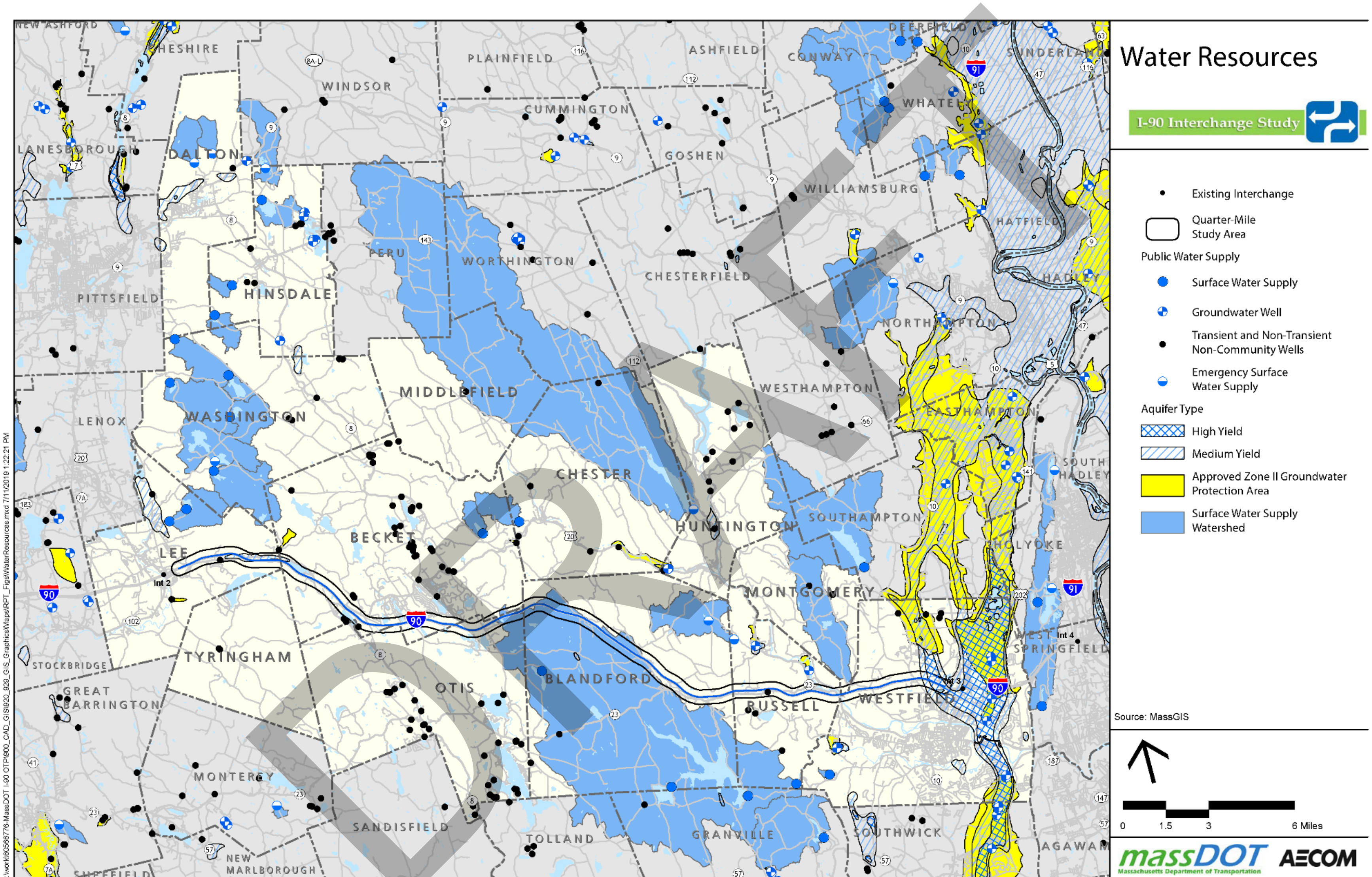


Figure 2-3. Topography

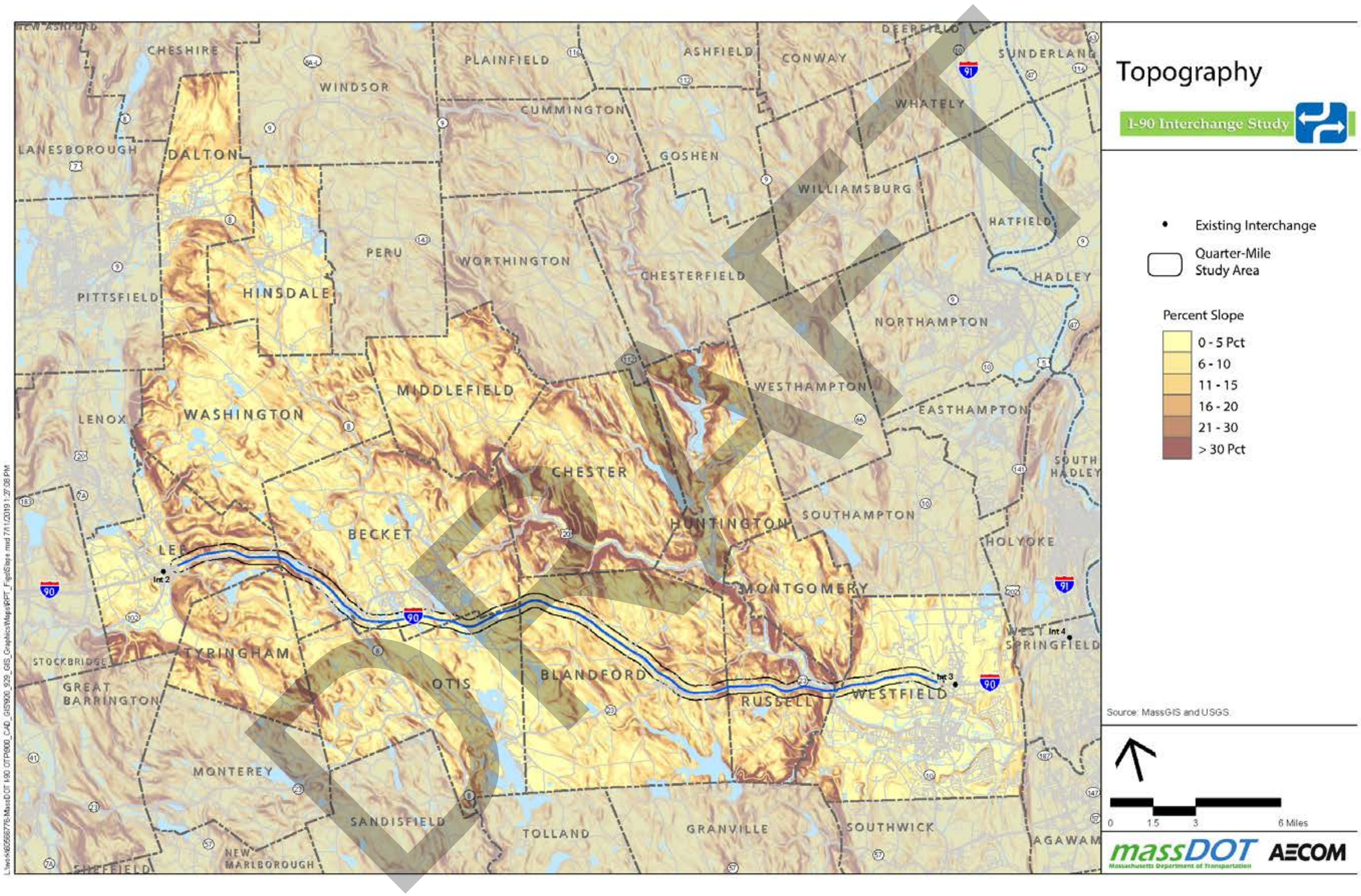


Figure 2-4. Surficial Geology

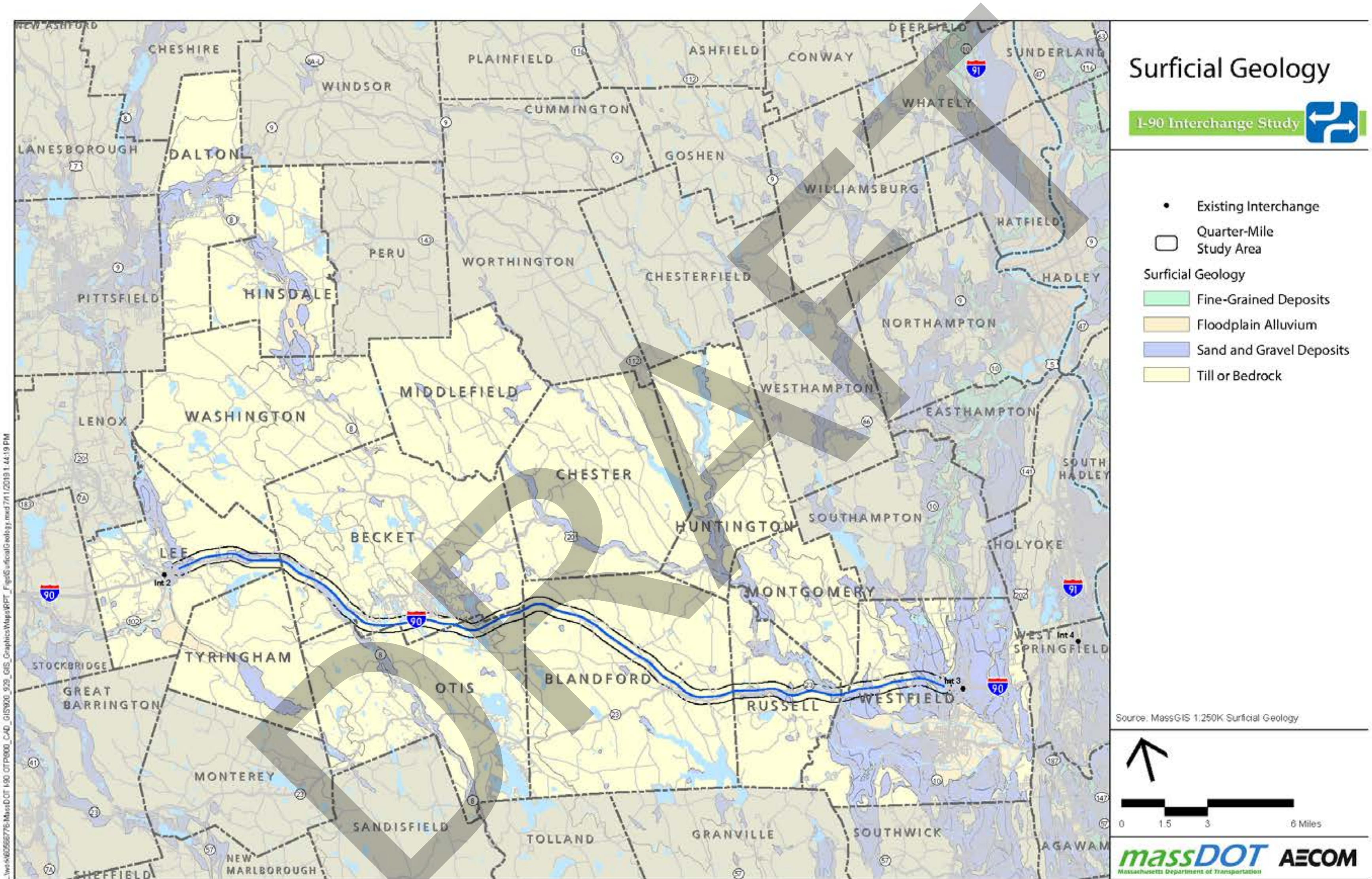


Figure 2-5. Soils

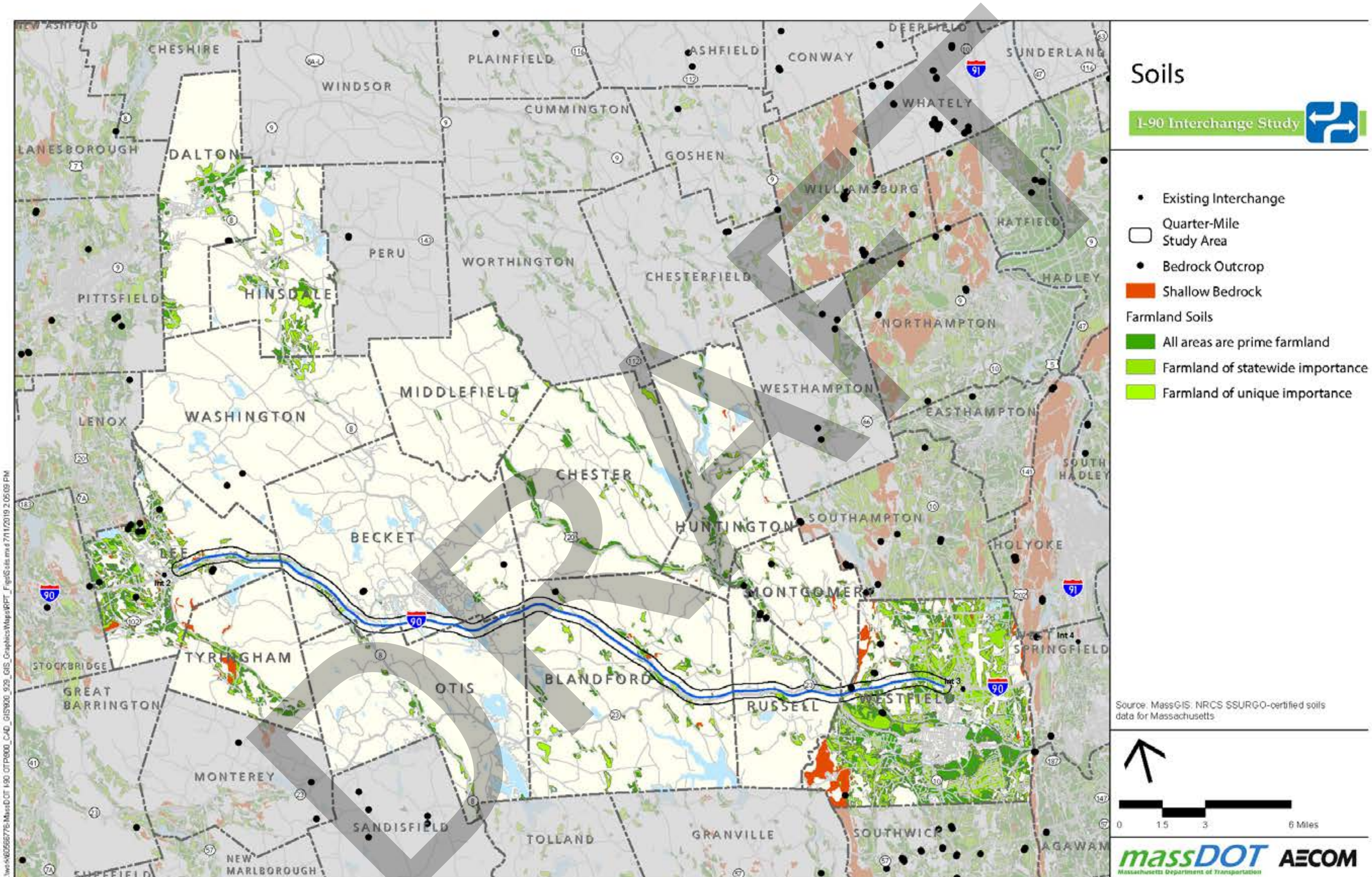


Figure 2-6. Protected Open Space and Recreation

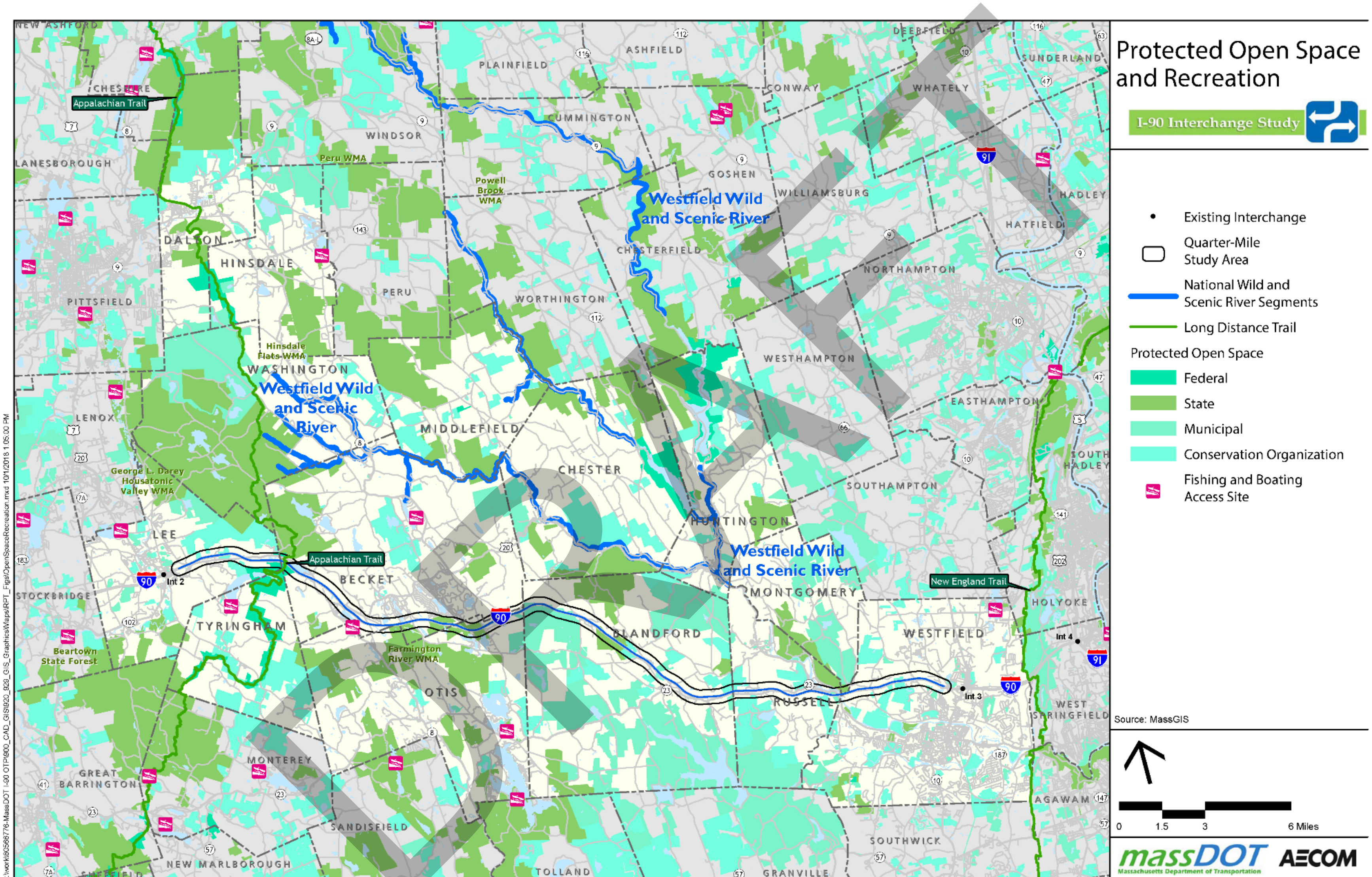


Figure 2-7. Hazardous Materials Sites

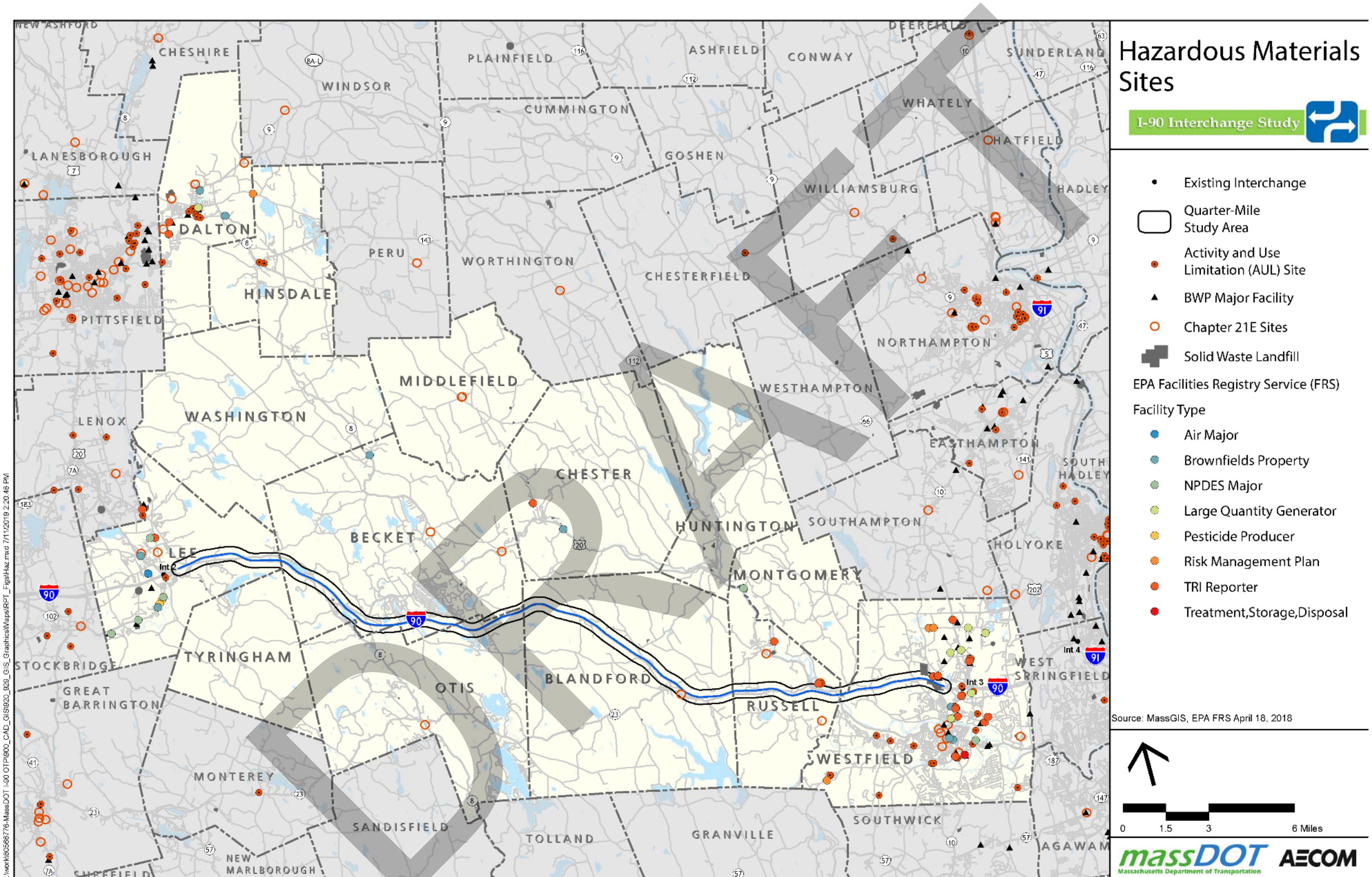


Figure 2-8. Historical Resources

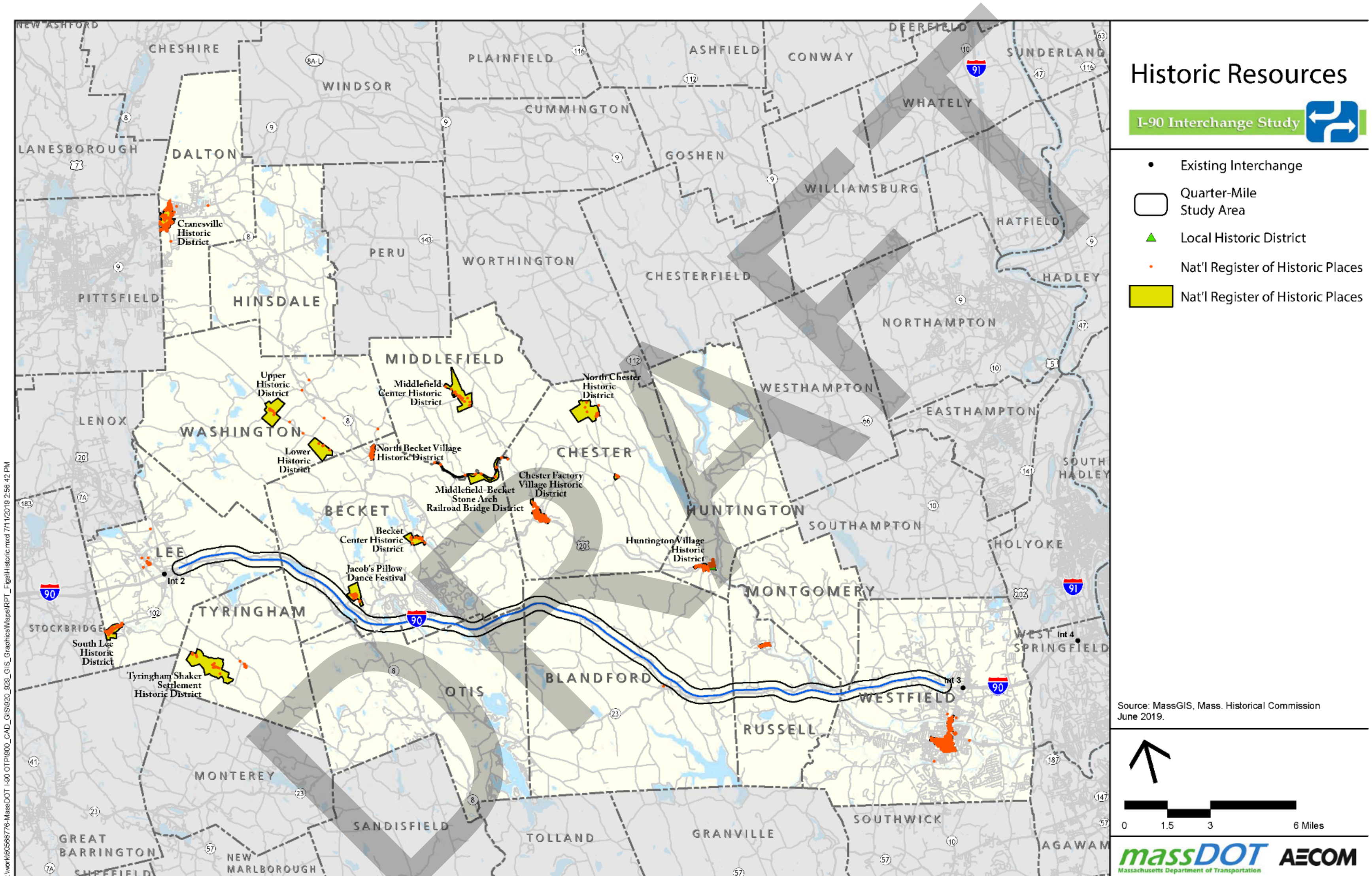


Figure 2-9. Sensitive Receptors

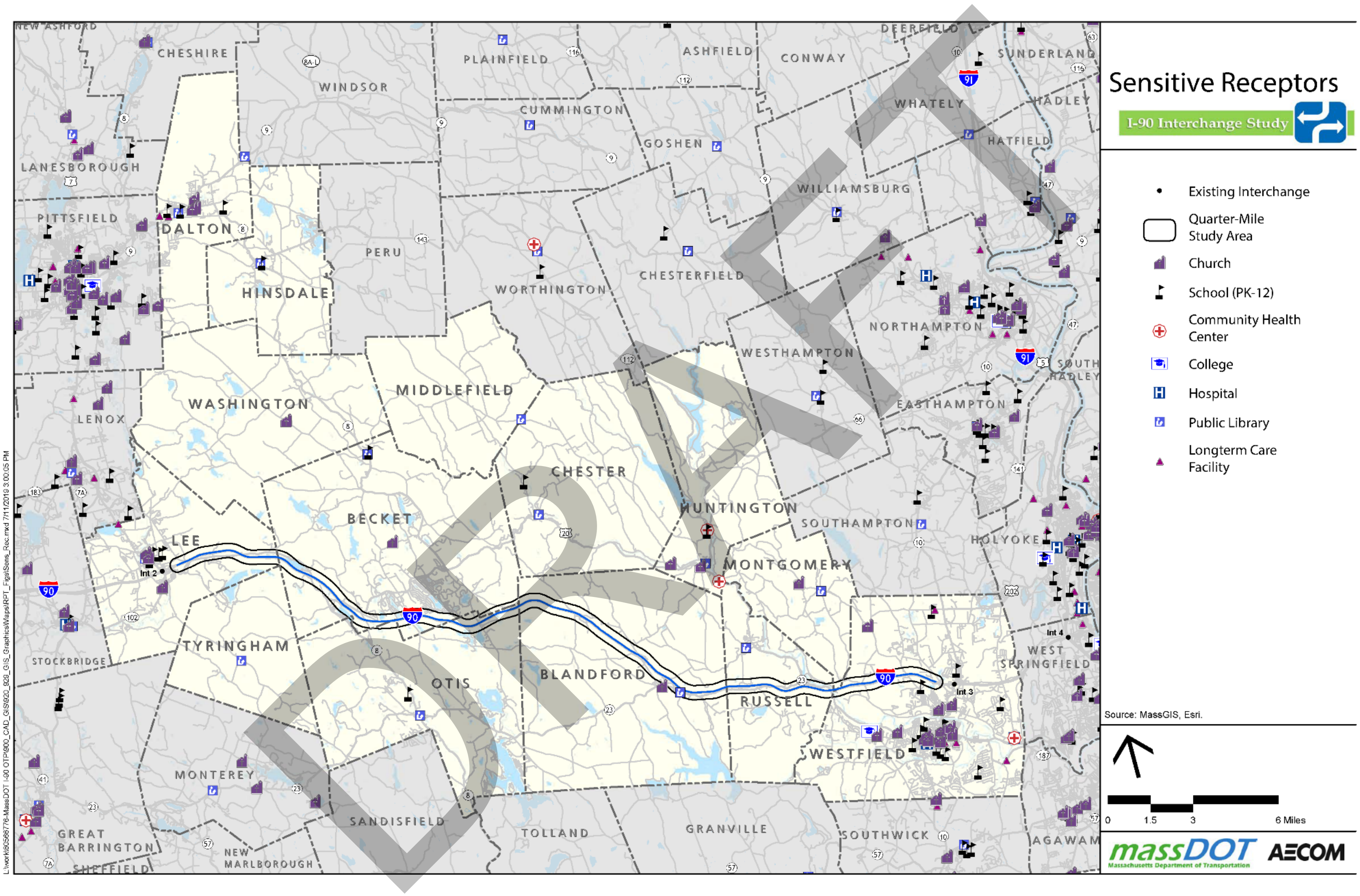
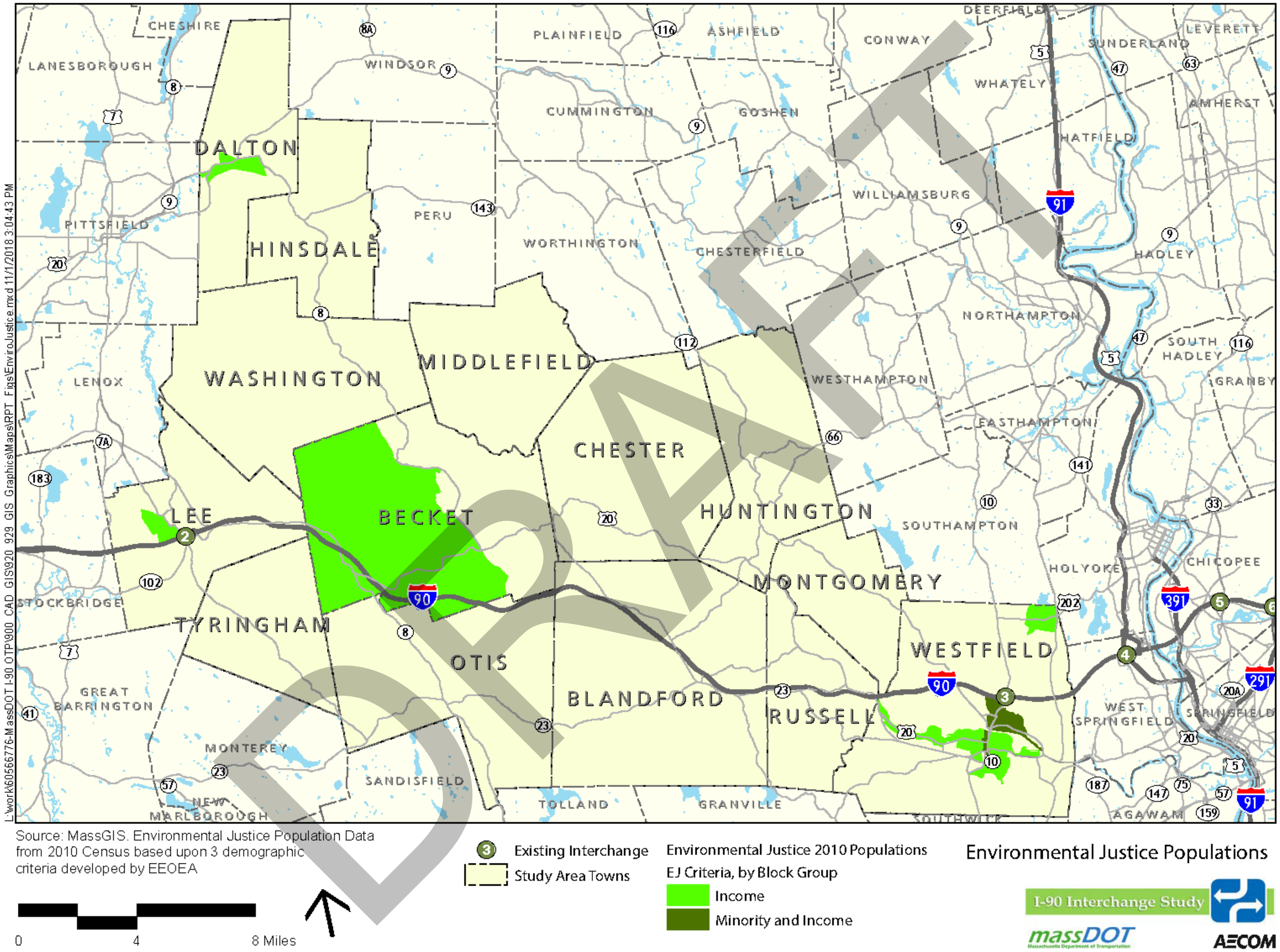


Figure 2-10. I-90 Study Area Environmental Justice Population



2.2 Land Use

Land use within the study area is largely dominated by undeveloped rural areas. Through the public engagement process, many residents have indicated that this rural landscape is among the primary attributes of living in the Hilltowns. The majority of developed land within the study area is residential, with mixed-use residential/commercial serving as the most prevalent non-exclusively residential use. The eastern and western edges of the study area (Lee and Westfield) provide the majority of commercial and industrial activity, and serve as the primary employment centers in the study area.

There are numerous open space and conservation lands within the study area, including town and state forests, watershed and reservoir protection areas. Figure 2-11 illustrates the existing land use patterns in the study area.

2.3 Zoning

The vast majority of the study area is zoned for residential or combined agricultural/residential use. Small pockets of commercial or industrial zoning exist near village centers or town outskirts to serve local needs or employment centers. In the town of Huntington, a noticeable portion of the community is zoned for conservation and natural resource protection. The Towns of Montgomery, Tyringham and Washington each have a single zoning district (agricultural/residential), with any other uses allowed only by special permit. The majority of study area communities have floodplain or watershed protection zones, either as a separate district or as an overlay to underlying zoning. Lee and Westfield contain the highest concentrations of commercial and industrial zones within the study area. Figure 2-12 illustrates the existing zoning in the study area. Table 2-1 summarizes the general zoning categories present in each of the communities.

Table 2-1. Study Area Zoning District by Community

Study Area Community	Zoning District									
	Agricultural-Residential	Residential	Agricultural	Conservation	Commercial	Industrial	Business	Village/Central Business District	Floodplain/ Watershed Protection	Airport
Becket	✓								✓	
Blandford		✓	✓				✓		✓	
Chester	✓	✓				✓	✓		✓	
Dalton	✓	✓				✓	✓		✓	
Hinsdale	✓	✓					✓		✓	
Huntington		✓		✓		✓	✓	✓		
Lee	✓	✓			✓	✓	✓	✓		
Middlefield	✓						✓		✓	
Montgomery	✓									
Otis		✓						✓	✓	
Russell		✓				✓	✓		✓	
Tyringham	✓									
Washington	✓									
Westfield		✓			✓	✓	✓	✓	✓	✓

Figure 2-11. Existing Land Use

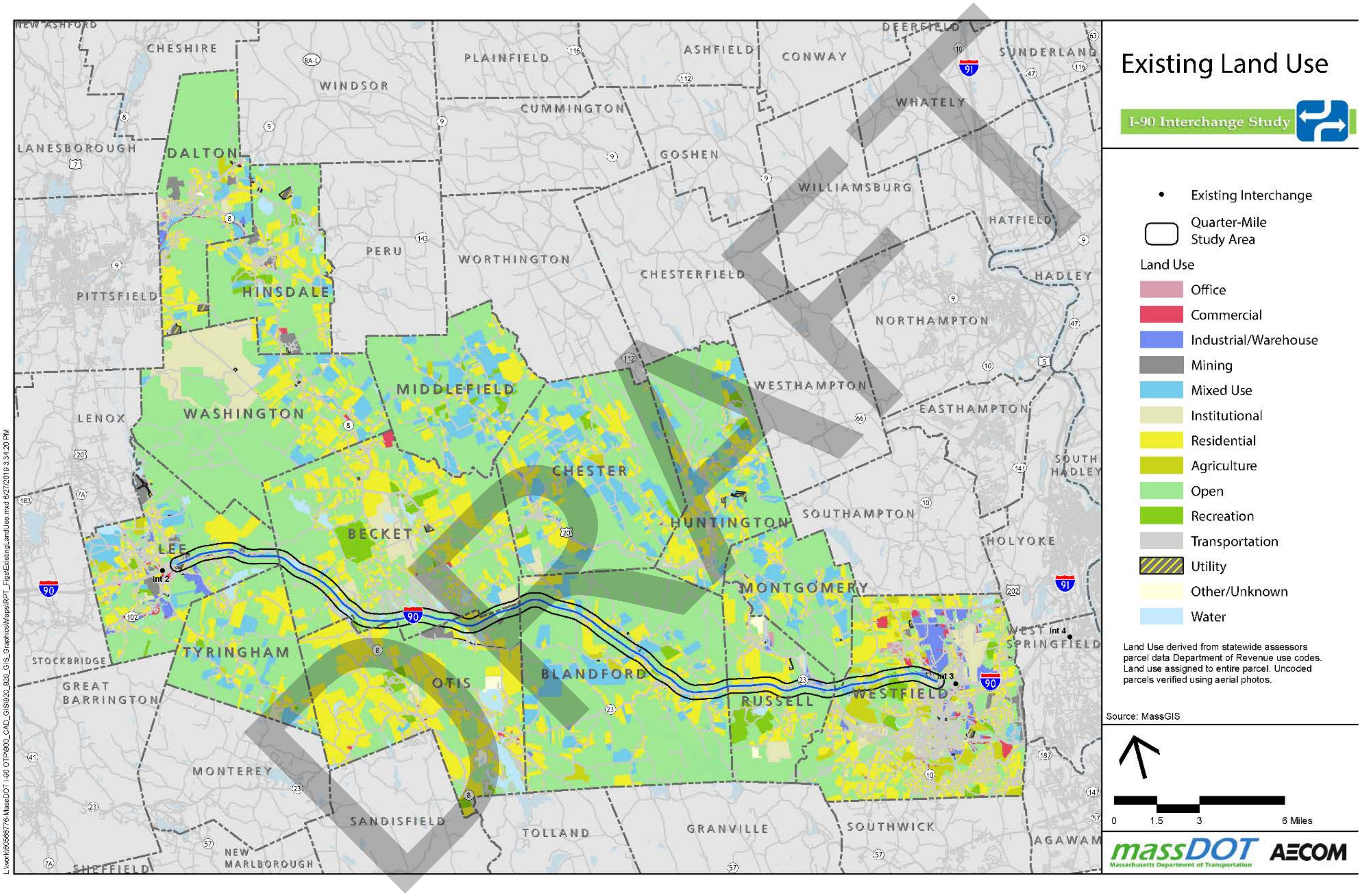
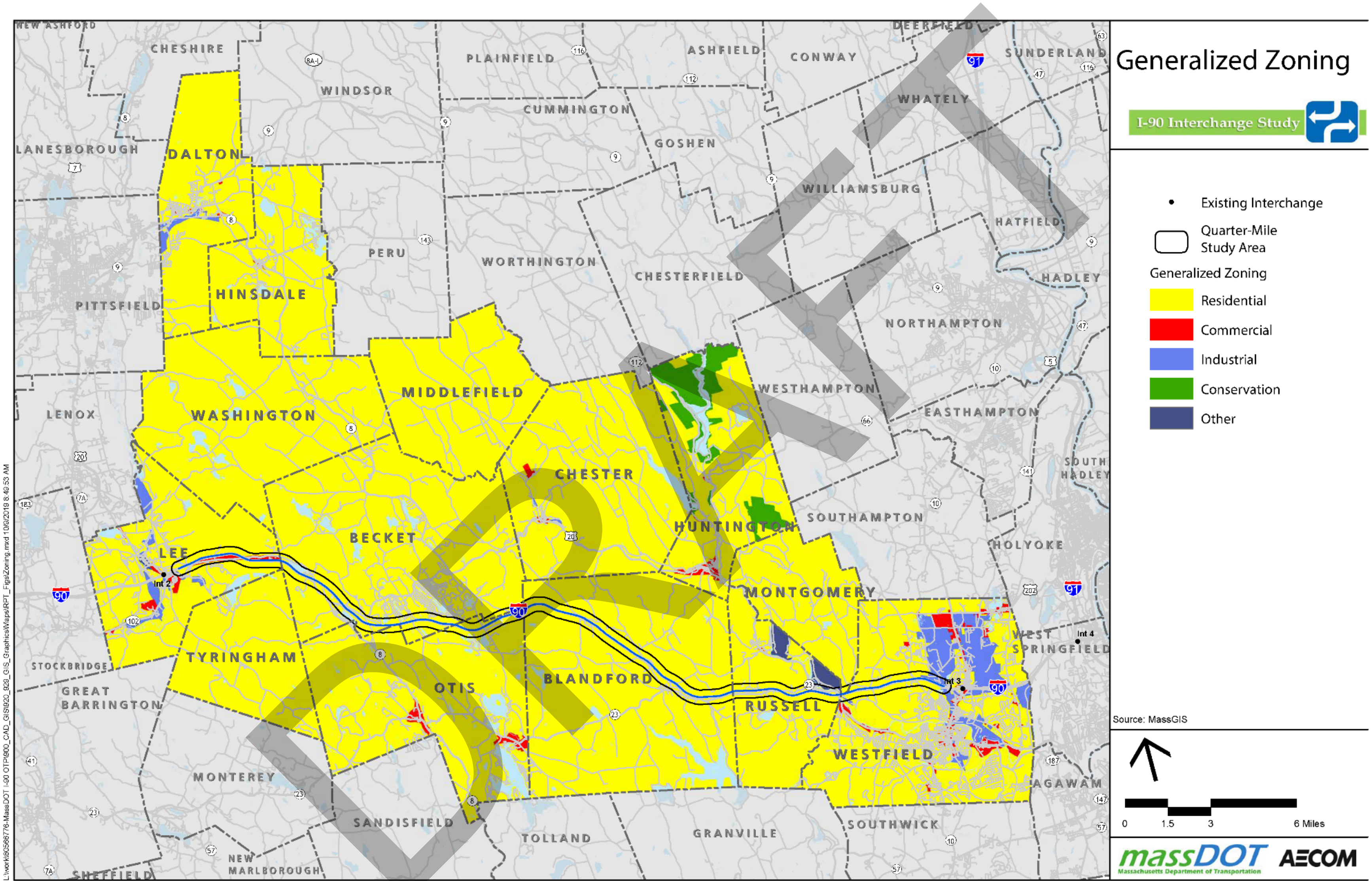


Figure 2-12. Generalized Zoning



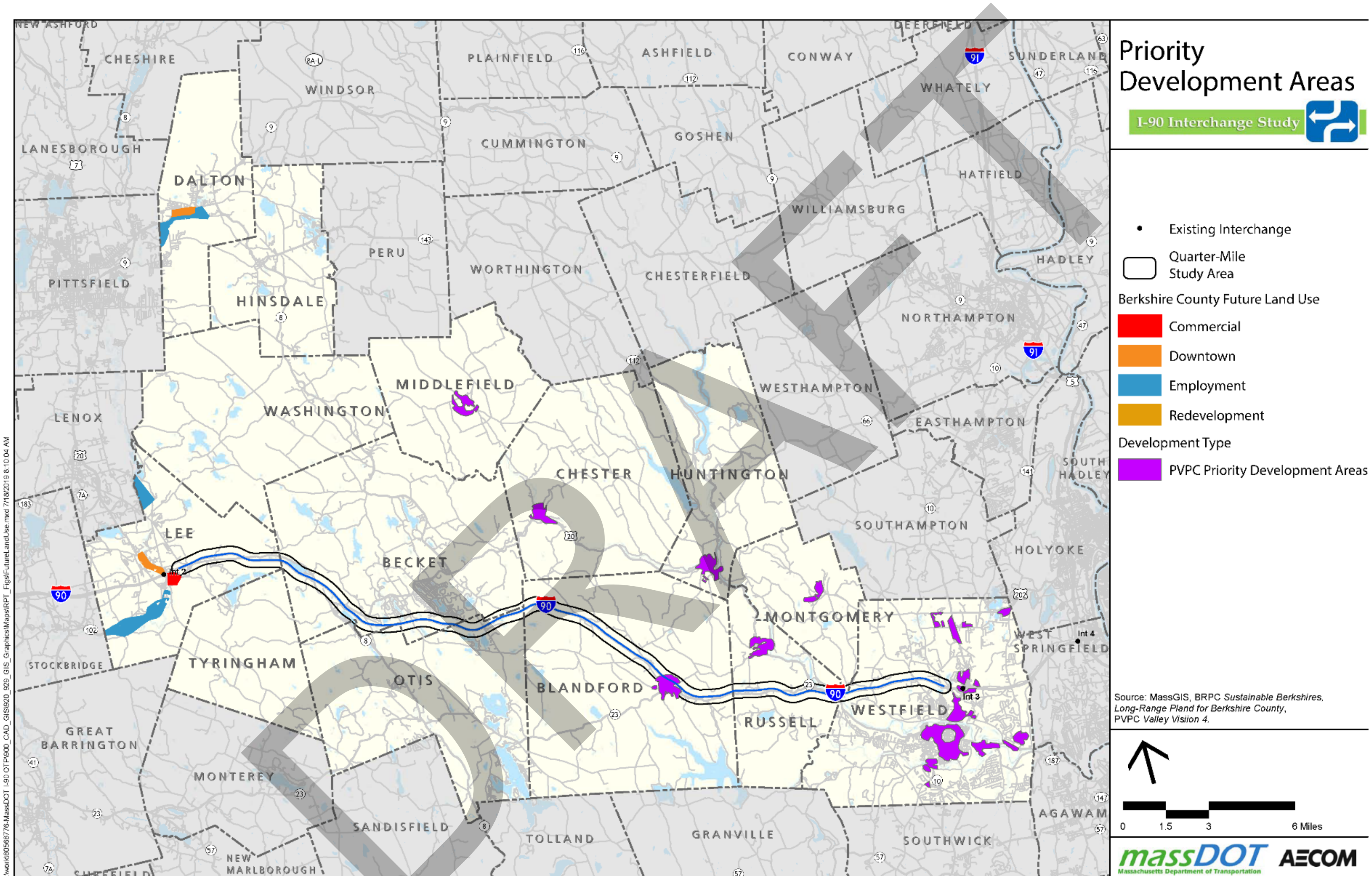
2.4 Priority Development Areas

With any planning study, it is important to understand whether any local priorities for development have been established. The study area is served by two Metropolitan Planning Organizations (MPOs). An MPO is a federally mandated and federally funded transportation policy-making organization made up of representatives from local government and governmental transportation authorities. The eastern part of the study area is served by an MPO called the Pioneer Valley Planning Commission (PVPC). PVPC published its "Valley Vison 4: Land Use Plan" in 2014. As stated in the plan, its purpose is "to create a more sustainable Pioneer Valley region by managing growth and development to reduce sprawl, support and strengthen our urban and town centers, reduce vehicle miles traveled and the resulting air emissions, promote availability of affordable housing for all; reduce water pollution; and protect farmland, open space and natural resources." As a part of its efforts, the plan identified "Priority Areas for Development" based on the following criteria:

- Areas Suitable for Transit-Oriented Development (TOD) Zoning Districts;
- Existing or Proposed Chapter 40R Smart Growth Zoning Districts;
- Existing Chapter 43D Priority Development Sites (PDS);
- Areas Suitable for Smart Growth Development;
- Community-identified Priority Development Sites.

The western half of the study area is served by a different MPO, the Berkshire Regional Planning Commission (BRPC), which adopted its Sustainable Berkshire Long Range Plan in 2014. Similarly to the PVPC's planning document, this plan identified several areas within its planning area for targeted future development and redevelopment. Future development and redevelopment areas from both MPOs are shown in Figure 2-13.

Figure 2-13. Priority Development Areas



2.5 Real Estate Market Trends

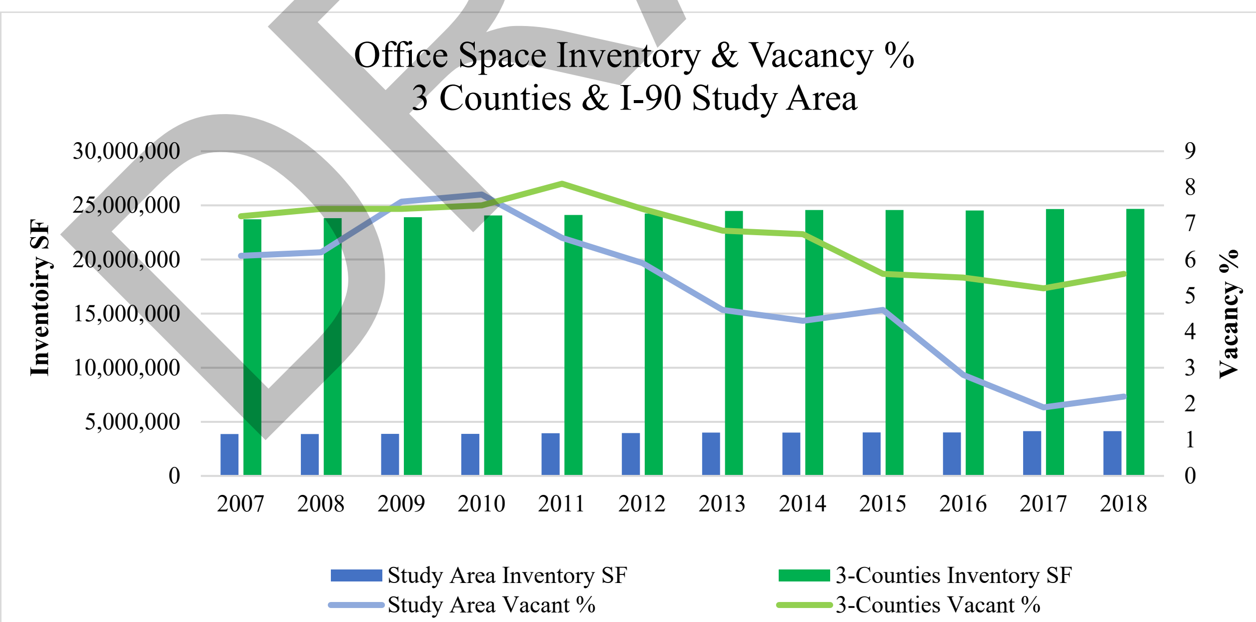
In order to develop an understanding of economic development in the study area, an assessment of historical trends in the supply of office, industrial, and retail space was conducted. Projected increases in occupancy and net absorption of these major categories of commercial space are compared to the employment-driven space demand forecasts. Trends in the inventory of each space type, vacancy rates, and occupancy are analyzed for the study area communities compared to the 3-county broader market area. The data source for these analyses is Co Star Property Information Systems, a proprietary subscription service that is a source of commercial property information used by real estate brokers, financiers, developers, and analysts.

2.5.1 Office Space

Figure 2-14 graphs the inventory and vacancy rates for office space between 2007 and 2018. In 2018, the study area communities contained about 4.1 million square feet of office space compared to 24.7 million square feet for the three study area counties (Berkshire, Hampshire, Hampden) overall. Figure 2-15 shows trends in office occupancy, which totaled about 4 million square feet in the study area and 23.3 million square feet in the three counties overall.

As shown in Figure 2-14 the total inventory of office space increased by 277,000 SF in the study area, a gain of 7.2% over the amount in 2007. Average annual increases in the supply of office space (net additions from new construction and rehabilitation compared to demolitions and removal from the market) totaled about 25,000 square feet per year within the study area communities between 2007 and 2018. Within the 3-county market area overall the inventory of office space increased by 971,000 square feet between 2007 and 2018, a 4.1% gain. The vacancy rate for office space has been declining and now stands (3rd quarter 2018) at 2.2% in the study area 5.6% in the three counties overall. Both study area and overall market area vacancy rates are considered very low and indicative of opportunities to add to the office space supply.

Figure 2-14. Office Space Inventory & Vacancy, 3 Counties and I-90 Study Area



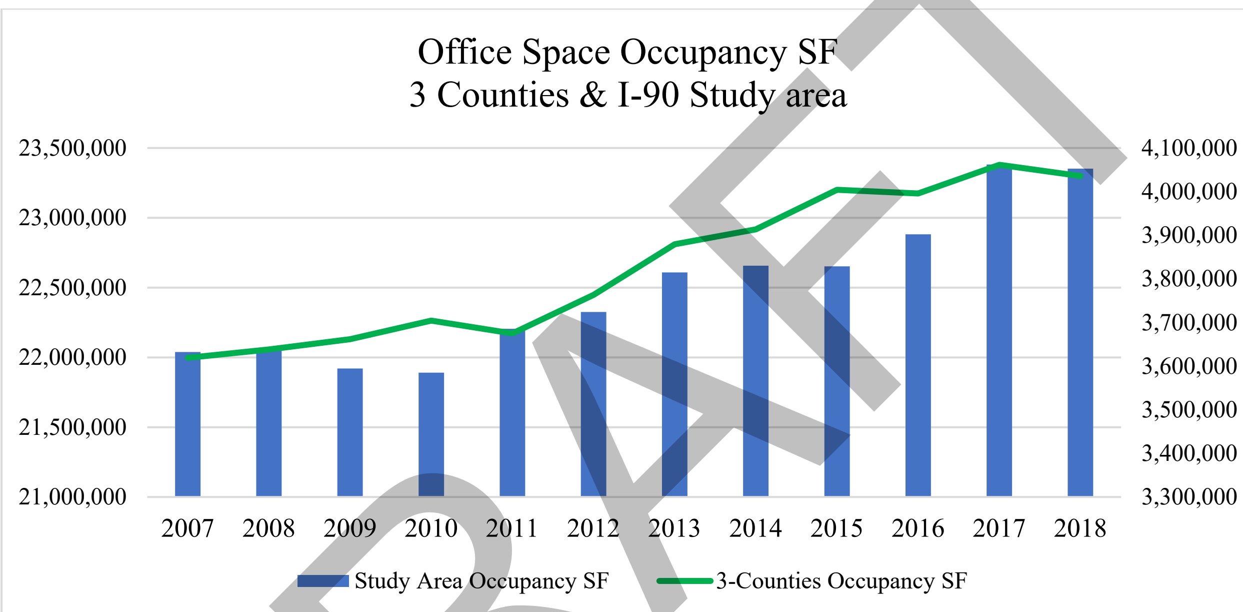
Source: CoStar, 2017 and FXM

This observation is supported by steady increases in office space occupancy as shown in Figure 2-15. Within the study area, occupancies in office space increased by 420,000 square feet between 2007 and 2018, an 11.6% gain over that period. Average annual increases were over

38,000 square feet during that period. Within the three counties overall occupied office space increased by over 1.3 million square feet, a 5.9% gain over that period. Average annual increases in occupied office space totaled over 118,000 square feet within the three counties between 2007 and 2018.

Based on 5-year annual average net absorption (increases in occupancy minus decreases), Co Star is forecasting average annual net absorption of over 45,000 square feet in the study area and 94,000 square feet in the three counties overall. Through 2022 net absorption is forecast at 181,000 square feet in the study area and 376,000 square feet for the three counties. That amount of forecast net absorption through 2022 for the three counties is virtually the same as the 377,000 square foot-projected demand for office space based on employment trends.

Figure 2-15. Office Space Occupancy, 3 Counties & I-90 Study Area



Source: CoStar, 2017 and FXM

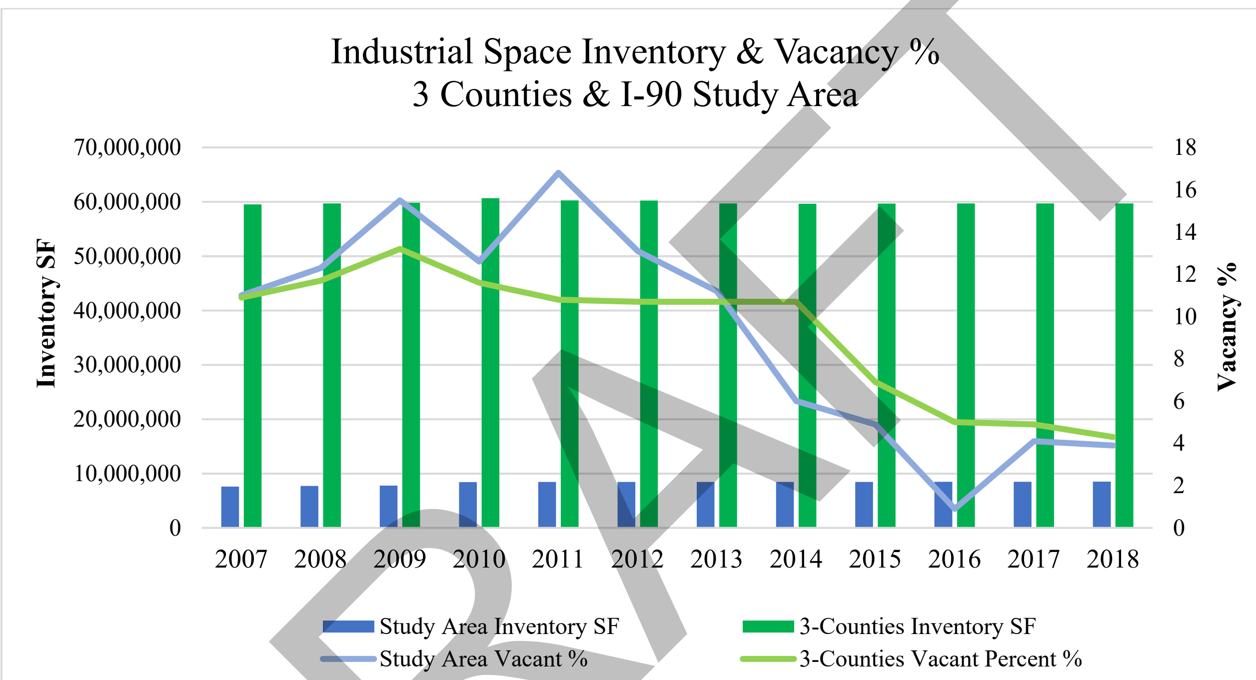
2.5.2 Industrial Space

Figure 2-16 graphs the inventory and vacancy rates for industrial space between 2007 and 2018. Co Star defines "industrial space" to include space used by manufacturers, wholesalers and warehousing. In 2018, the study area communities contained about 8.5 million square feet of industrial space compared to 59.7 million square feet the three counties (Berkshire, Hampshire, Hampden) overall. Figure 2-17 shows trends in industrial space occupancy which totaled about 8.2 million square feet in the study area and 57.1 million square feet in the three counties overall in 2018.

As shown in Figure 2-16 the total inventory of industrial space increased by 930,000 square feet in the study area, a gain of 12.3% over the amount in 2007. Average annual increases in the supply of industrial space (net additions from new construction and rehabilitation compared to demolitions and removal from the market) totaled about 85,000 square feet per year within the study area communities between 2007 and 2018. Within the three-county market area overall the inventory of industrial space increased by only 155,000 square feet between 2007 and 2018, a 0.3% gain, meaning that there was a loss of industrial space outside the study area between 2007 and 2018. The vacancy rate for industrial space has been declining and in 2018 stands at 3.9% in the study area and 4.3% in the three counties overall. Both study area and overall market area vacancy rates are relatively very low and indicative of opportunities to add to the supply of industrial space.

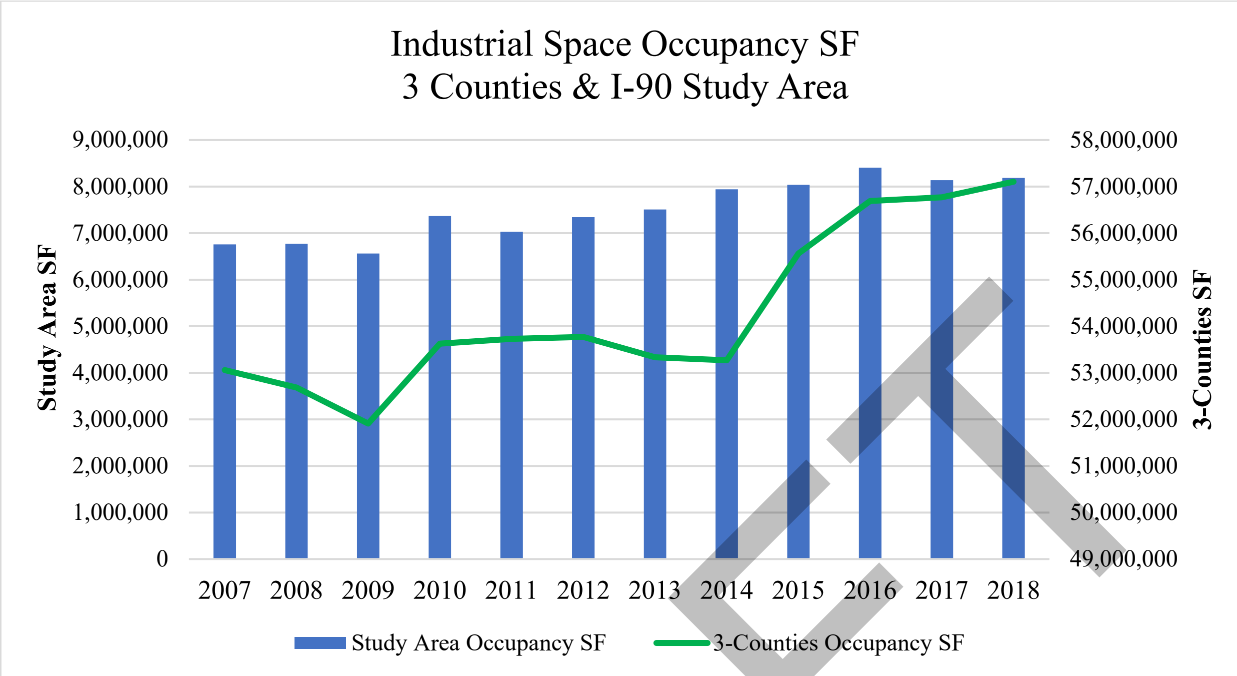
This observation is supported by steady increases in industrial space occupancy as shown in Figure 2-17. Within the study area occupancies in industrial space increased by 1.4 million square feet between 2007 and 2018, which is a 21.2% gain over that period. Average annual increases were nearly 130,000 square feet during that period. Within the three counties overall occupied industrial space increased by over 4 million square feet, a 7.6% gain over that period. Average annual increases in occupied industrial space totaled over 368,000 square feet within the three counties between 2007 and 2018.

Figure 2-16. Industrial Space Inventory & Vacancy, 3 Counties & I-90 Study Area



Source: CoStar, 2017 and FXM

Figure 2-17. Industrial Space Occupancy, 3 Counties & I-90 Study Area



Source: CoStar, 2017 and FXM

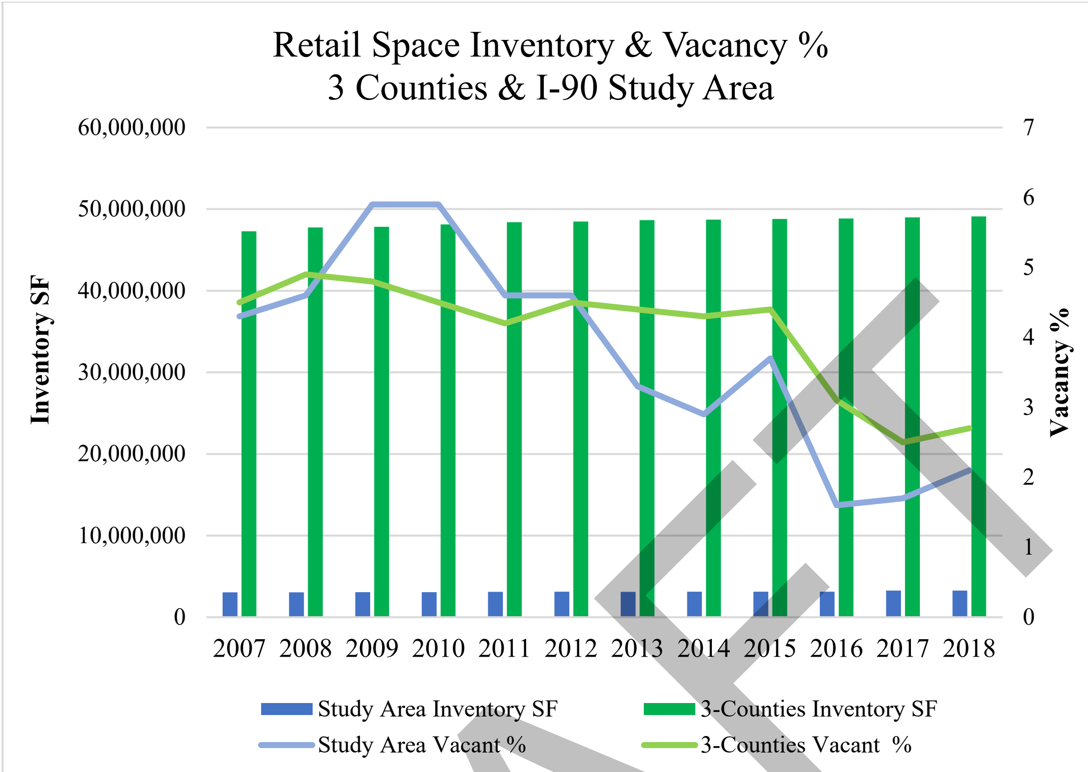
Based on 5-year annual average net absorption (increases in occupancy minus decreases), Co Star is forecasting average annual net absorption of about 136,000 square feet of industrial space in the study area and 735,000 square feet in the three counties overall. Through 2022 net absorption of industrial space is forecast at 543,000 square feet in the study area and 2.9 million square feet for the three counties. That amount of forecast net absorption through 2022 for the three counties is substantially greater than the 310,000 square foot-projected demand for industrial space based on extrapolated employment trends.

2.5.3 Retail Space

Figure 2-18 graphs the inventory and vacancy rates for retail space between 2007 and 2018. Co Star defines "retail space" as space used by retail stores and restaurants. In 2018, the study area communities contained about 3.3 million square feet of retail space compared to 49 million square for the three counties (Berkshire, Hampshire, Hampden) overall. Figure 2-19 shows trends in retail space occupancy which totaled about 3.2 million square feet in the study area in 2018 and 47.8 million study area in the three counties overall.

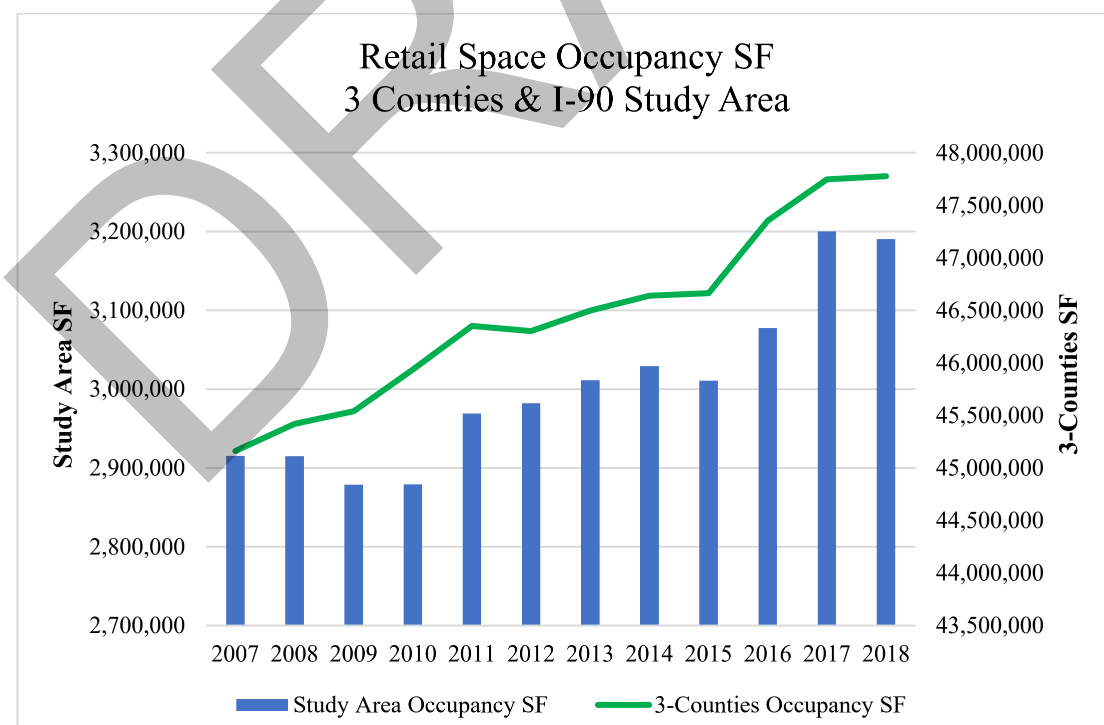
As shown in Figure 2-18 the total inventory of retail space increased by 212,000 square feet in the study area, a gain of 6.9% over the amount available in 2007. Average annual increases in the supply of retail space (net additions from new construction and rehabilitation compared to demolitions and removal from the market) totaled about 19,000 SF per year within the I-90 Study Area communities between 2007 and 2018. Within the three counties market area overall the inventory of retail space increased by 1.8 million square feet between 2007 and 2018, a 3.9% gain. The vacancy rate for retail space has been declining and now stands (3rd quarter 2018) at 2.1% in the I-90 Study Area and 2.7% in the three counties overall.

Figure 2-18. Retail Space Inventory & Vacancy, 3 Counties & I-90 Study Area



Source: CoStar, 2017 and FXM

Figure 2-19. Retail Space Occupancy, 3 Counties & I-90 Study Area



Source: CoStar, 2017 and FXM

As shown in Figure 2-19, retail space occupancy within the study area increased by 275,000 square feet between 2007 and 2018, an 9.4% gain over that period. Average annual increases were about 25,000 square feet during that period. Within the three counties overall occupied retail space increased by over 2.6 million square feet, a 5.8% gain over that period. Average annual increases in occupied retail space totaled about 238,000 square feet within the three counties between 2007 and 2018.

Based on 5-year annual average net absorption (increases in occupancy minus decreases), Co Star is forecasting average annual net absorption of about 34,000 square feet in the study area and 205,000 square feet in the three counties overall. Through 2022 net absorption of retail space is forecast at 135,000 square feet in the study area and 819,000 square feet for the three counties. The amount of forecast net absorption through 2022 for the study area and three counties overall is negligible and comports with the very limited forecast growth in retail employment over the same period.

2.6 Local Planning Documents

Many communities develop planning documents to help shape their future growth. Master plans have been published for the towns of Dalton (2016), Huntington (2003), Lee (2000) and Otis (2016). Among these communities, the most common theme of the plans are a desire to maintain rural character, carefully manage any commercial growth, and increase available transit options where possible. A new exit along I-90 has been discussed in some plans as well. Huntington's 2003 development plan contains a goal to:

> *"…develop a local consensus as to where a new Massachusetts Turnpike (I-90) exit at Route 20 or Route 23 should be located. At some point, an additional I-90 exit will be created between Westfield and Lee, with West Becket or Blandford the most likely candidate. Either exit (but especially Blandford) would increase the accessibility to Huntington, and therefore its economic development potential. An exit at Route 20 in Russell, however, would also dramatically increase the desirability of Huntington for suburban housing, which could harm the character of Huntington."*

The Berkshire County Comprehensive Economic Development Strategy (CEDS), a committee of the Berkshire Regional Planning Commission, published a report in 2017 that also relates to I-90. It states that the I-90 provides prime highway access to the county, while other major routes (US Routes 7 & 20 and State Highways 2, 8, & 9) also transect the region. However, limited access to interstate highways within the region is listed as a weakness. The report goes on to say that the most populous areas in the region (such as Pittsfield and North Adams) have poor access to the interstate highway system. According to the CEDS, this region is at a significant disadvantage for interstate highway access compared to Pioneer Valley (Hampden, Hampshire and Franklin Counties), which have access to multiple interstate highways and have more land available for development.

Similarly, Gateway Hilltowns, a collaborative representing the economic interests of the Towns of Blandford, Chester, Huntington, Middlefield, Montgomery, and Russell, prepared a multi-town Economic Development Strategy in 2017. In the report, lack of access to the interstate is listed as a challenge and threat to the area's economic development. Residents and business owners stated that without direct access to the interstate, attracting visitors, businesses, and new residents to the area will be difficult in the future.

2.7 Socioeconomic Conditions

The following section examines baseline demographic conditions including population, employment and other socioeconomic details. This data is used to provide an important understanding of the study area and context for the potential impacts and benefits associated with the placement of a new interchange. It also helps form the basis of projecting for future conditions. Data was collected for all study area communities.

2.7.1 Population

According to the latest US Census Bureau data, collected in 2010, Westfield, Dalton, and Lee are the only study area communities with populations over 5,000 people. The remaining study area communities all have fewer than 2,200 residents. Figure 2-20 illustrates the population totals for each study area community.

Figure 2-20. Population in Study Area Communities

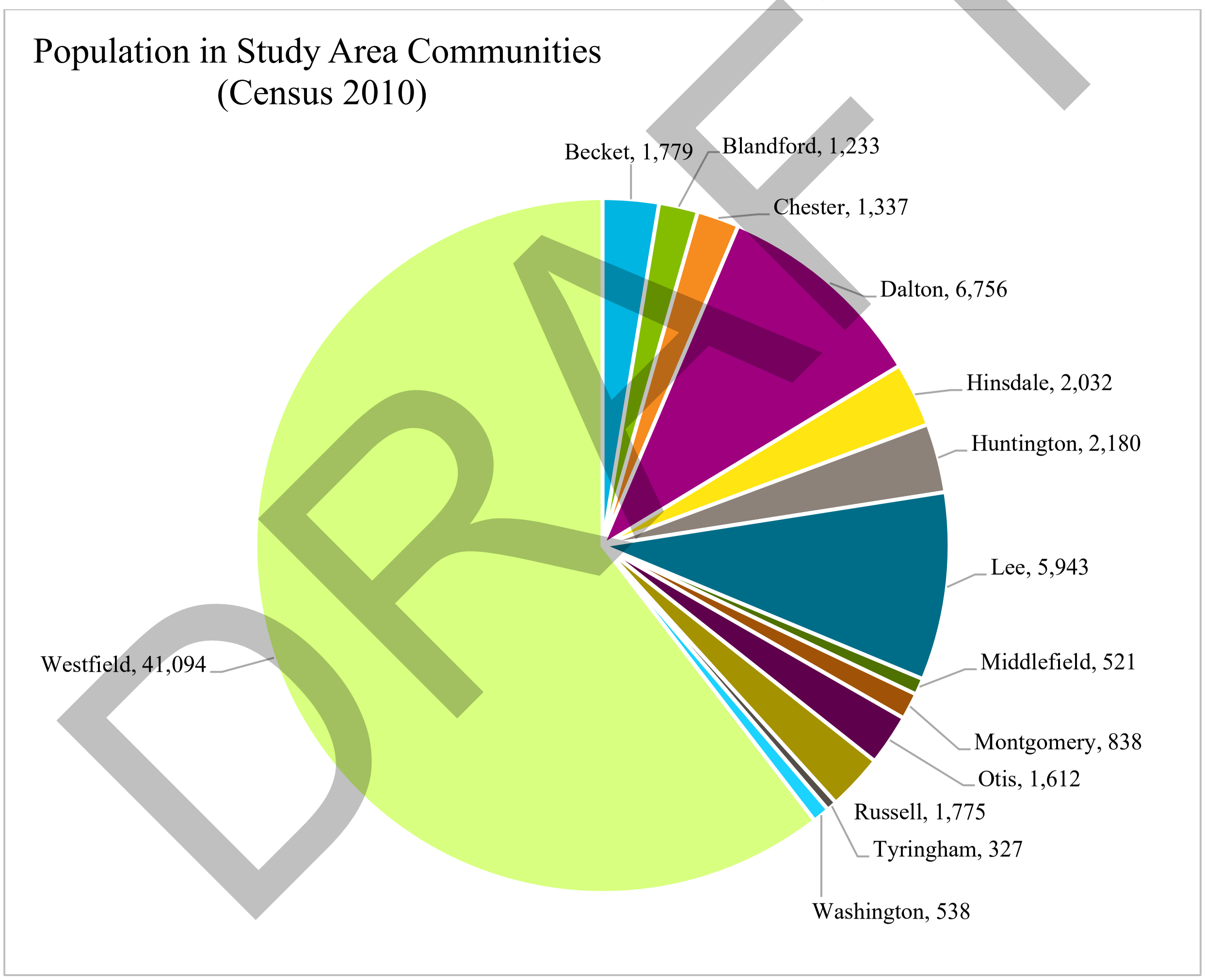
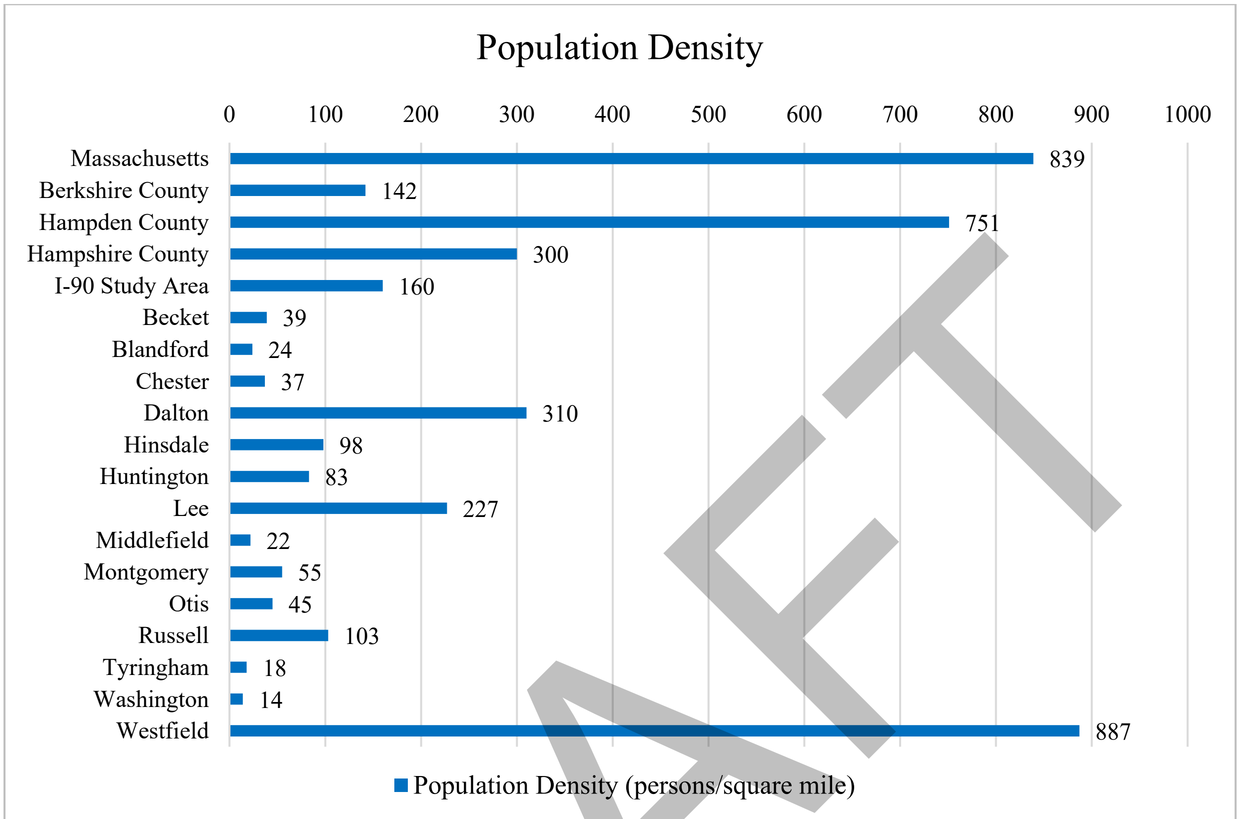


Figure 2-21. Population Density



Source: U.S. Census Bureau, 2010 Census

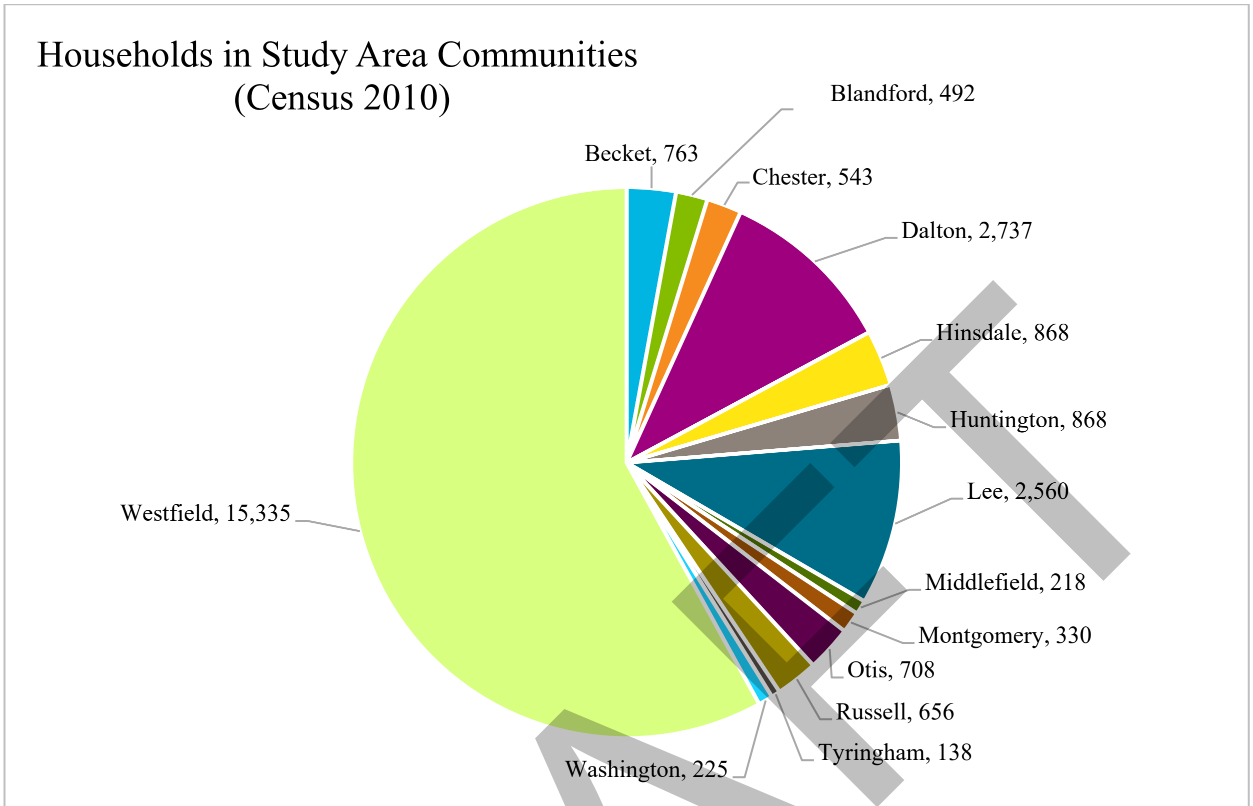
Given the mostly undeveloped terrain and protected open space throughout the study area, population density in the study area is relatively low. Population density is calculated by dividing the community population by community land area (defined as Total Area minus Water Area). Figure 2-21 displays the population density at statewide, countywide, study area and individual community levels.

The communities of Westfield, Lee and Dalton have the highest population densities with 887, 310, and 227 persons per square mile, respectively. Westfield exceeds the statewide population density, as well as county and I-90 study area population densities. The remaining eleven communities have much lower population densities.

2.7.2 Housing

The number of households in each study area community, also from the 2010 Census, is provided below in Figure 2-22. The communities of Westfield, Dalton and Lee have the highest number of households in the study area, which is expected given that households generally correlate directly with population density.

Figure 2-22. I-90 Study Area Households



The U.S. Census Bureau distinguishes between households and housing units when collecting and compiling data. Housing units represent the total housing supply within a community, while households represent occupied housing units. This distinction is important within the I-90 study area given the popularity of second homes or vacation homes. Households represent homes occupied year-round. Housing units on the other hand are characterized by the U.S. Census as including those being "for seasonal, recreational or occasional use."

The communities of Otis, Becket and Tyringham all contain a seasonal housing supply that either approaches or exceeds the number of year-round occupied units in their communities. Table 2-2 lists the number of total housing units and seasonal housing units in each study area community.

Table 2-2. I-90 Study Area Seasonal Housing Units

Community	Total Housing Units	Seasonal Housing Units	% Seasonal Housing Units
Becket	1,728	890	52%
Blandford	574	58	10%
Chester	645	60	9%
Dalton	2,920	60	2%
Hinsdale	1,133	215	19%
Huntington	1,014	95	9%
Lee	3,056	354	12%
Middlefield	279	49	18%
Montgomery	343	6	2%
Otis	1,701	938	55%
Russell	699	12	2%
Tyringham	280	131	47%
Washington	261	26	10%
Westfield	16,075	74	0%

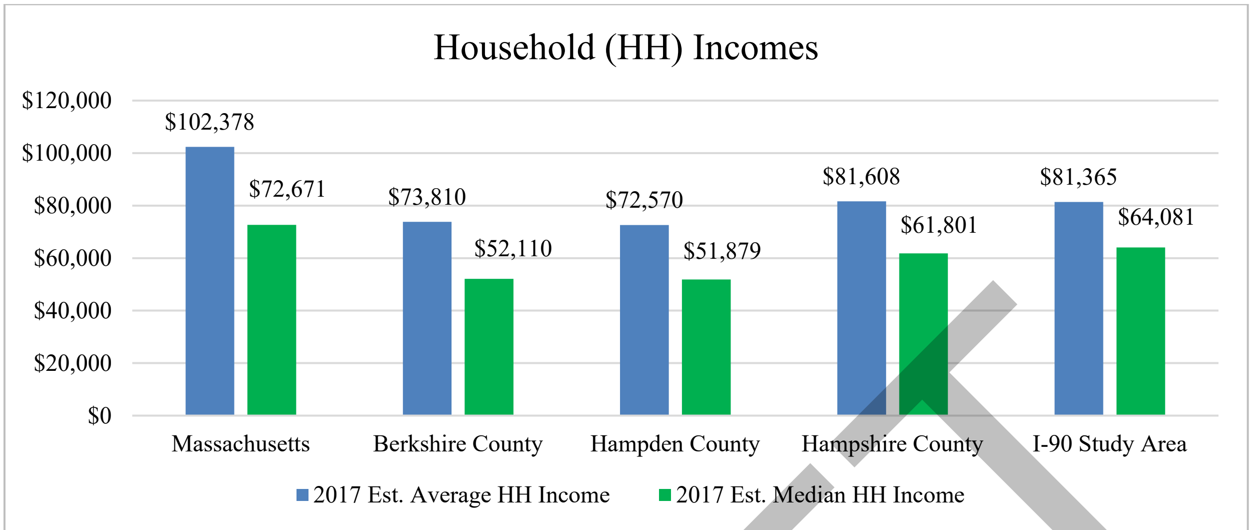
Source: US Census Bureau, American Fact Finder, Census 2010

2.7.3 Household Income

Household income is typically reported in two separate measures: average household income and median household income. Average income is the sum of total household income divided by the number of households. Median is based on the frequency distribution of individual household incomes such that there are an equal number of incomes above and below the midpoint of the distribution. A small number of high-income households can contribute to differences between average and median household incomes.

As shown in Figure 2-23, the average household income for the study area is $81,365. This is close to the average income for Hampshire County ($81,608) and is greater than the average income for Berkshire County ($73,810) and Hampden County ($72,570). When compared to the average household income of the entire Commonwealth ($102,378), all three counties and the study area are below this income level. The estimated median income ($64,081) of the study area is greater than all three surrounding counties but is again most similar to Hampshire County ($61,801). Notably, the study area's median household income still remains $8,590 lower than the state median.

Figure 2-23. Household Incomes



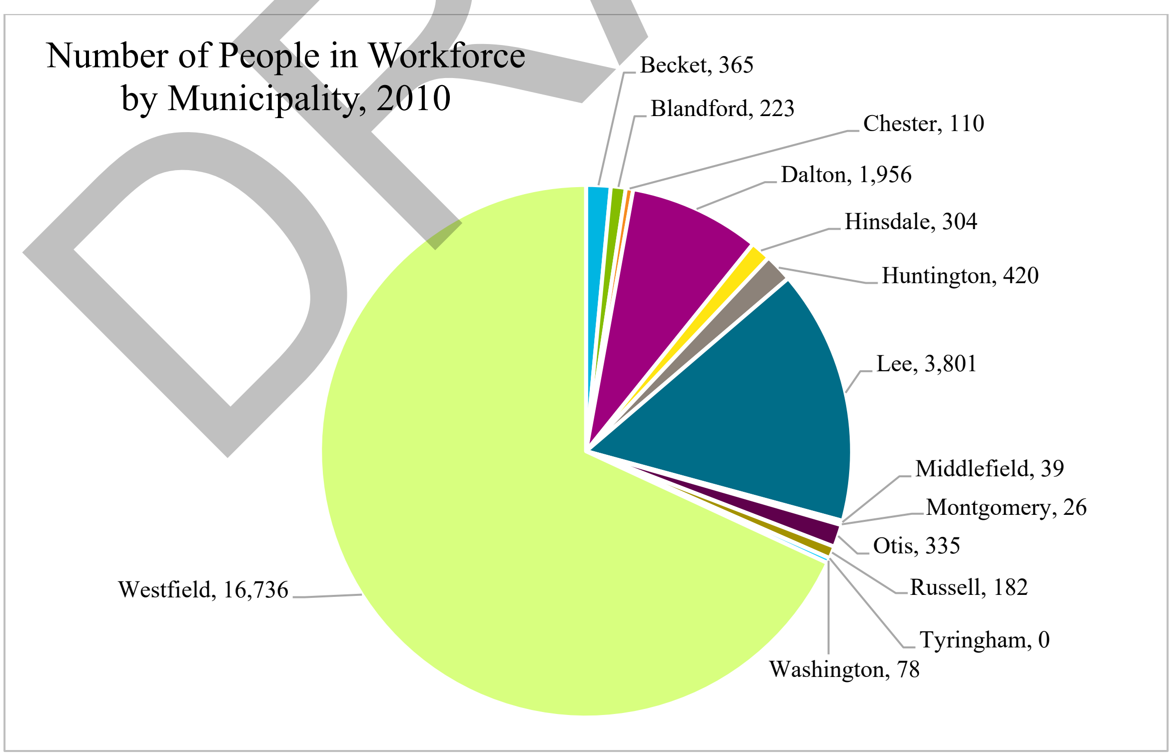
Source: Environ Analytics, 2017, and FXM Associates

The study area's poverty rate (7%) is less than Berkshire County (10%), Hampden County (14%), the state of Massachusetts (8%), and lies just above Hampshire County (6%).

2.7.4 Employment

Employment data is derived from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD) ES 202 data series. The most recent data is from 2010. Figure 2-24 shows the number of people in the workforce for each community. Similar to the population data, the workforce is larger at the employment centers of Westfield, Lee and Dalton. Westfield comprises most of the workforce within the study area, unsurprising for its size.

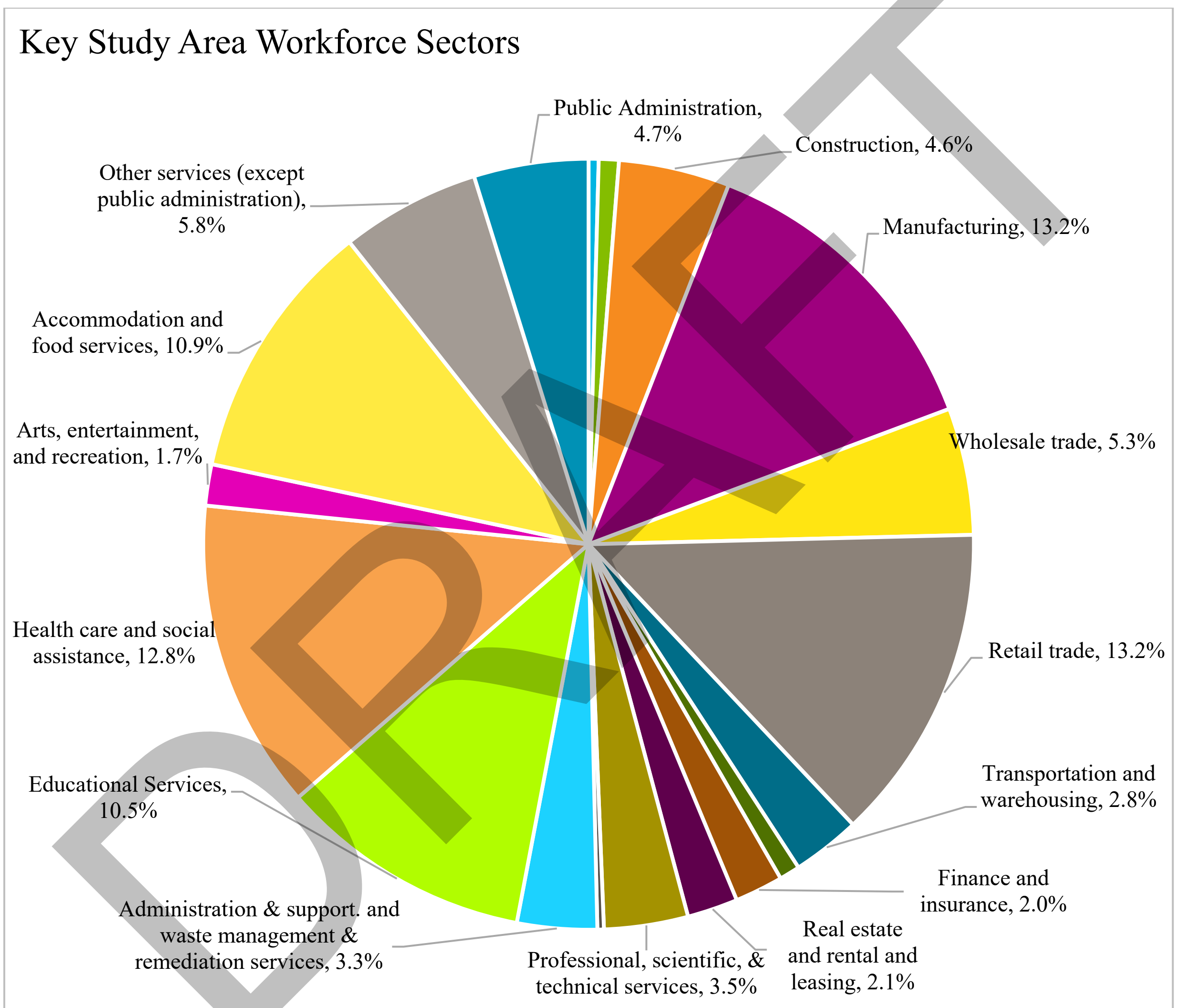
Figure 2-24. I-90 Study Area Employment



Key workforce sectors within the study area are summarized in Figure 2-25. Leading sectors as a proportion of all study area jobs include manufacturing, retail trade, health care, accommodation and food service, and educational services.

Average wages for all industries are similar throughout the three counties with Hampden County leading with an average wage of $47,892, followed by Berkshire County ($45,032) and Hampshire County ($44,980). All three counties average wages across all sectors are only about two-thirds of the average wage for the state of Massachusetts overall ($67,444). Reported local wages in the I-90 Study Area are less than county and statewide averages for wages overall.

Figure 2-25. Study Area Workforce Sectors



2.7.5 Journey to Work Data

Workplace locations of study area residents are an important component in understanding travel patterns within the study area. Journey to work data is taken from the U.S. Census Bureau 2012-2016 American Community Survey (ACS) 5-year Estimates. The dataset provides community estimates of where residents work, as well as where employees within the community reside. Commuting characteristics such as mean travel time to work are also provided.

Mode of transportation to work is also provided in the ACS dataset. Public transportation options in the study area are primarily limited to Lee and Westfield. The highest percentage of study area workers drive alone, although there is a noticeable amount of carpooling in some communities. Respondents who categorized their commute as "other" either walk to work or work at home. Table 2-3 identifies the percentage of various modes of transportation for each study area community as well as for the study area as a whole. In all communities, the large majority of commuters travel to work by driving alone.

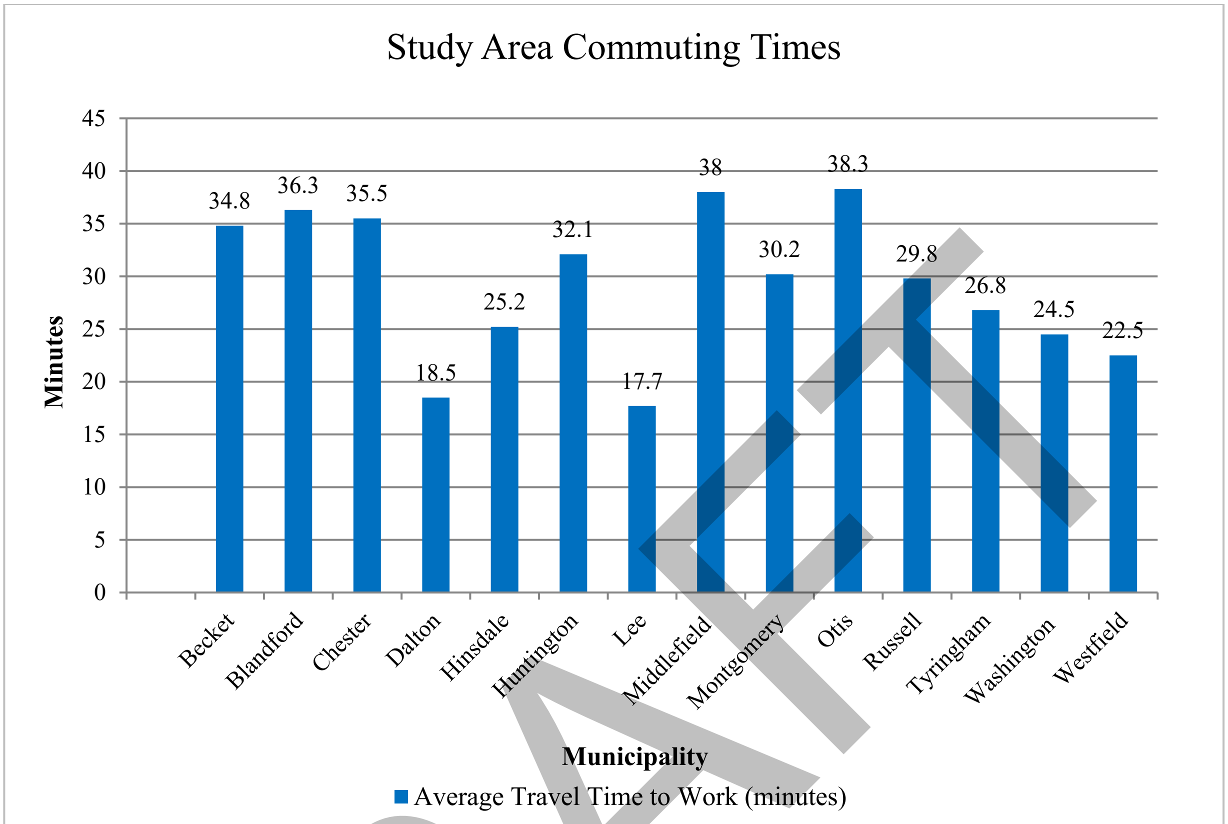
Table 2-3. Study Area Commuting Modes

Study Area Community	Drove Alone	Carpool	Other	Public Transportation
Becket	85.59%	5.02%	9.40%	0.00%
Blandford	84.88%	9.88%	5.23%	0.00%
Chester	80.07%	15.12%	4.82%	0.00%
Dalton	82.63%	7.19%	10.18%	0.00%
Hinsdale	91.28%	5.51%	3.21%	0.00%
Huntington	82.58%	13.01%	4.42%	0.00%
Lee	80.32%	9.33%	7.61%	2.74%
Middlefield	89.64%	2.07%	8.29%	0.00%
Montgomery	86.56%	6.72%	6.72%	0.00%
Otis	79.26%	8.62%	12.11%	0.00%
Russell	78.40%	14.95%	6.66%	0.00%
Tyringham	68.61%	7.30%	20.44%	3.65%
Washington	82.35%	5.88%	10.86%	0.90%
Westfield	84.06%	8.25%	7.43%	0.26%
Combined I-90 Study Area	83.51%	8.46%	7.59%	0.44%

The figures on the following pages illustrate the 'commutershed' for each community, and the natural directional orientation based on travel time and employment centers. Overall, journey to work patterns in western study area communities are oriented toward regional employment centers to the west in Lee and Pittsfield, while communities in the eastern study area are oriented toward Westfield and Springfield.

Figure 2-26 illustrates the average travel time to work for residents of each study area community. With few exceptions, study area communities in the center of the study area exhibit longer commuting times than those on the edges near employment centers. Journey to work patterns for the individual study area communities are provided in the following pages.

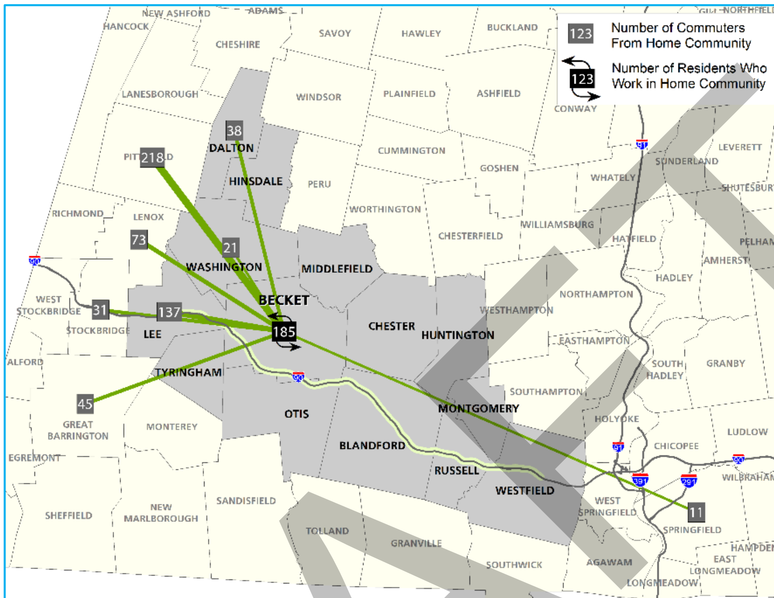
Figure 2-26. Study Area Commuting Times



Becket

The primary workplace locations of Becket residents are north and west of the community, as well as in Becket itself. Pittsfield, Lee and Lenox attract the most workers from Becket. For those who work in Becket, the vast majority are residents, with the balance coming mostly from Pittsfield, Middlefield and Washington. The mean travel time to work for Becket residents is 34.8 minutes.

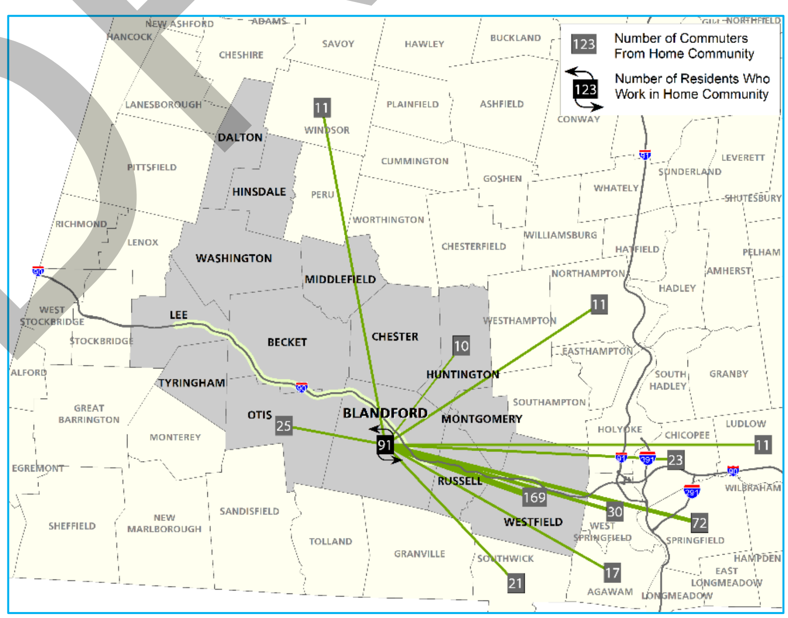
Figure 2-27. Workplace Locations of Becket Residents



Blandford

65% of people who work in Blandford are also Blandford residents. Blandford residents who do not work in the town itself are most likely to travel east to the Westfield and Springfield area for work. The mean travel time to work for Blandford residents is 36.3 minutes.

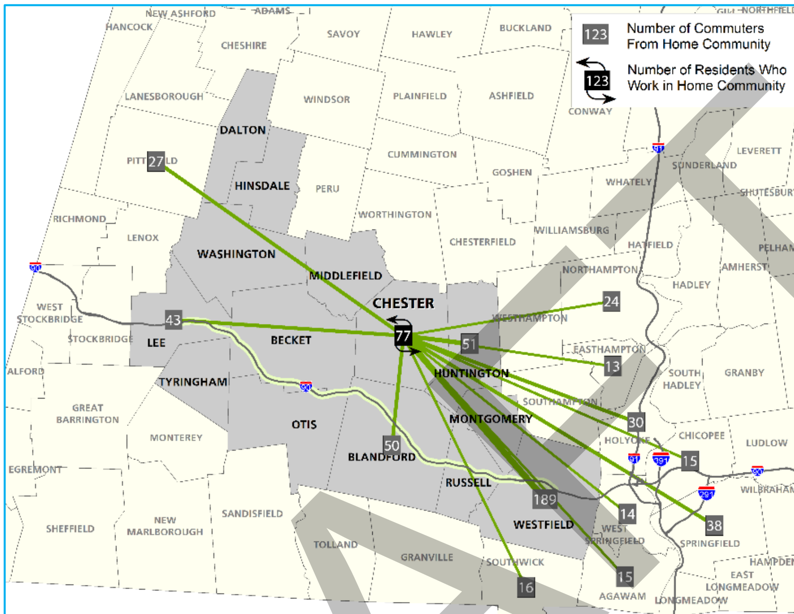
Figure 2-28. Workplace Locations of Blandford Residents



Chester

Nearly 90% of the residents of Chester either work in Chester, Blandford and Huntington, or to the east in the Westfield or Springfield areas. Those who are employed in Chester are likely to be residents, with a small percentage living in the adjacent town of Middlefield. The mean travel time to work for Chester residents is 35.5 minutes.

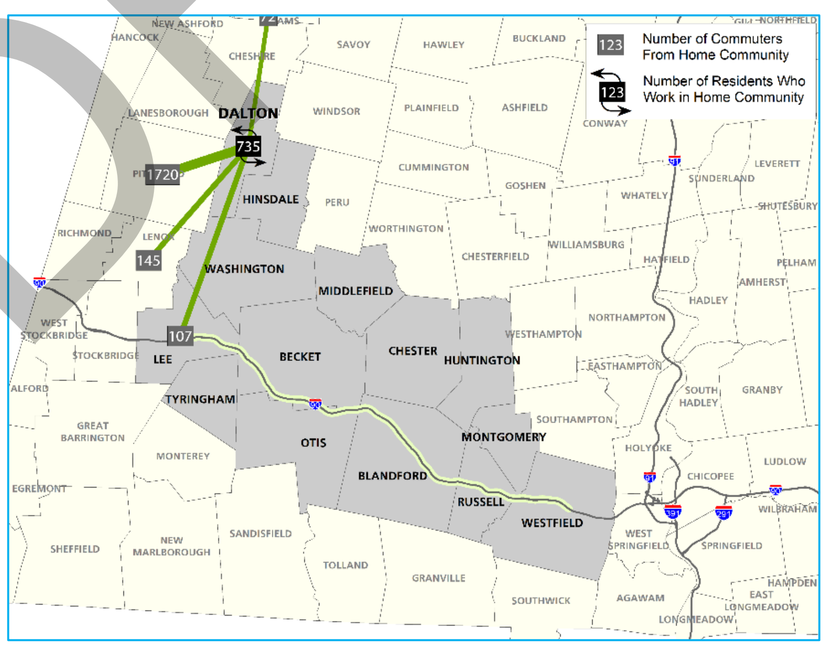
Figure 2-29. Workplace Locations of Chester Residents



Dalton

Dalton residents overwhelmingly work in Pittsfield or Dalton, with the rest working in Lee, Lenox or North Adams. Other than local residents, those who work in Dalton are likely to be from Pittsfield or other adjacent communities. The mean travel time to work for Dalton residents is 18.5 minutes.

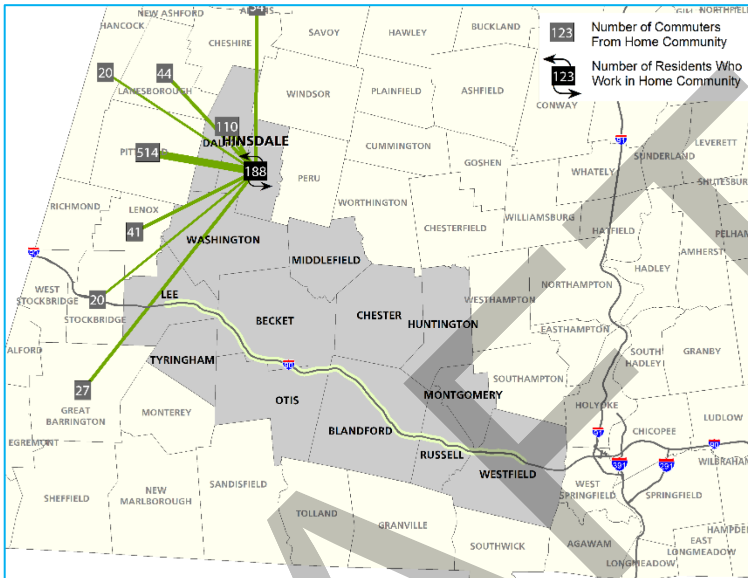
Figure 2-30. Workplace of Dalton Residents



Hinsdale

The workplace distribution pattern of Hinsdale residents is similar to Dalton in that most workers are from the town itself or the west. Pittsfield is again the dominant employment location for those who do not work in town. The adjacent communities of Pittsfield and Peru are the only notable outside contributors to those working in Hinsdale. The mean travel time to work for residents of Hinsdale is 25.2 minutes.

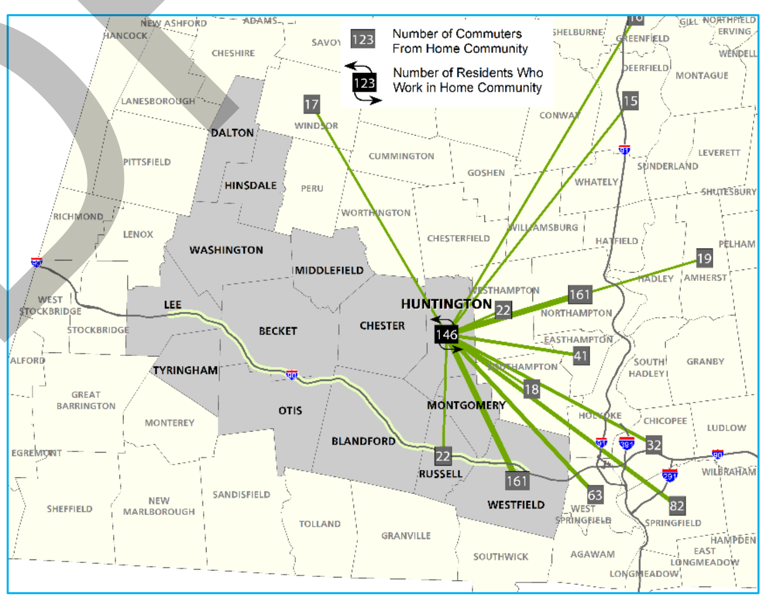
Figure 2-31. Workplace Locations of Hinsdale Residents



Huntington

Huntington residents are most likely to work locally or east of town, with Westfield, Northampton and the Springfield area exhibiting roughly equal shares of workplace destinations. Huntington residents represent approximately half of those working in town, with only Chester and Northampton contributing more than a 10% share. The mean travel time to work for Huntington residents is 32.1 minutes.

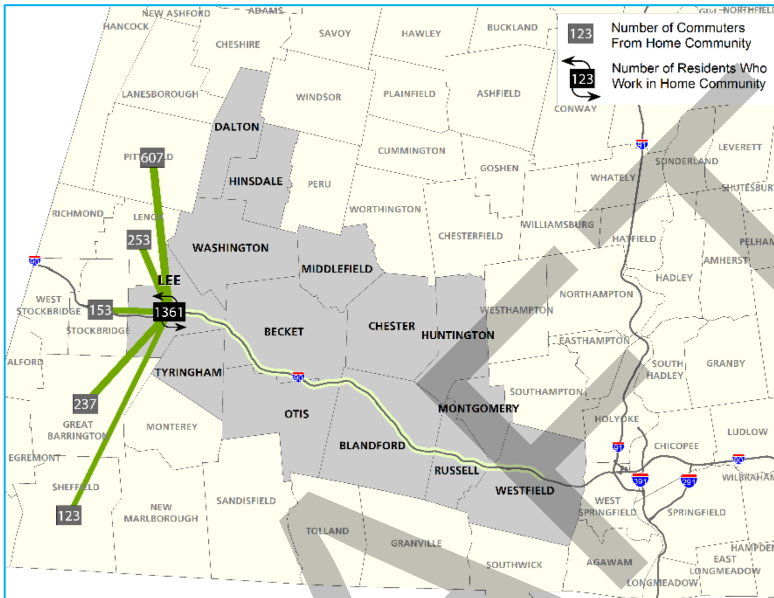
Figure 2-32. Workplace Locations of Huntington Residents



Lee

Fifty percent of Lee residents work in Lee, with most other residents working in the nearby towns of Pittsfield, Lenox, Great Barrington, Stockbridge or Sheffield. As a regional employment center, those who work in Lee reside in over 20 communities, with Lee and Pittsfield providing the largest shares. The mean travel time to work for Lee residents is 17.7 minutes.

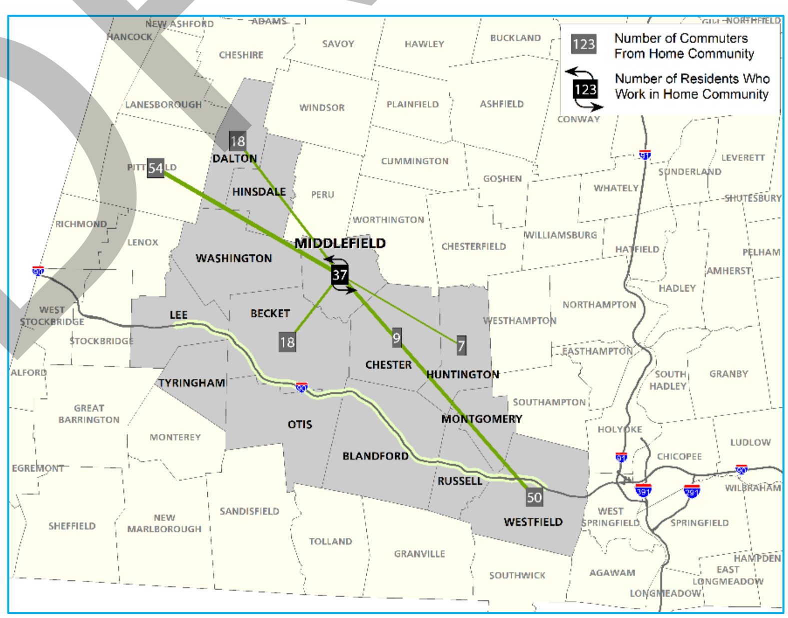
Figure 2-33. Workplace Locations of Lee Residents



Middlefield

The primary workplace locations for Middlefield residents are Pittsfield and Westfield, along with Middlefield. Residents make up nearly all of those who work in Middlefield. The mean travel time to work for residents of Middlefield is 38.0 minutes.

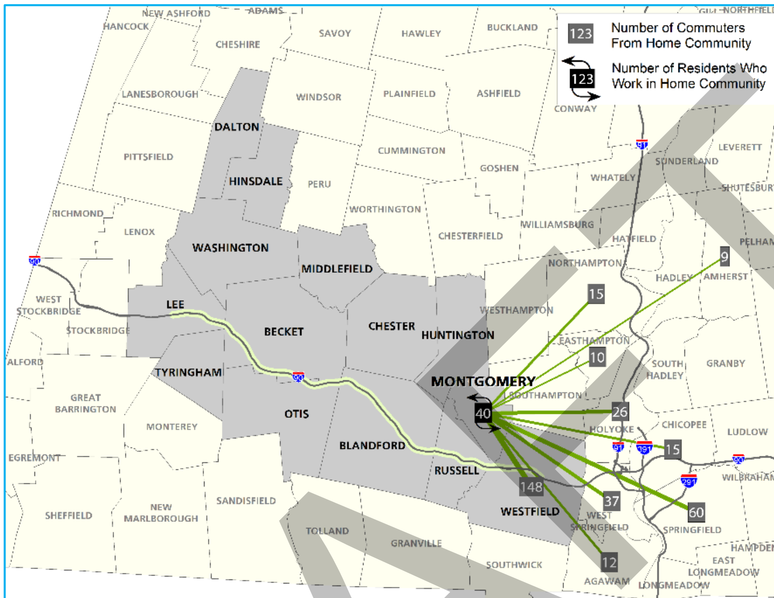
Figure 2-34. Workplace Locations of Middlefield Residents



Montgomery

The commuting pattern for residents of Montgomery is decidedly oriented to the east. Westfield serves as the largest workplace location for residents, with Springfield-area communities attracting a similar percentage. As was the case with Middlefield, Montgomery residents represent nearly the entire workforce within the town itself. The mean travel time to work for Montgomery residents is 30.2 minutes.

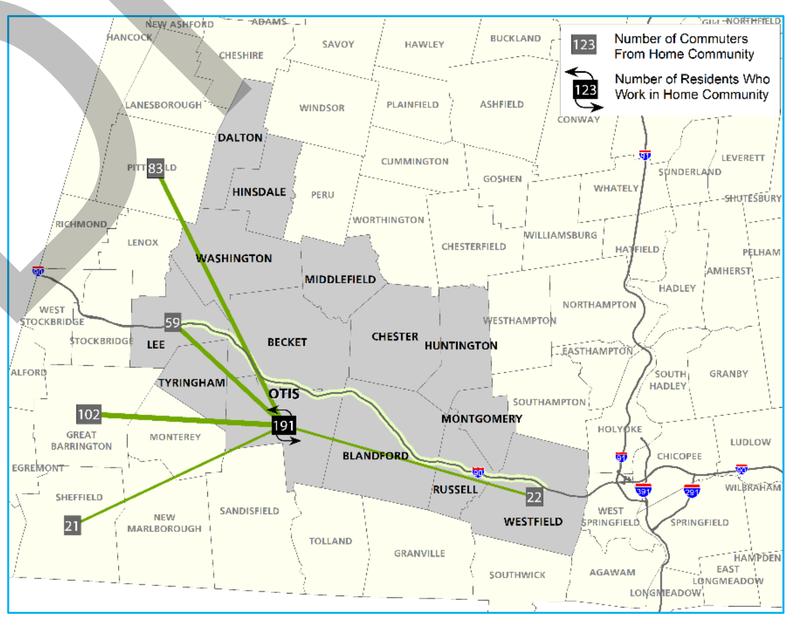
Figure 2-35. Workplace Locations of Montgomery Residents



Otis

Other than a small fraction of residents who work in Westfield, residents of Otis either work in town or in communities to the west such as Great Barrington, Pittsfield or Lee. People who work in town are primarily residents or travel from Blandford or Tolland. The mean travel time to work for Otis residents is 38.3 minutes.

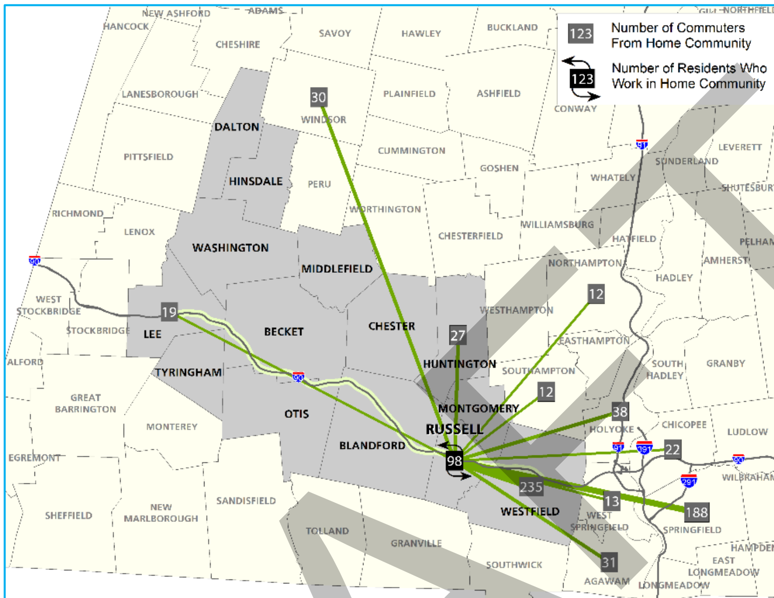
Figure 2-36. Workplace Locations of Otis Residents



Russell

The cities of Westfield and Springfield are the primary workplace locations for residents of Russell, along with the town itself. The rest is distributed among at least ten other communities. More than half of those who work in Russell live there, with residents of Westfield and Huntington comprising the majority of the remaining. The mean travel time to work for residents of Russell is 29.8 minutes.

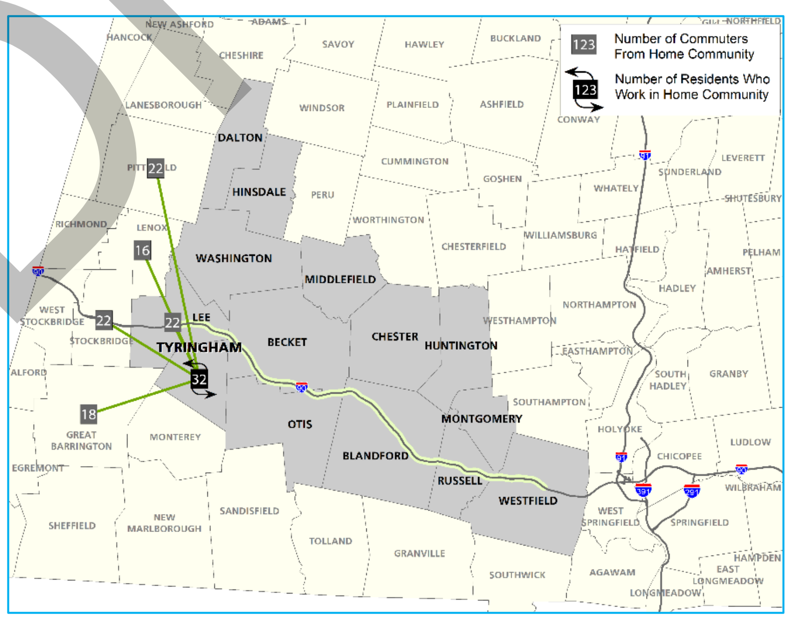
Figure 2-37. Workplace Locations of Russell Residents



Tyringham

Tyringham residents who also work in town comprise approximately 25% of the total workforce, with the rest distributed relatively equally among nearby communities to the north and west. Tyringham residents represent nearly the entire workforce within the town itself. The mean travel time to work for residents of Tyringham is 26.8 minutes.

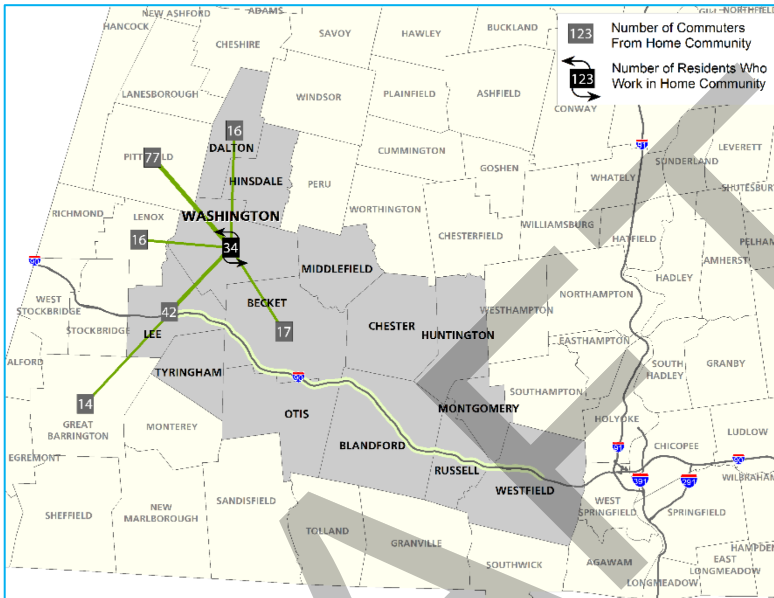
Figure 2-38. Workplace Locations of Tyringham Residents



Washington

Pittsfield and Lee are the primary workplace locations for residents of Washington, followed by Washington itself. The rest of the workplace locations for Washington residents are in neighboring or nearby towns. Those who work in Washington are likely to be residents of Washington or Becket. The mean travel time to work for Washington residents is 24.5 minutes.

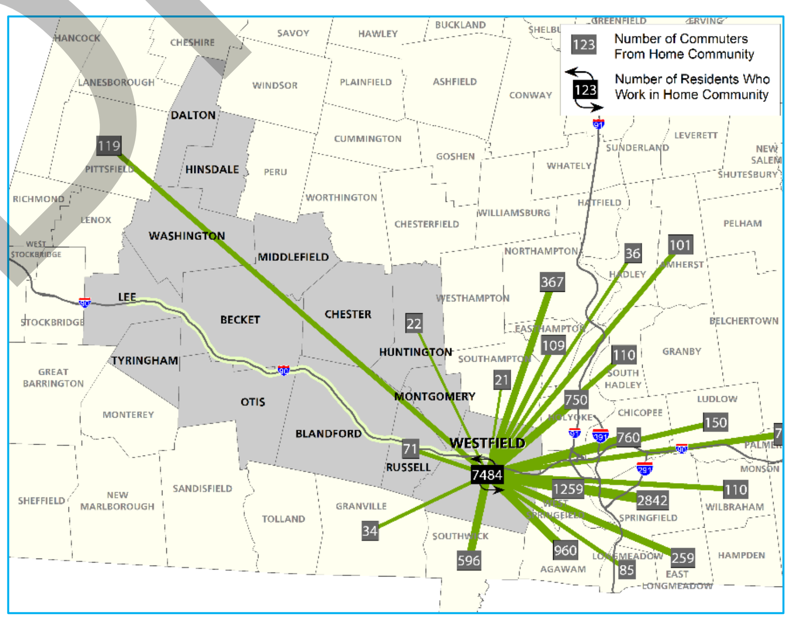
Figure 2-39. Workplace Locations of Washington Residents



Westfield

Westfield is the largest employment center within the project study area, and houses the largest workforce. Primary workplace locations for Westfield residents include Westfield (42%), Springfield (16%), West Springfield (7%) and Agawam (5%). Westfield residents represent the highest percentage of those who work in Westfield, followed by Springfield, Chicopee, Agawam, and West Springfield. The mean travel time to work for Westfield residents is 22.5 minutes.

Figure 2-40. Workplace Locations of Westfield Residents



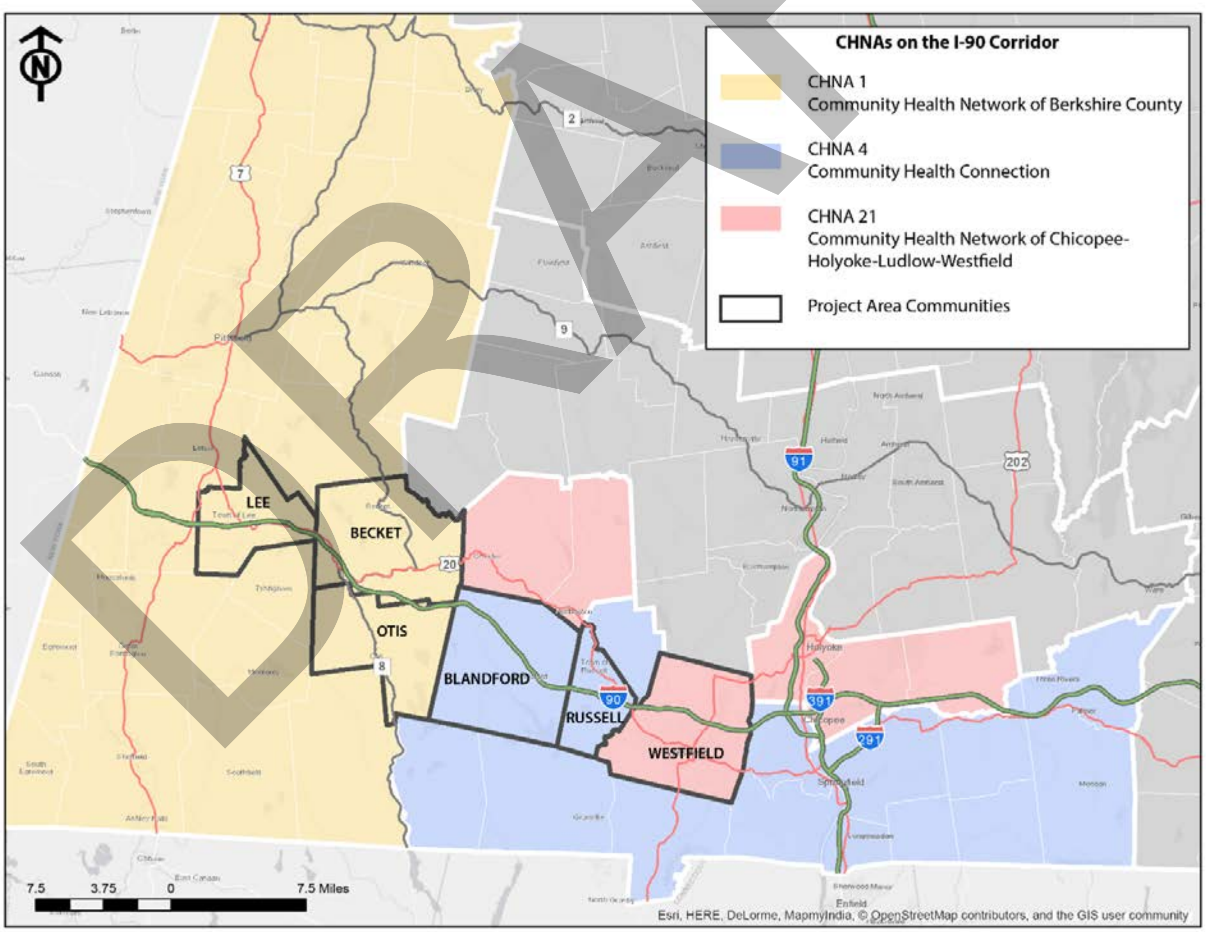
2.7.6 Public Health

Public health data were examined using information provided by several sources. Understanding public health conditions within the study area allows for consideration of how a new interchange could potentially improve or worsen public health. Because the study area is mostly rural and has a low population density, most public health data can only be collected as a part of larger geographies. The majority of public health data examined in this study is reported county-wide or through a Community Health Network Area (CHNA). CHNAs were established by the Massachusetts Department of Public Health in 1992 to identify local and regional health priorities, develop health improvement projects, and track the success of those projects. Three CHNAs were evaluated to provide insight into public health in the six communities along I-90:

- CHNA 1: Community Health Network of Berkshire County:
- CHNA 4: Community Health Connection:
- CHNA 21: Community Health Network of Chicopee-Holyoke-Ludlow-Westfield:

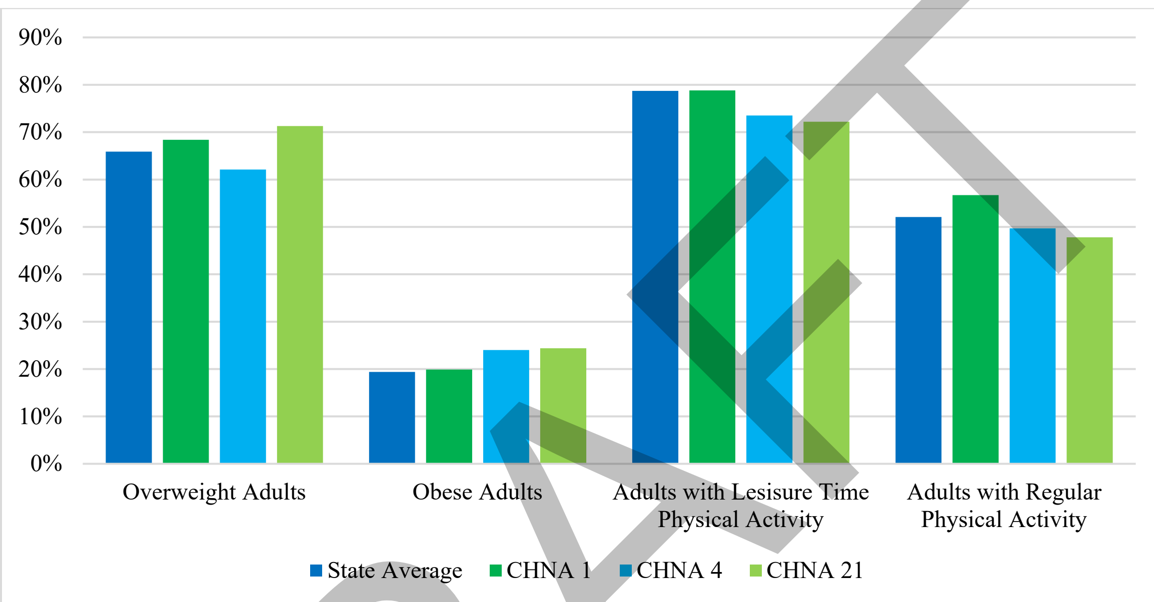
As Figure 2-41 illustrates, the CHNAs encompass more communities than are included in the study area for this effort. While this data is still a helpful resource, this is important to note.

Figure 2-41. CHNA Areas Compared to the I-90 Corridor Communities



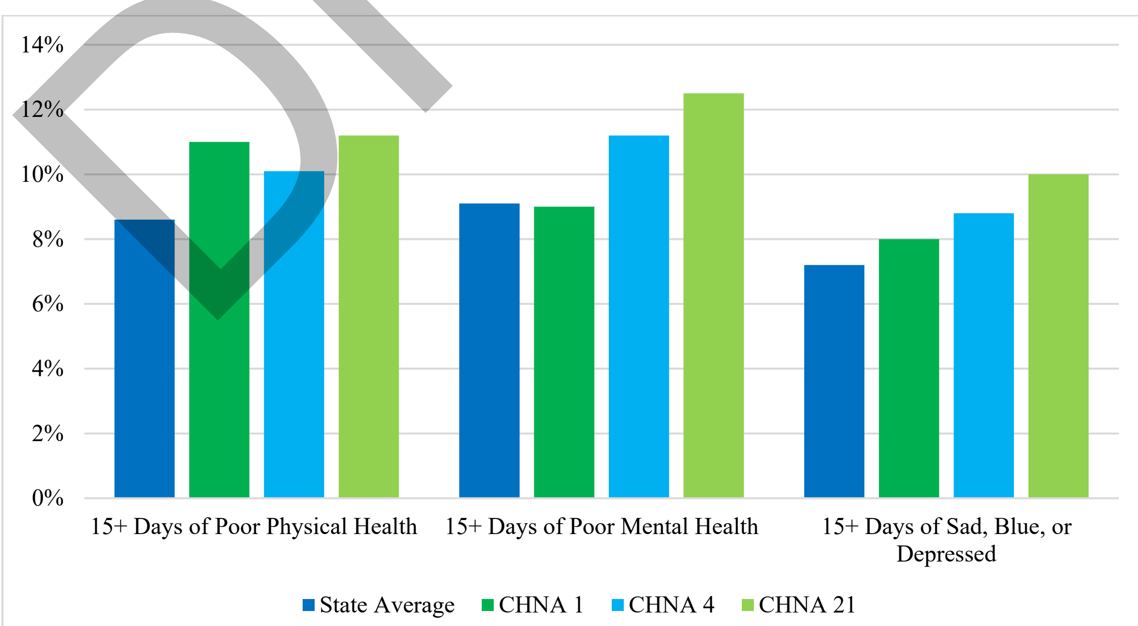
The area CHNAs have reported that between 60-70% of adults within those areas are overweight. CHNA 1 and CHNA 21 have a slightly larger percentage of overweight adults than the overall state average. Furthermore, CHNA 4 and 21 have reported a larger percentage of obese adults compared to the state. The same CHNAs with higher percentages of overweight and obese adults also report having less adults with leisure time physical activity or physical activity. On the other hand, CHNA 1 meets the state level of percentage of adults with leisure time physical activity, and surpasses the state in the percentage of adults with regular physical activity. Figure 2-42 summarizes this data.

Figure 2-42. Community Health Network Area Obesity and Physical Activity Rates



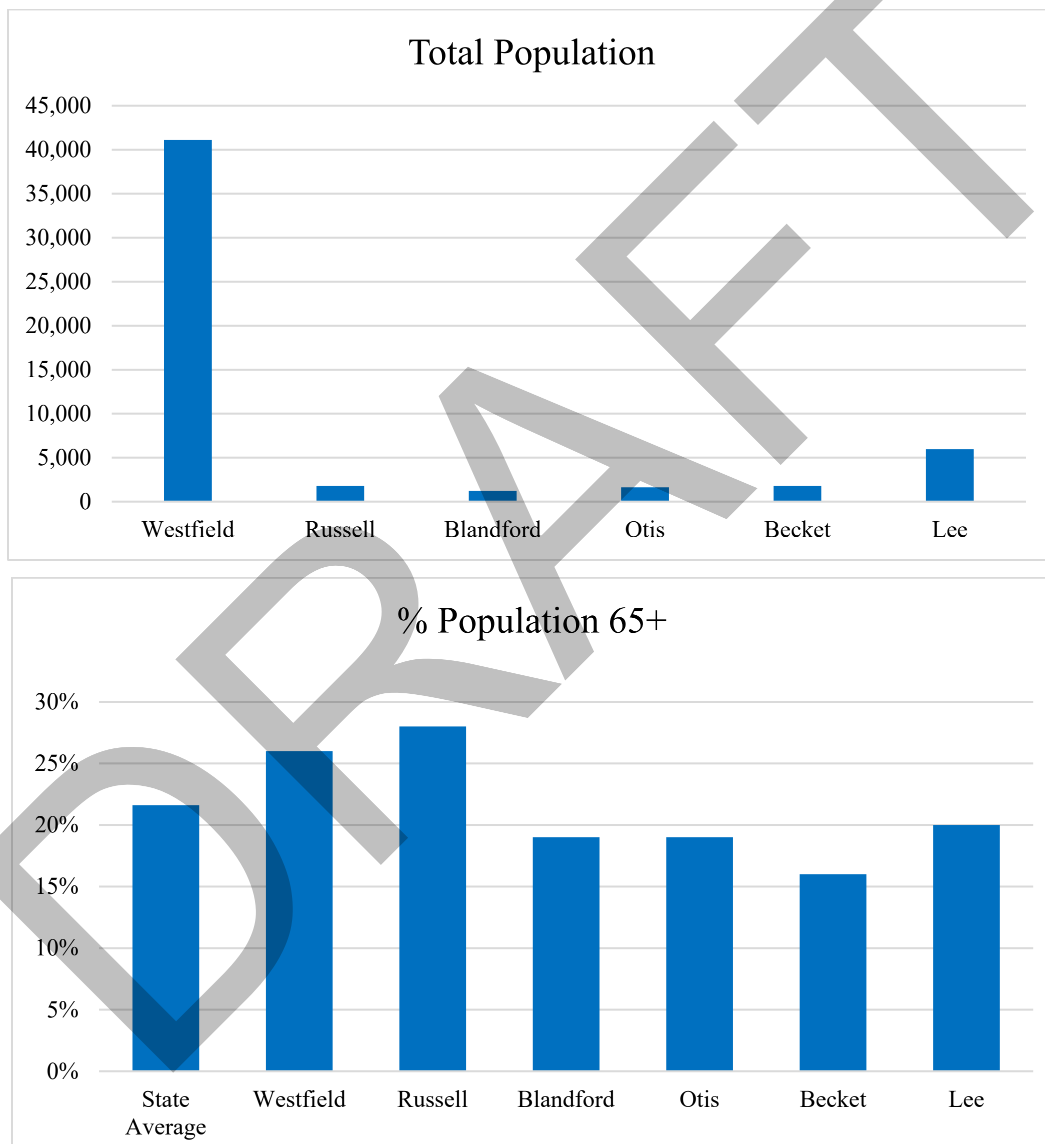
CHNA also report on the general wellbeing of area residents. Figure 2-43 charts the results and compares them to statewide figures. CHNA 4 and 21 greatly surpass the state percentage of residents who report fair to poor health.

Figure 2-43. Community Health Network Area General Wellbeing



Aging populations are important to consider as a factor of public health as well because elderly populations tend to have greater needs for services like public transportation, access to hospitals and health clinics, grocery stores, and community centers. A new interchange could greatly affect access to those services. Figure 2-44 illustrates the total population and percent of population age 65 and above in the communities located directly along I-90 between Exits 2 and 3. These communities include Westfield, Russell, Blandford, Otis, Becket, and Lee. Two of the six communities (Westfield and Russell) have a higher percentage of populations over 65 than the state average. Meanwhile, the remaining four communities have populations over 65 that are just below the state average.

Figure 2-44. Total Population and Percent of Population Age 65 and Above



The Department of Public Health's Behavioral Risk Factor Surveillance System (BRFSS) collects data on general health for the entire state. Table 2-4 compares the mortality and hospitalization rates in the Western Region for asthma, heart disease, diabetes and motor vehicle-related injuries. The data shows that the mortality rates in Western Massachusetts are higher than the statewide rate.

Table 2-4. Mortality and Hospitalization Rates for Western Massachusetts

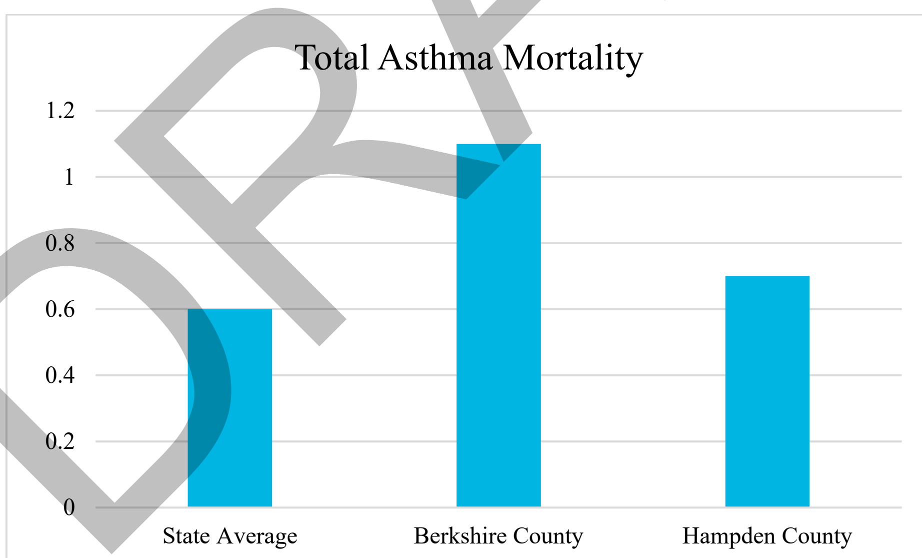
	Mortality		Hospitalization	
	Western Region	Massachusetts	Western Region	Massachusetts
Asthma[1]	N/A	N/A	125	140
Heart Disease[2]	188.8	182.5	35	38.7
Diabetes[3]	20.3	18.4	151.4	132.5
Motor Vehicle-Related Injuries[4]	10.2	7.7	93	77

Source: Regional Health Status Indicators Western Massachusetts report, Massachusetts DPH, June 2007 (https://www.mass.gov/files/documents/2016/07/tg/western-report.pdf)

1 Mortality rates not available; hospitalization rate based on 2005 Age-Adjusted rate per 100,000
2 Mortality rates based on 2003-2005 deaths per 100,000; hospitalization rate based on 2003-2005; Hypertension discharges per 100,000
3 Mortality rates based on 2003-2005 deaths per 100,000; hospitalization rates based on 2003-2005; Age-Adjusted rate per 100,000
4 Mortality rates based on 2003-2005 deaths per 100,000; hospitalization rates based on 2003-2005 discharges per 100,000

Asthma is another important factor of public health to consider for the study area. A new interchange could affect air quality (both positively and negatively), which could correlate to changes in reported Asthma conditions. Asthma-related data is presented at the county level from the Massachusetts Community Health Information Profile (MassCHIP) for the most recent time period available, 2008-2010. According to this data, both Berkshire and Hampden Counties have asthma mortality rates that are higher than the state average. This is shown in Figure 2-45 below.

Figure 2-45. Asthma Mortality Rate



MassCHIP also reports that both Berkshire and Hampden Counties have lower asthma inpatient hospitalizations than the state average, but have much higher asthma related emergency room visits compared to statewide figures. Figures 2-46 through 2-48 provide more insight into asthma-related issues in the study area counties.

Figure 2-46. Asthma Inpatient Hospitalizations and Emergency Room Visits

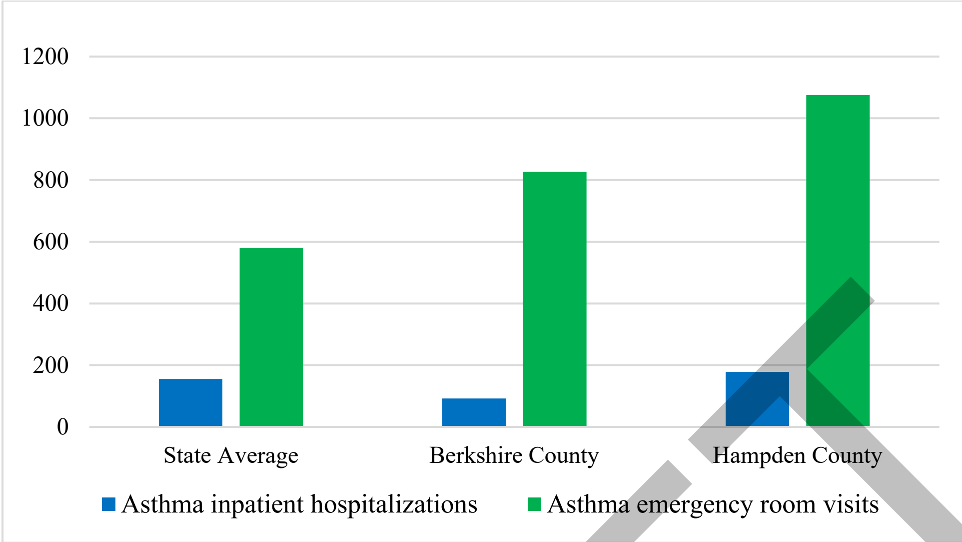


Figure 2-47. Asthma Emergency Department Visits per 10,000 People

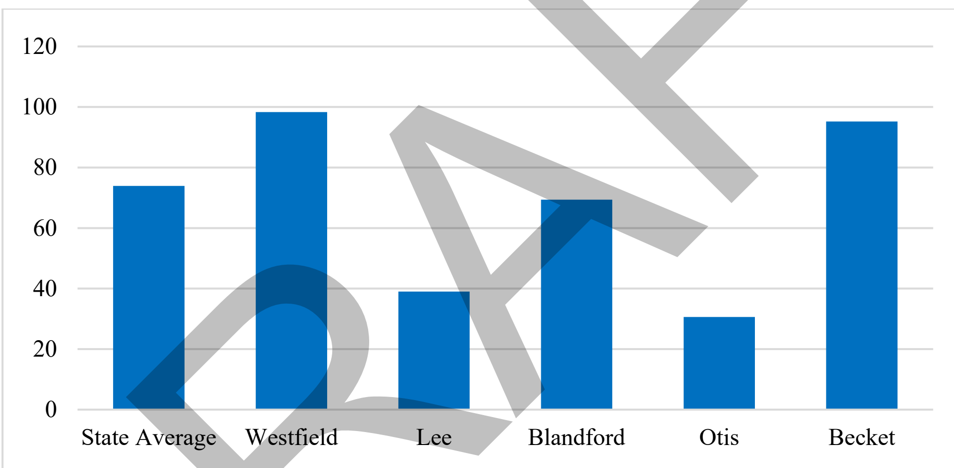
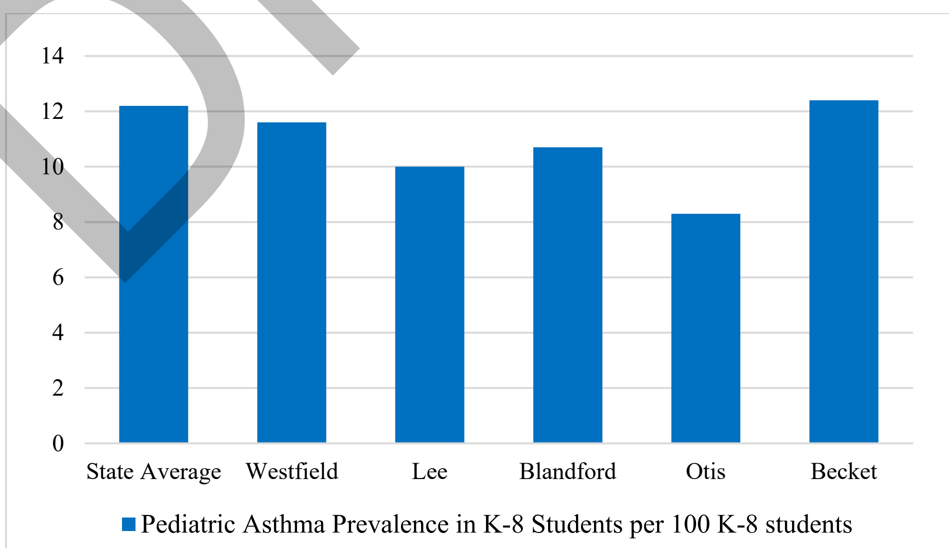


Figure 2-48. Pediatric Asthma Prevalence in K-9 Students per 100 K-8 Students



2.8 Transportation Conditions

2.8.1 Regional Roadway Network

The regional study area roadway network includes Interstate 90 (I-90, Mass Pike) and the state-numbered routes serving study area communities between Exits 2 and 3. A map (Figure 2-49) and descriptions of these facilities are provided below.

Interstate 90 (I-90/Mass Pike)

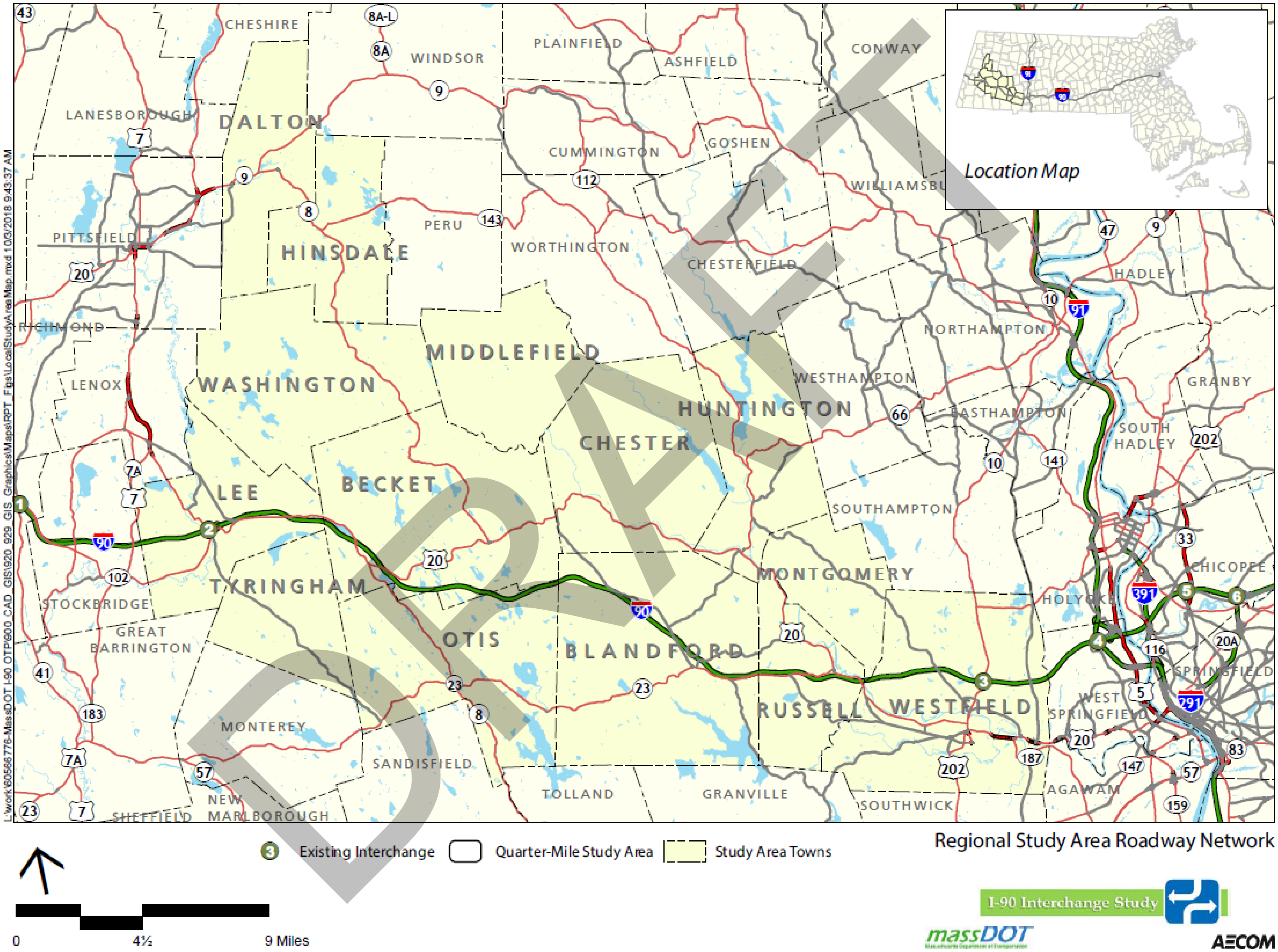
I-90 is a limited access segment of the Interstate Highway System. The segment encompassed by the study area between Exit 2 in Lee and Exit 3 in Westfield is approximately 30 miles in length. Within this segment, I-90 is comprised of two lanes in each direction with median separation and auxiliary truck climbing lanes where dictated by steep grades. The speed limit is 65 miles per hour. Several turnaround spots can be found along the stretch, restricted for use only by maintenance and emergency vehicles.

Service plazas providing fuel, food and rest room facilities are located on both sides of the highway near milepost 29 in Blandford, which is near the center of the study area.

Routes 20, 102, 8, 23, 112, 10 and 202

Several state-numbered and maintained routes serve the study regional area. Route 20 is an east-west route that winds through the entire study area, serving the communities of Lee, Becket, Chester, Huntington, Montgomery and Westfield. Route 102 is an east-west roadway that serves Lee. Route 8 is a north-south route serving Otis, Becket, Washington, Hinsdale and Dalton. Route 23 is an east-west route that serves Otis, Blandford and Russell. Route 112 is a north-south route that serves Huntington. These five routes are all two-lane roads (one lane in each direction) of varying widths and speed limits. Meanwhile, Route 10 and 202 run concurrently through most of Westfield before splitting at North Road. The roadway varies in width from two-to-four lanes throughout the city. All of the routes are named locally in addition to their state number.

Figure 2-49. Regional Study Area Roadway Network



2.8.2 Local Roadway Network

An inventory of local roadways and intersections important to consider in the context of this report was collected for the study area communities that intersect with I-90 and thus would be most immediately impacted by a new interchange. A brief description of the principal roadways and intersections within the communities of the study area is provided by municipality below.

Lee Roadways

Route 20

Route 20 travels east-to-west through the Town of Lee, south of I-90, turning north at the I-90 Exit 2 interchange, where it is known as Housatonic Street and then Park Street. It provides direct access to I-90 and commercial and residential land uses. The roadway is classified as a rural minor arterial under MassDOT jurisdiction at the local study area intersections. Route 20 generally provides two lanes of travel in each direction within the vicinity of the local study area. Route 20 provides sidewalks on each side of the roadway west of the Premium Outlet Boulevard intersection. The posted speed limit along Route 20 is 30 miles per hour within the vicinity of the local study area.

West Park Street

West Park Street generally travels in an east-to-west direction and provides access to commercial and residential land uses. The roadway is classified as a rural minor collector under local jurisdiction. West Park Street generally provides one lane of travel in each direction until its unsignalized intersection with Park Street/Main Street (Route 20) where an exclusive left-turn lane and a shared through/right-turn lane are provided. Sidewalks are provided on both sides of West Park Street within the vicinity of the local study area. A crosswalk is provided across the eastbound West Park Street approach.

Route 102 (Pleasant Street)

Route 102 (Pleasant Street) begins at its intersection with Route 20, south of the Interstate 90 interchange, and generally travels in a northeast-to-southwest direction (designated as north to south for the purpose of this report) through South Lee. Route 102 provides access to commercial land uses and connections to residential land uses in the vicinity of the study area. The roadway is classified as a rural minor arterial under MassDOT jurisdiction in the vicinity of the local study area. Route 102 generally provides one lane of travel in each direction and widens at the signalized intersection of Route 102 with Tyringham Road. Sidewalks are provided on each side of the roadway and a bicycle lane is provided on the west side of the roadway. The posted speed limit along Route 102 is 30 miles per hour in the vicinity of the local study area.

Tyringham Road

Tyringham Road generally travels in a southeast-to-northwest direction (designated as east to west for the purpose of this report) and provides access to mainly residential land uses. The roadway is classified as a rural major collector under local jurisdiction. Tyringham Road provides one lane of travel in each direction and widens at the signalized intersection of Tyringham Road and Route 102. A sidewalk is provided on the northern side of Tyringham Road on its westbound approach to the intersection. The posted speed limit along Tyringham Road is 30 miles per hour in the vicinity of the local study area.

Premium Outlet Boulevard

Premium Outlet Boulevard generally travels in a north-to-south direction and provides access to the Lee Premium Outlets. The roadway is classified as a local roadway under local jurisdiction. Premium Outlet Boulevard generally provides one lane of travel in each direction and widens at the intersection of Premium Outlet Boulevard and Route 20. A sidewalk is provided on the western side of Premium Outlets Boulevard.

Lee Signalized Intersections

Park Street/Main Street (Route 20)

Park Street travels in generally an east-to-west direction and Main Street travels in a generally north to south direction through the Town of Lee. Park Street/Main Street (Route 20) is classified as a rural principal arterial under MassDOT jurisdiction within the vicinity of its intersection with West Park Street. Park Street/Main Street (Route 20) provides access to residential and commercial land uses, and generally provides one lane of travel in each direction. At its intersection with West Park Street, the Park Street approach provides a shared left-turn/through lane and an exclusive right-turn lane while the Main Street approach provides a shared general purpose lane. The roadway provides sidewalks on both sides of the street, excluding the north side of Park Street as it approaches its intersection with Main Street. Main Street provides street parking on both sides of the roadway north of its intersection with West Park Street and Park Street. A crosswalk is provided across Park Street east of the unsignalized intersection of Park Street/Main Street (Route 20) at West Park Street. The posted speed limit along Park Street/Main Street (Route 20) is 25 miles per hour.

Route 102 (Pleasant Street) at Tyringham Road and Big Y Plaza

At the intersection of Route 102 at Tyringham Road and Big Y Plaza, Route 102 provides an exclusive left-turn lane and a shared through/right-turn lane on the northbound approach, and an exclusive left-turn lane, a shared through/right-turn lane, and a striped bicycle shoulder traveling southbound. At the intersection, Tyringham Road provides an exclusive left-turn lane and a shared through/right-turn lane in the westbound direction, and Big Y Plaza provides an exclusive left-turn lane and a shared through/right-turn lane in the eastbound direction. Crosswalks are provided on each of the approaches to the intersection and an exclusive pedestrian phase is provided. A bicycle path is provided between the Tyringham Road and the Premium Outlet Boulevard on the eastern side of Route 102.

Route 20 at Premium Outlet Boulevard

At the intersection of Route 20 at Premium Outlet Boulevard, Route 20 provides a through lane and a shared through/right-turn lane in the eastbound direction, and a through lane and left-turn lane in the westbound direction. The Premium Outlet Boulevard provides a left-turn lane and a shared left/right-turn lane. Sidewalks are provided on both sides of Route 20 on the eastbound approach to its intersection with the Premium Outlet Boulevard and on the northern side of Route 20 east of the intersection. The Premium Outlet Boulevard currently provides a sidewalk on the west side of the roadway. A crosswalk with exclusive pedestrian signalization is provided across the eastbound Route 20 approach to the intersection.

Blandford Roadways

Route 23 (Otis Stage Road)

Route 23 (Otis Stage Road) generally travels in an east-to-west direction through the Town of Blandford and provides access primarily to residential uses. The roadway is classified as a rural major collector under MassDOT where it meets Main Street, along which Route 23 continues. Route 23 generally provides one lane of travel in each direction. The roadway does not currently provide parking, sidewalks, or bicycle lanes. The posted speed limit is 25 miles per hour towards the unsignalized intersection of North Street at Otis Stage Road/Route 23.

Route 23 (Main Street)

Route 23 (Main Street) generally travels in an east-to-west direction through the Town of Blandford and provides access to municipal and residential land uses. The roadway is classified as a rural major collector under MassDOT jurisdiction within the vicinity of its intersection with North Street/Russell Stage Road. Route 23 provides one lane of travel in each direction. Sidewalks are provided on the northern side of the roadway and a crosswalk is provided across Route 23 approximately 100 feet west of its intersection with Russell Stage Road. The posted speed limit along Route 23 is 25 miles per hour approaching the intersection of North Street at Route 23 (Otis Stage Road)/Route 23 (Main Street), and 35 miles per hour approaching the intersection of Route 23 and Russell Stage Road.

North Street

North Street generally travels in a north-to-south direction through the Town of Blandford and provides access to recreational and residential land uses. The roadway is classified as a rural major collector under MassDOT jurisdiction. North Street provides one lane of travel in each direction. The roadway provides a sidewalk on the east side of the street at its intersection with Route 23 (Otis Stage Road)/Route 23 (Main Street). The posted speed limit along North Street is 35 miles per hour within the vicinity of the local study area.

Russell Stage Road

Russell Stage Road generally travels in a north-to-south direction through the Town of Blandford and provides access to municipal and residential land uses in the vicinity of the local study area. The roadway is classified as a rural major collector under local jurisdiction. A sidewalk is provided on the western side of Russell Stage Road. A crosswalk is provided across Russell Stage Road at its intersection with Route 23.

Russell Roadways

Route 20 (Westfield Road)

Route 20 (Westfield Road) generally travels in a north-to-south direction through the Town of Russell and provides access to residential and recreational land uses in the vicinity of the local study area. The roadway is classified as a rural minor arterial under MassDOT jurisdiction. Westfield Road generally provides one lane of travel in each direction and widens at the unsignalized intersection of Route 20 and Route 23 (Blandford Road). At its intersection with Route 23 (Blandford Road), Route 20 provides a left-turn lane and a through lane in the northbound direction, and an exclusive right-turn lane and through lane in the southbound direction. The roadway does not provide parking, sidewalks, or bicycle lanes in the vicinity of the study area. The posted speed limit along Route 20 is 50 miles per hour within the vicinity of the local study area.

Route 23 (Blandford Road)

Route 23 (Blandford Road) generally travels in an east-to-west direction through the Town of Russell and provides access to residential land uses in the vicinity of the local study area. The roadway is classified as a rural major collector under MassDOT jurisdiction. Blandford Road generally provides on lane of travel in each direction and widens at the unsignalized intersection of Route 20 (Westfield Road) and Route 23. Route 23 currently provides a shared through/left-turn lane and an exclusive right-turn lane at its intersection with Route 20. The roadway does not currently provide parking, sidewalks, or bicycle lanes in the vicinity of the study area. The posted speed limit along Blandford Road is 35 miles per hour in the vicinity of the local study area.

Westfield Roadways

Route 202/Route 10 (Southampton Road)

Routes 202 and 10 (Southampton Road) travel concurrently in a north-to-south direction through the City of Westfield, and then meets and runs along North Elm Street south of the Interstate 90 Interchange at its intersection with Arch Road/Westfield Industrial Park Road. It provides access to commercial, institutional, and residential land uses. The roadway is classified as an urban principal arterial under MassDOT jurisdiction. Route 202/Route 10 generally provides one lane of travel in each direction. The roadway does not currently provide parking, sidewalks, or bicycle lanes in the vicinity of the local study area. The posted speed limit along Route 202/Route 10 is 40 miles per hour.

Route 202/Route 10 (North Elm Street)/Elm Street

Route 202/Route 10 (North Elm Street)/Elm Street generally travels in a north-to-south direction through the City of Westfield and primarily provides access to commercial and residential land uses. Route 202/Route 10 are classified as an urban principal arterial and is under MassDOT jurisdiction at its signalized intersection with Arch Road and Westfield Industrial Park Road and under local jurisdiction south of the intersection. The roadway generally provides two lanes of travel in each direction.

At its intersection with Arch Road and Westfield Industrial Park Road, Route 202/Route 10 provides a sidewalk on the eastern side of the street. The roadway does not currently provide parking or bicycle lanes in the vicinity of the study area. The posted speed limit along Route 202/Route 10 is 35 miles per hour in the vicinity of its intersection with Arch Road and Westfield Industrial Park Road.

At its intersection with Notre Dame Street, Route 202/Route 10 provides sidewalks on both sides of the roadway. The roadway does not currently provide parking in the vicinity of the study area. The posted speed limit along Route 202/Route 10 is 30 miles per hour in the vicinity of its intersection with Notre Dame Street.

Elm Street provides sidewalks on both sides of the street and on-street parking on the west side of Elm Street on the northbound approach to the Franklin Street intersection. At the intersection of Elm Street at Franklin Street and Mobil Gas Station Driveway, the Mobil Gas Station Driveway currently provides entrance only access and prohibits southbound left-turns from entering.

Servistar Industrial Way

Servistar Industrial Way is located north of the Interstate 90 Interchange and generally travels in an east-to-west direction. It mainly provides access to industrial land uses. The roadway is classified as a local roadway under local jurisdiction. Servistar Industrial Way provides one lane of travel in each direction. The roadway has no on-street parking, sidewalks, or bicycle lanes.

Arch Road

Arch Road is located to the south of the Interstate 90 Interchange and generally travels in an east-to-west direction through the City of Westfield, providing access to commercial and industrial land uses. The roadway is classified as a local roadway under local jurisdiction. Arch Road generally provides one lane of travel in each direction and widens at its signalized intersection with North Elm Street and Westfield Industrial Park Road. The roadway does not currently provide on-street parking, sidewalks, or bicycle lanes.

Westfield Industrial Park Road

Westfield Industrial Park Road generally travels in an east-to-west direction through the City of Westfield and provides access to an industrial park. The roadway is classified as an urban collector under local jurisdiction. The roadway currently provides one lane of one-way travel south of Friendly's Way and provides access to the I-90 entrance via Friendly's Way.

Notre Dame Street

Notre Dame Street generally travels in a southeast-to-northwest direction (designated as east to west for the purpose of this report) through the City of Westfield and provides access to commercial and residential land uses. The roadway is classified as an urban minor arterial under local jurisdiction to the west of its intersection with North Elm Street, and a local roadway under local jurisdiction to the east of the intersection. Notre Dame Street generally provides one lane of travel in each direction and widens at its intersection with North Elm Street. The roadway provides sidewalks on both sides of the roadway in the vicinity of the local study area.

Franklin Street

Franklin Street generally travels in an east-to-west direction through the City of Westfield and provides access to commercial and residential land uses. The roadway is classified as an urban principal arterial under local jurisdiction. Franklin Street generally provides two lanes of travel in each direction. Sidewalks are provided on each side of the roadway. The posted speed limit on Franklin Street is 25 miles per hour within the vicinity of the study area.

Westfield Signalized Intersections

Route 202/Route 10 (North Elm Street) at Arch Road and Westfield Industrial Park Road

At the intersection of Route 202/Route 10 (North Elm Street at Arch Road and Westfield Industrial Park Road, Route 202/Route 10 provides an exclusive left-turn lane, a through lane, and a shared through/right-turn lane in the northbound direction, and a through lane and shared through/right-turn lane in the southbound direction. Arch Road provides a shared left-turn/through lane, and an exclusive right-turn lane on the eastbound approach and Westfield Industrial Park Road provides one receiving lane. North Elm Street provides a sidewalk on the east side of the roadway. A crosswalk with exclusive pedestrian signalization is provided across Westfield Industrial Park Road. Bicycle lanes are present at the intersection.

Route 202/Route 10 (North Elm Street) at Notre Dame Street

The intersection of North Elm Street at Notre Dame Street currently provides a left-turn lane, a through lane, and a shared through/right-turn lane in the northbound and southbound directions. Notre Dame Street provides a shared through/left-turn lane and an exclusive right-turn lane in the eastbound direction and a general purpose lane in the westbound direction. Crosswalks are available on each of the approaches to the intersection with an exclusive pedestrian phase. Bicycle sharrows are present on each of the approaches to the intersection.

Elm Street at Franklin Street and Mobil Gas Station Driveway

At its intersection with Franklin Street, Elm Street provides an exclusive left-turn lane and a shared through/right-turn lane in the northbound direction, and two through lanes and an exclusive right-turn lane in the southbound direction. Franklin Street provides a shared through/left-turn lane, and an exclusive right turn lane in the eastbound direction. The Mobil Gas Station Driveway provides entrance only access. Sidewalks are provided on both sides of each of the approaching roadways to the intersection. Crosswalks are provided across the Franklin Street approach and the northbound Elm Street approach. An exclusive pedestrian phase is provided at the intersection.

2.8.3 Traffic Counts

A comprehensive traffic counting program was developed in order to support analysis and modeling efforts for the study. Daily Automatic Traffic Recorder (ATRs) were used on selected roadway segments to gather traffic volumes. ATRs are pneumatic tubes that are laid across a roadway perpendicular to the direction of travel. A recording device stores the number of vehicles that pass over the tubes during certain intervals. Turning Movement Counts (TMCs) were also collected as part of the program. TMCs provide the data necessary to analyze delay and queuing at an intersection, which allows the study team to assign a level of service (LOS) to a location during network operations analysis.

Locations for traffic counts were selected based on anticipated study needs and to validate existing and historic traffic count data contained in the MassDOT Transportation Data Management System (TDMS). Since traffic counts are generally conducted before alternatives development, the study team, with guidance from the Working Group, assessed the roadway network and programed counts for the seemingly most influential intersections. Should an interchange project advance, a more robust traffic counting program would be performed. The list of traffic count locations used for this study is provided below and illustrated in Figure 2-50.

Automatic Traffic Recorder (ATR) Count Locations

Roadways Intersecting I-90 in Study Area

- Werden Road, Becket
- Johnson Road, Becket
- Algerie Road, Otis
- Chester Road and Old Chester Road, Blandford
- North Street, Blandford

I-90 Ramps

- Exit 2 on and off-ramps, Lee
- Exit 3 on and off-ramps, Westfield

- Entrance and exit lanes of both eastbound and westbound Blandford Rest Stop facilities

<u>Other Roadways</u>

- Route 102 north of Tyringham Road, Lee
- Route 202 both north and south of the I-90 Exit 3 ramps, Westfield
- Route 23 east of North Blandford Road, Blandford
- Route 23 east of North Street, Blandford

Turning Movement Count (TMC) Locations

<u>Lee:</u>

- I-90 Exit 2 On-Ramp/Route 20/Route 102
- I-90 Exit 2 Off-Ramp/Route 20/Big Y Express
- Park Street (Route 20)/Main Street (Route 20)/West Park Street
- Premium Outlet Boulevard/ Housatonic Street (Route 20)
- Tyringham Road/Pleasant Street (Route 102)

<u>Westfield:</u>

- I-90 Exit 3 Ramps /Route 202/Friendly's Way
- Elm Street (Route 20/Route 202/Route 10)/Franklin Street (Route 20)
- North Elm Street (Route 10/Route 202)/Notre Dame Street
- Arch Road/North Elm Street (Route 10/Route 202)
- Servistar Industrial Way and Southampton Road (Route 10/Route 202)

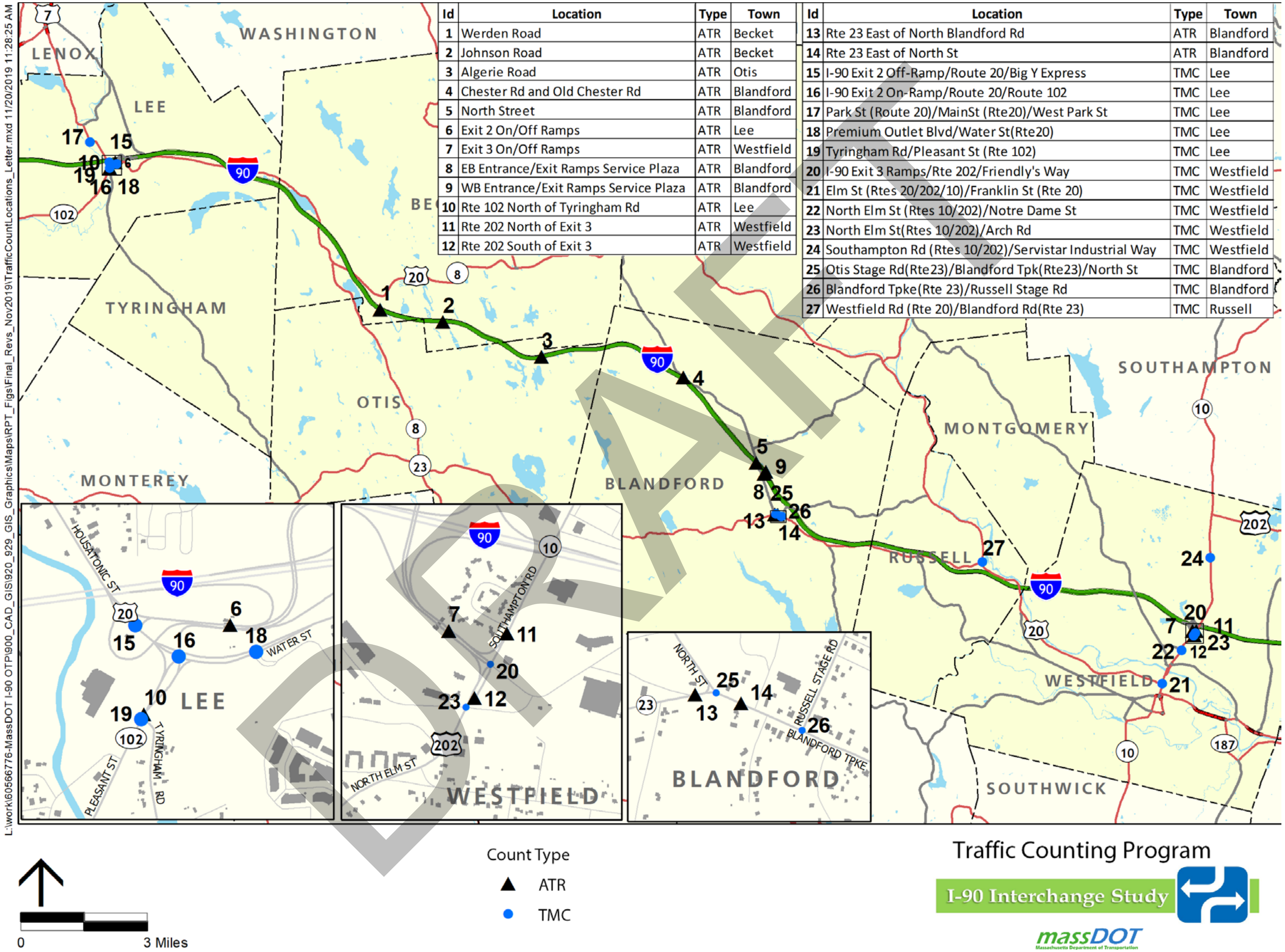
<u>Blandford:</u>

- Otis Stage Road (Route 23)/Main Street (Route 23)/North Street
- Main Street (Route 23)/Russell Stage Road

<u>Russell:</u>

- Westfield Road (Route 20)/Blandford Road (Route 23)

Figure 2-50. Traffic Counting Program



Id	Location	Type	Town
1	Werden Road	ATR	Becket
2	Johnson Road	ATR	Becket
3	Algerie Road	ATR	Otis
4	Chester Rd and Old Chester Rd	ATR	Blandford
5	North Street	ATR	Blandford
6	Exit 2 On/Off Ramps	ATR	Lee
7	Exit 3 On/Off Ramps	ATR	Westfield
8	EB Entrance/Exit Ramps Service Plaza	ATR	Blandford
9	WB Entrance/Exit Ramps Service Plaza	ATR	Blandford
10	Rte 102 North of Tyringham Rd	ATR	Lee
11	Rte 202 North of Exit 3	ATR	Westfield
12	Rte 202 South of Exit 3	ATR	Westfield

Id	Location	Type	Town
13	Rte 23 East of North Blandford Rd	ATR	Blandford
14	Rte 23 East of North St	ATR	Blandford
15	I-90 Exit 2 Off-Ramp/Route 20/Big Y Express	TMC	Lee
16	I-90 Exit 2 On-Ramp/Route 20/Route 102	TMC	Lee
17	Park St (Route 20)/MainSt (Rte20)/West Park St	TMC	Lee
18	Premium Outlet Blvd/Water St(Rte20)	TMC	Lee
19	Tyringham Rd/Pleasant St (Rte 102)	TMC	Lee
20	I-90 Exit 3 Ramps/Rte 202/Friendly's Way	TMC	Westfield
21	Elm St (Rtes 20/202/10)/Franklin St (Rte 20)	TMC	Westfield
22	North Elm St (Rtes 10/202)/Notre Dame St	TMC	Westfield
23	North Elm St(Rtes 10/202)/Arch Rd	TMC	Westfield
24	Southampton Rd (Rtes 10/202)/Servistar Industrial Way	TMC	Westfield
25	Otis Stage Rd(Rte23)/Blandford Tpk(Rte23)/North St	TMC	Blandford
26	Blandford Tpke(Rte 23)/Russell Stage Rd	TMC	Blandford
27	Westfield Rd (Rte 20)/Blandford Rd(Rte 23)	TMC	Russell

Traffic data was collected in May 2018, during a normal, non-holiday period. The ATR data allowed the study team to develop average weekday daily traffic (AWDT), average daily traffic (ADT), as well as Saturday and Sunday daily traffic volumes. This data is summarized for all count locations in Table 2-5. Using the TMC data, the morning (AM) peak hour, weekday evening (PM) peak hour, and Saturday midday peak hour intersection volumes are summarized in Table 2-6. Peak hours represent the one-hour time period that experiences the highest traffic volume on a particular facility. Generally, the morning peak hour throughout roadway facilities in study area is 7:00AM – 8:00AM, while the evening peak hour is 4:00PM – 5:00PM. The following pages also show the Turning Movement Count data for each identified intersection.

Table 2-5. Daily Traffic Volumes at Study Area Locations (vehicles/day)

Location	Town	AWDT	ADT	Saturday	Sunday
Werden Road	Becket	417	400	453	422
Johnson Road	Becket	71	70	27	48
Algerie Road	Otis	665	630	428	415
Chester Rd and Old Chester Rd	Blandford	80	80	NA	NA
North Street	Blandford	916	840	994	706
Exit 2 EB On Ramp	Lee	4,215	4,254	4,062	4,791
Exit 2 EB Off Ramp	Lee	1,628	1,763	1,981	2,260
Exit 2 WB Off Ramp	Lee	4,406	4,319	4,371	4,087
Exit 2 WB On Ramp	Lee	1,605	1,690	1,920	1,955
Exit 3 WB Off Ramp	Westfield	11,040	10,092	8,345	7,123
Exit 3 WB On Ramp	Westfield	1,170	1,111	979	966
Exit 3 EB Off Ramp	Westfield	1,239	1,217	1,077	1,267
Exit 3 EB On Ramp	Westfield	11,180	10,125	8,201	6,804
EB Entrance Ramps Service Plaza	Blandford	1,860	1,927	1,812	2,383
EB Exit Ramps Service Plaza	Blandford	1,814	1,884	1,795	2,347
WB Entrance Ramps Service Plaza	Blandford	2,652	2,702	2,675	3,019
WB Exit Ramps Service Plaza	Blandford	2,781	2,808	2,730	3,119
Rte 102 North of Tyringham Rd	Lee	11,727	10,800	9,298	876
Rte 202 North of Exit 3	Westfield	19,681	18,100	13,570	12,911
Rte 202 South of Exit 3	Westfield	20,714	19,100	16,614	15,038
Rte 23 East of North Blandford Rd	Blandford	2,013	1,900	1,895	1,854
Rte 23 East of North St	Blandford	2,565	2,400	2,557	2,337
Friendlys Way	Westfield	13,517	11,600	10,420	8,722
I-90 Blandford Gantry EB	Blandford	16,208	16,573	14,687	19,551
I-90 Blandford Gantry WB	Blandford	16,751	16,223	15,034	15,828
Industrial Park Rd	Westfield	8,297	7,600	7,337	6,166

AWDT – Average Weekday Traffic (Monday-Friday)
ADT – Average Daily Traffic (Sunday-Saturday)

Table 2-6. Peak Hour Total Intersection Traffic Volumes at Study Area Locations (vehicles/hour)

Location	Town	AM peak hour	PM peak hour	Saturday midday peak hour
I-90 Exit 2 Off-Ramp/Route 20/Big Y Express	Lee	1,191	1,450	1,433
I-90 Exit 2 On-Ramp/Route 20/Route 102	Lee	1,209	1,576	1,747
Park St (Route 20)/Main St (Rte20)/West Park St	Lee	1,313	1,544	1,473
Premium Outlet Blvd/Water St (Rte20)	Lee	501	919	1,147
Tyringham Rd/Pleasant St (Route 102)	Lee	871	1,113	1,077
I-90 Exit 3 Ramps/Route 202/Friendly's Way	Westfield	3,006	2,904	2,214
Elm St (Routes 20/202/10)/Franklin St (Route 20)	Westfield	2,143	2,383	2,158
North Elm St (Routes 10/202)/Notre Dame St	Westfield	2,545	2,841	2,034
North Elm St (Routes 10/202)/Arch Rd	Westfield	2,527	2,884	2,286
Southampton Rd (Routes 10/202)/Servistar Industrial Way	Westfield	1,100	1,385	899
Otis Stage Rd (Route 23)/Blandford Tpk (Route 23)/North St	Blandford	207	236	261
Blandford Tpke (Route 23)/Russell Stage Rd	Blandford	209	250	264
Westfield Rd (Route 20)/Blandford Rd (Route 23)	Russell	592	728	620

Figure 2-51. Existing (2019) ATR Counts

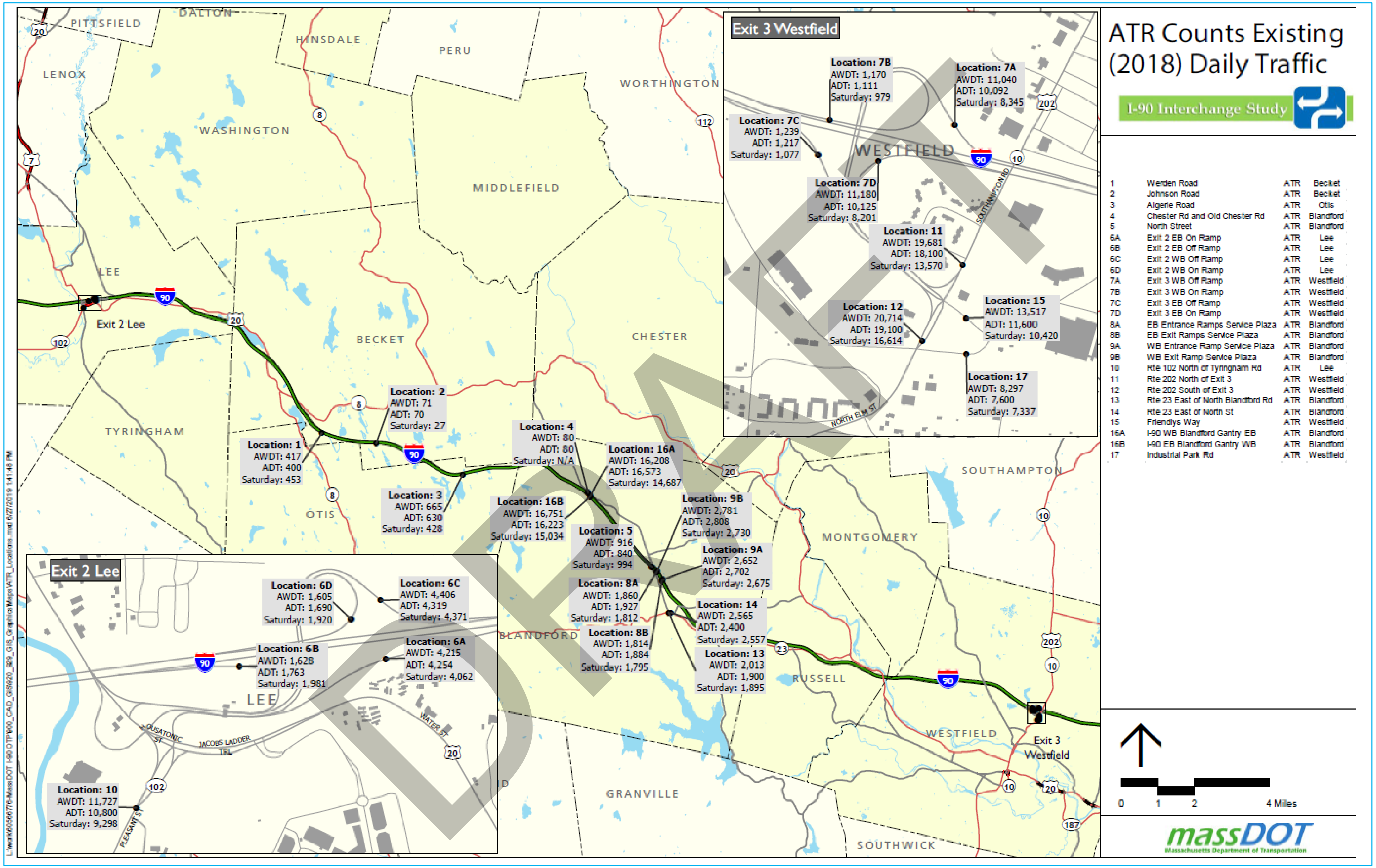


Figure 2-52 Existing (2018) Weekday AM Peak Hour Turning Movement Counts

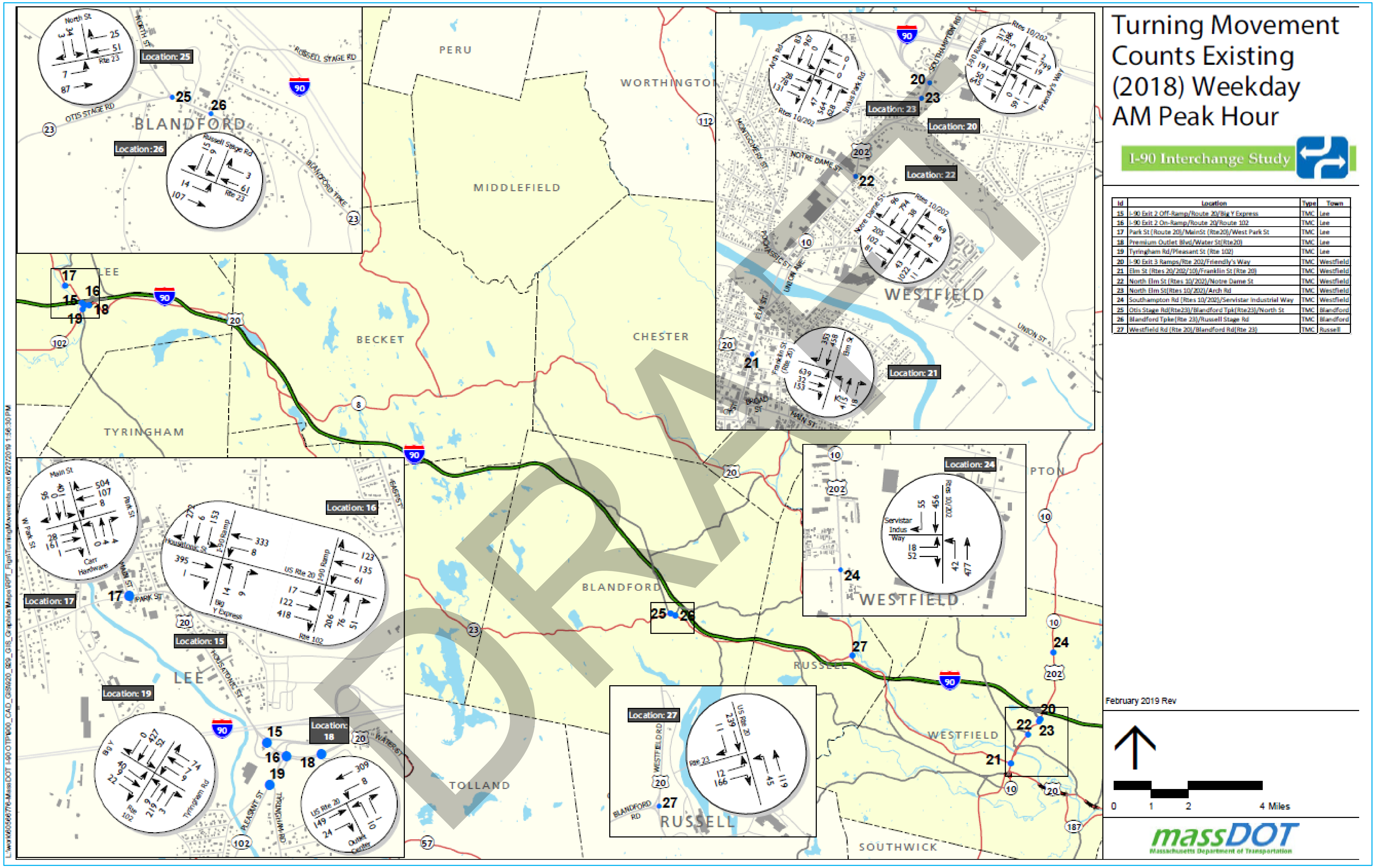


Figure 2-53. Existing (2018) Weekday PM Peak Hour Turning Movement Counts

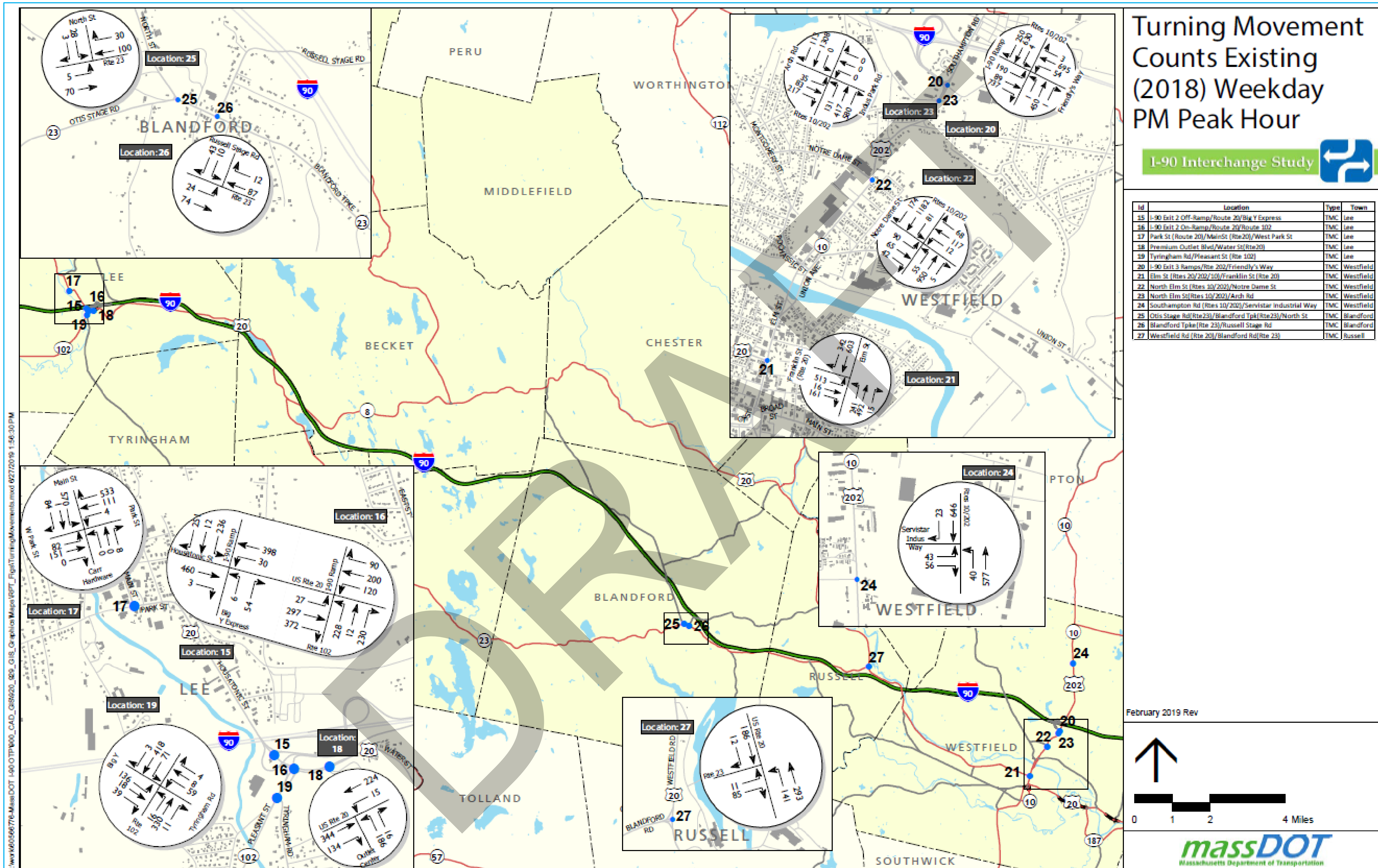
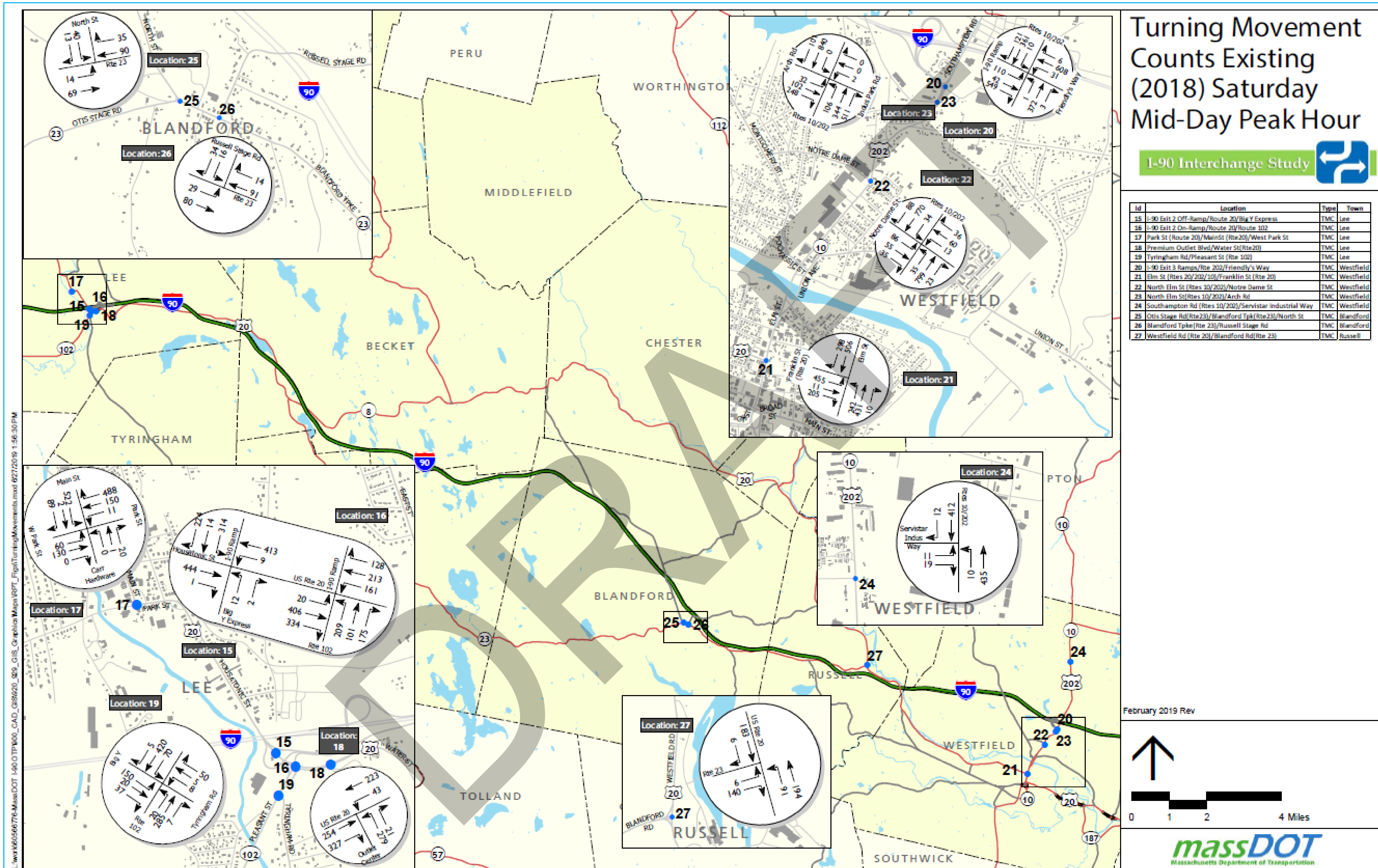


Figure 2-54. Existing (2018) Saturday Midday Peak Hour Turning Movement Counts

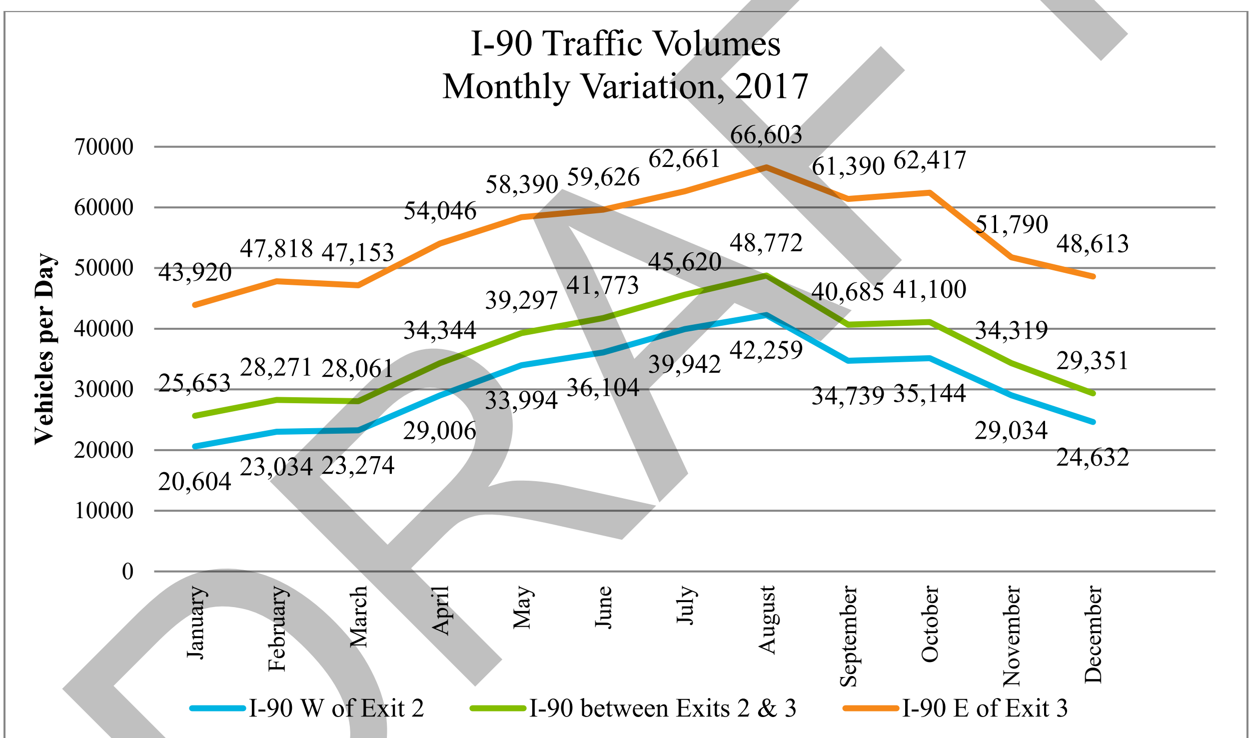


2.8.4 Seasonal Variation in Traffic Volumes

The study area is unique in that its local roadways provide access to summer recreational facilities and activities in the Hilltowns and Berkshires. Moreover, many homes in the study area are secondary homes utilized mostly in the summer season. As a result, regional roadways experience noticeable seasonal variation in traffic, particularly on I-90 and the arterial roadways serving as links between the highway and recreational destinations. While transportation planning is usually conducted for typical conditions, it is helpful to understand the variations that exist between different timeframes in order to make informed decisions.

In order to understand the seasonal variations, traffic data was collected from the three I-90 All-Electronic Tolling (AET) toll gantries located in the study area. These gantries continuously record traffic volumes. AET Station 01 is located West of I-90 Exit 2 (Stockbridge), while AET Station 02 is situated between I-90 Exits 2 and 3 (Blandford), and AET Station 03 is east of I-90 Exit 3 (Westfield). Traffic data was obtained for the entire calendar year of 2017.

Figure 2-55. I-90 Monthly Variation in Traffic Volumes, 2017



As shown in Figure 2-55, all three locations recorded their highest traffic volumes in August. When compared to the annual average daily traffic volume, August exhibited the following peak variations:

- AET Station 01: 36% higher than average
- AET Station 02: 34% higher than average
- AET Station 03: 20% higher than average

To understand seasonal variations on local roadways, select locations from the May 2018 traffic counting program were repeated in August 2018. Table 2-7 compares total traffic volumes between May and August. Meanwhile, Table 2-8 compares traffic volumes at key study area intersections in May and August during peak hours.

Table 2-7. Comparison of May 2018 – August 2018 Daily Traffic Volumes at Selected Study Area Locations

Location	Town	May 2018 AWDT	August 2018 ADT	August 2018 Saturday	August 2018 Sunday	AWDT Change from May 2018	ADT Change from May 2018	Saturday Change from May 2018	Sunday Change from May 2018
Chester Rd and Old Chester Rd	Blandford	80	70	NA	NA	-2.50%	-12.50%	NA	NA
I-90 Exit 2 EB On Ramp	Lee	4,215	5,140	5,471	6,267	15.14%	20.83%	34.69%	30.81%
I-90 Exit 2 EB Off Ramp	Lee	1,628	2,279	2,638	3,316	23.16%	29.27%	33.17%	46.73%
I-90 Exit 2 WB Off Ramp	Lee	4,406	5,243	5,784	4,558	19.77%	21.39%	32.33%	11.52%
I-90 Exit 2 WB On Ramp	Lee	1,605	2,434	2,733	3,011	41.25%	44.02%	42.34%	54.02%
I-90 Exit 3 WB Off Ramp	Westfield	11,040	9,489	7,683	6,581	-5.47%	-5.98%	-7.93%	-7.61%
I-90 Exit 3 WB On Ramp	Westfield	1,170	NA	NA	NA	NA	NA	NA	NA
I-90 Exit 3 EB Off Ramp	Westfield	1,239	1,285	1,123	1,323	5.89%	5.59%	4.27%	4.42%
I-90 Exit 3 EB On Ramp	Westfield	11,180	8,238	7,056	6,045	-20.24%	-18.64%	-13.96%	-11.16%
I-90 EB Entrance Ramps Service Plaza	Blandford	1,860	2,388	2,546	3,337	16.61%	23.92%	40.51%	40.03%
I-90 EB Exit Ramps Service Plaza	Blandford	1,814	2,354	2,515	3,308	17.75%	24.95%	40.11%	40.95%
I-90 WB Entrance Ramp Service Plaza	Blandford	2,652	3,181	3,604	3,443	14.89%	17.73%	34.73%	14.04%
I-90 WB Exit Ramp Service Plaza	Blandford	2,781	3,151	3,603	3,432	8.34%	12.22%	31.98%	10.04%
Rte 202 North of Exit 3	Westfield	19,681	16,700	13,038	11,280	-6.30%	-7.73%	-3.92%	-12.63%
Rte 202 South of Exit 3	Westfield	20,714	20,100	16,531	14,981	5.68%	5.24%	-0.50%	-0.38%

Table 2-8. May 2018 – August 2018 Peak Hour Intersection Turning Movement Counts at Selected Locations

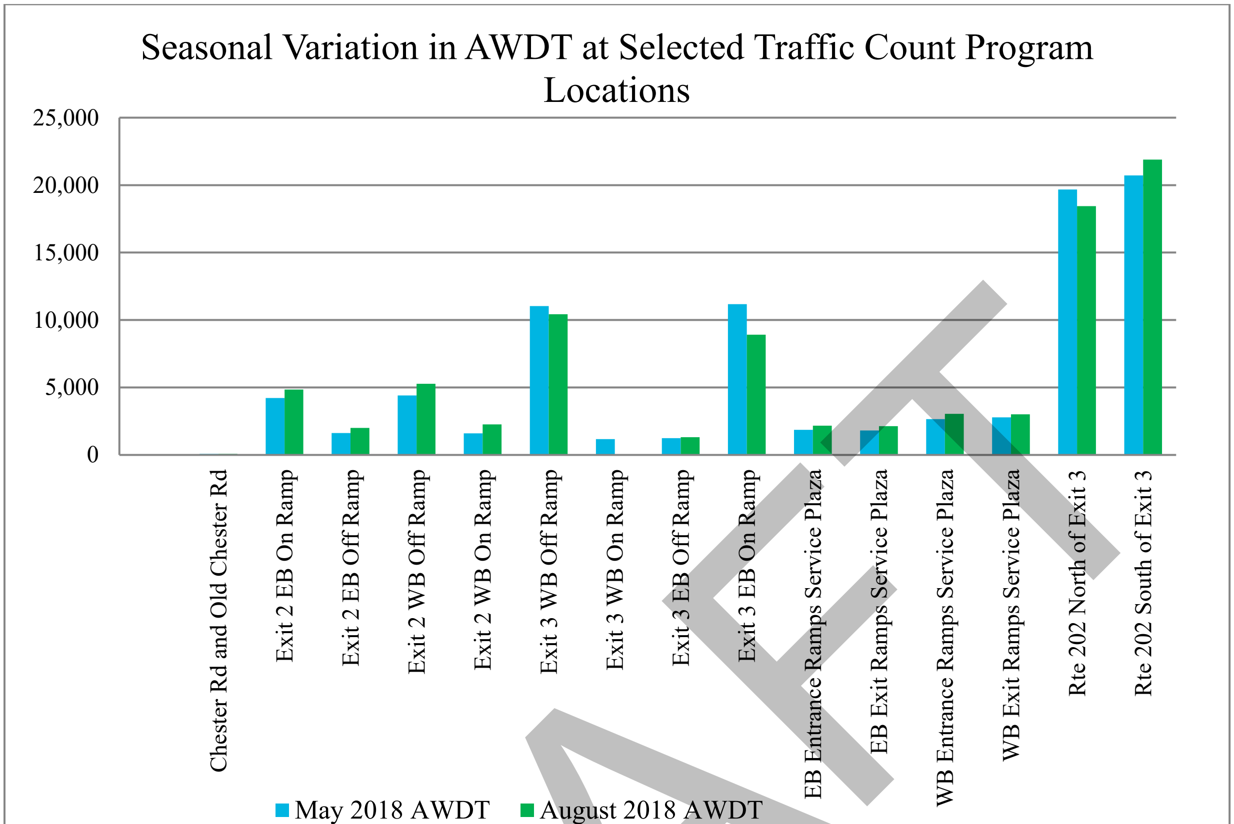
Location	Town	August 2018 AM peak hour	August 2018 PM peak hour	August 2018 Saturday midday peak hour	AM peak change from May 2018	PM peak change from May 2018	Saturday midday peak hour change from May 2018
I-90 Exit 2 Off-Ramp/Route 20/Big Y Express	Lee	1,046	1,554	1,735	-12.17%	7.17%	21.07%
I-90 Exit 2 On-Ramp/Route 20/Route 102	Lee	1,230	1,959	2,145	1.74%	24.30%	22.78%
Park St (Route 20)/Main St (Rte20)/West Park St	Lee	1,166	1,711	1,426	-11.20%	10.82%	-3.19%
I-90 Exit 3 Ramps/Rte 202/Friendly's Way	Westfield	2,436	2,954	1,864	-18.96%	1.72%	-15.81%
Elm St (Rtes 20/202/10)/Franklin St (Rte 20)	Westfield	1,889	2,257	1,817	-11.85%	-5.29%	-15.80%
Southampton Rd (Rtes 10/202)/Servistar Industrial Way	Westfield	1,013	1,330	828	-7.91%	-3.97%	-7.90%

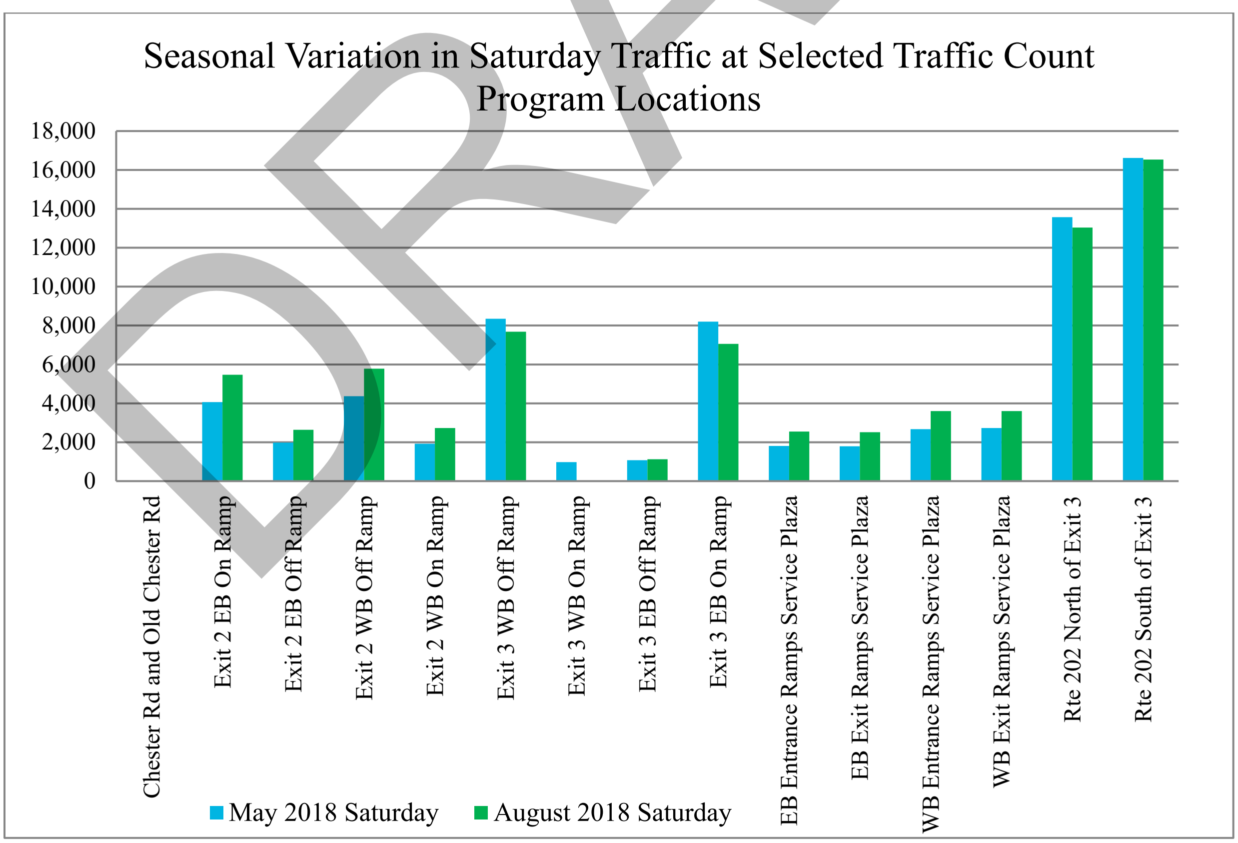
The seasonal variations observed on I-90 in the summer months are reflected in traffic volume increases on some local roadways. In other words, as volumes on I-90 increase, so do volumes on some local roads. Specifically, variations at the I-90 Exit 2 ramps confirm seasonal traffic increases in Lee and Lenox associated with summer recreational opportunities in the Hilltowns and Berkshires. Increases in weekday evening peak hour and Saturday midday peak hour volumes in the vicinity of Exit 2 also reflect increased summer season recreational activity,

Meanwhile, the monthly comparisons at the I-90 Exit 3 ramps show decreases in traffic in the summer months. This may be associated with reduced student activity at Westfield State University and increased usage of vacation time at Westfield employment centers. This pattern is reinforced by reductions in AM and PM peak hour volumes at most Westfield count locations.

As another means of comparison, AWDT for these traffic counts are provided in Figure 2-56 for May and August. A new interchange between Exits 2 and 3 could have a huge impact on seasonal traffic volumes, particularly at the local level. There would be potential for summer traffic to be diverted from Exit 2 to a new exit closer to travelers' summer destinations.

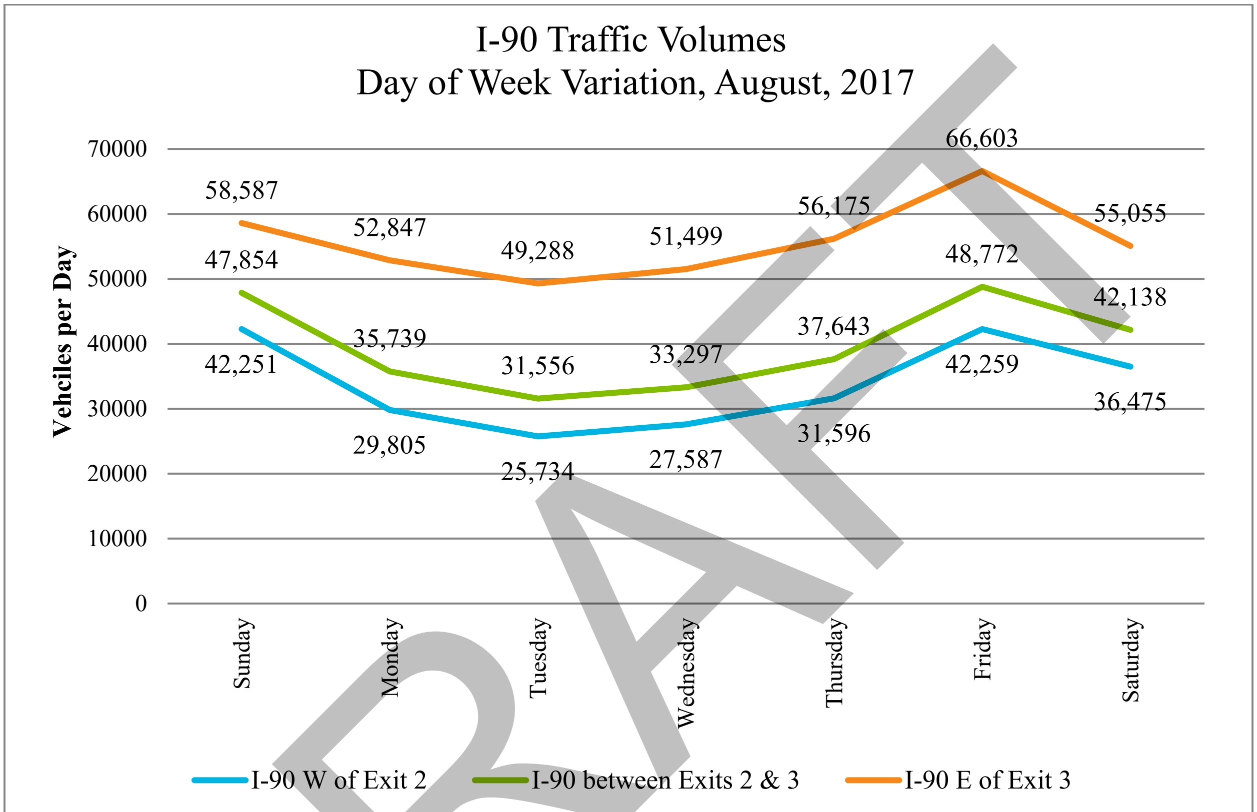
Figure 2-56. Seasonal Variation Charts





Daily variation in traffic is also a key component of seasonal variation, particularly in locations where the annual peak traffic occurs during the summer recreational season. Figure 2-57 illustrates the daily variation in total traffic volumes at the three study area I-90 AET continuous recording stations. Friday observes the highest traffic volumes, trailed closely by Sunday and Saturday. This is a typical summer travel pattern of high Friday volumes associated with weekend travel arrivals, and high Sunday volumes associated with weekend travel departures.

Figure 2-57. I-90 Traffic Volumes, Day of Week Variation, August 2017



2.8.5 Truck Traffic

The traffic counting program included vehicle classification counts in order to identify the percentage of truck traffic within the overall traffic stream. Table 2-9 summarizes the results of the vehicle classification counts. As to be expected, Exits 2 and 3 experience a significant amount of truck traffic, as well as the service plaza in Blandford. The AET gantry between Exits 2 and 3 unsurprisingly sees a similar percentage of truck traffic as the exits. However, Algerie Road in Otis sees the most notable daily truck percentages, with 28% of all trips being trucks.

It is logical to conclude that trucks traveling on local roads like Algerie Road generally have destinations at businesses within the study area, otherwise they would use I-90 to bypass the study area entirely, as it would be faster. Through consultation with the public, the study team learned that some of these local roads are challenging for trucks to traverse due to grade, sight distance, or roadway geometry. For reasons such as this, truck traffic data is important to consider. A new exit could potentially divert trucks from some of these local roads, as they could stay on I-90 longer or reach I-90 faster, rather than traversing local roads.

Table 2-9. Daily Truck Percentages on the Study Area Roadways

Location	Type	Town	Truck % (Daily)
Werden Road	ATR	Becket	3%
Johnson Road	ATR	Becket	15%
Algerie Road	ATR	Otis	28%
Chester Rd and Old Chester Rd	ATR	Blandford	11%
North Street	ATR	Blandford	4%
Exit 2 EB On Ramp	ATR	Lee	10%
Exit 2 EB Off Ramp	ATR	Lee	16%
Exit 2 WB Off Ramp	ATR	Lee	10%
Exit 2 WB On Ramp	ATR	Lee	14%
Exit 3 WB Off Ramp	ATR	Westfield	10%
Exit 3 WB On Ramp	ATR	Westfield	22%
Exit 3 EB Off Ramp	ATR	Westfield	25%
Exit 3 EB On Ramp	ATR	Westfield	10%
EB Entrance Ramps Service Plaza	ATR	Blandford	20%
EB Exit Ramps Service Plaza	ATR	Blandford	20%
WB Entrance Ramps Service Plaza	ATR	Blandford	21%
WB Exit Ramps Service Plaza	ATR	Blandford	20%
Rte 102 North of Tyringham Rd	ATR	Lee	3%
Rte 202 North of Exit 3	ATR	Westfield	8%
Rte 202 South of Exit 3	ATR	Westfield	9%
Rte 23 East of North Blandford Rd	ATR	Blandford	5%
Rte 23 East of North St	ATR	Blandford	4%
Friendly’s Way	ATR	Westfield	9%
I-90 Blandford Gantry EB	ATR	Blandford	21%
I-90 Blandford Gantry WB	ATR	Blandford	22%
Industrial Park Rd	ATR	Westfield	8%

Truck counts were also conducted as part of the peak hour intersection TMCs. The results of those counts are summarized in Table 2-10. During these peak hours, truck traffic is a very small percent of overall traffic volumes. This means that most truck travel occurs outside of peak periods. This is often intentional on the part of truck drivers and companies.

Table 2-10. Peak Hour Truck Percentage at Study Area Intersections

Location	Town	Truck % AM peak hour	Truck % PM peak hour	Truck % Saturday midday peak hour
I-90 Exit 2 Off-Ramp/Route 20/Big Y Express	Lee	9%	4%	2%
I-90 Exit 2 On-Ramp/Route 20/Route 102	Lee	8%	5%	2%
Park St (Route 20)/Main St (Rte20)/West Park St	Lee	8%	4%	2%
Premium Outlet Blvd/Water St(Rte20)	Lee	9%	5%	2%
Tyringham Rd/Pleasant St (Rte 102)	Lee	7%	4%	2%
I-90 Exit 3 Ramps/Rte 202/Friendly's Way	Westfield	9%	5%	3%
Elm St (Rtes 20/202/10)/Franklin St (Rte 20)	Westfield	6%	2%	2%
North Elm St (Rtes 10/202)/Notre Dame St	Westfield	7%	3%	2%
North Elm St(Rtes 10/202)/Arch Rd	Westfield	9%	4%	3%
Southampton Rd (Rtes 10/202)/Servistar Industrial Way	Westfield	10%	7%	7%
Otis Stage Rd(Rte23)/Blandford Tpk(Rte23)/North St	Blandford	6%	5%	2%
Blandford Tpke(Rte 23)/Russell Stage Rd	Blandford	6%	5%	2%
Westfield Rd (Rte 20)/Blandford Rd(Rte 23)	Russell	6%	3%	1%

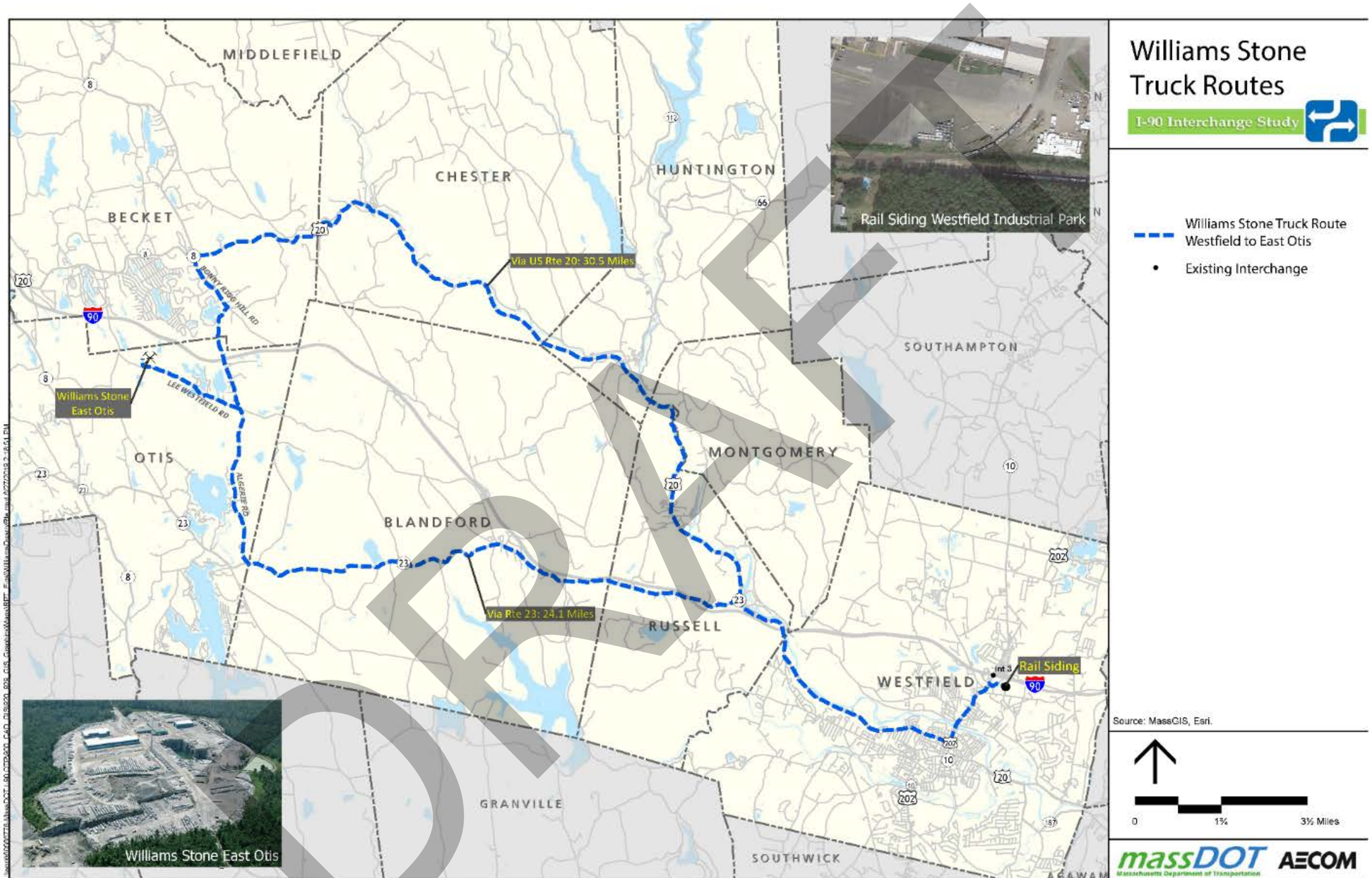
Two specific generators of truck traffic within the study area have been identified as part of study-related outreach and discussion: Williams Stone and Tonlino & Sons Crushed Stone. Williams Stone, located in Otis, frequently sends trucks between the company's facility in East Otis and the railroad siding in Westfield where raw materials (granite) are delivered by rail from their quarries in Georgia. Williams Stone was contacted by the study team to discuss the routes their trucks take to reach their destination.

Figure 2-58 illustrates that Williams Stone trucks get to Westfield by accessing Algerie Road and then using either Route 20 or 23. They receive approximately 15 rail cars of raw materials per week, which requires between 45-50 round-trip truck trips on the local roadway network per week. Transporting their finish product involves approximately 20 truck trips per day. Williams Stone estimates that about 25-33% of these trucks travel west to use Exit 2 in Lee, while the remainder travel east and use Exit 3 in Westfield.

Tonlino & Sons Crushed Stone is located on Algerie Road in Otis and provides materials to the construction industry. Approximately 120 trucks leave their facility per day. Approximately 70% of total trips use Algerie Road to access Route 20 and Route 8 to the north, and 30% use Route 23 to go south.

The combined total of approximately 150 trucks per day on Algerie Road is likely noticeable on the transportation system given that the recorded AWDT is just 665 vehicles per day. The operators of both businesses indicated that a new interchange on I-90 near their facility would result in the majority of their truck trips shifting to I-90 rather than using local roads.

Figure 2-58. Williams Stone Truck Routes



2.8.6 Traffic Desire Lines

A review of the traffic volumes entering and exiting I-90 at Exits 2 and 3 was conducted in an effort to identify existing "desire lines" between I-90 and the study area communities. By tracing the routes of traffic using Exits 2 and 3, an order-of-magnitude understanding of the proportion of traffic from the study area that may be attracted to a new interchange can be estimated. While it is expected that traffic to and from the communities directly served by the existing interchanges (such as Lee and Westfield) will continue to use those interchanges, traffic to and from communities in the center of the study area may divert to a new interchange depending on where it might be located.

Figure 2-59 uses a bandwidth scale to illustrate daily traffic volumes within the study area, excluding I-90. Similarly, Figure 2-60 illustrates the daily interchange volumes at Exit 2 in Lee, while Figure 2-61 illustrates the daily interchanging volumes at Exit 3 in Westfield.

Figure 2-59. Regional Daily Traffic Volume Desire Lines, 2017

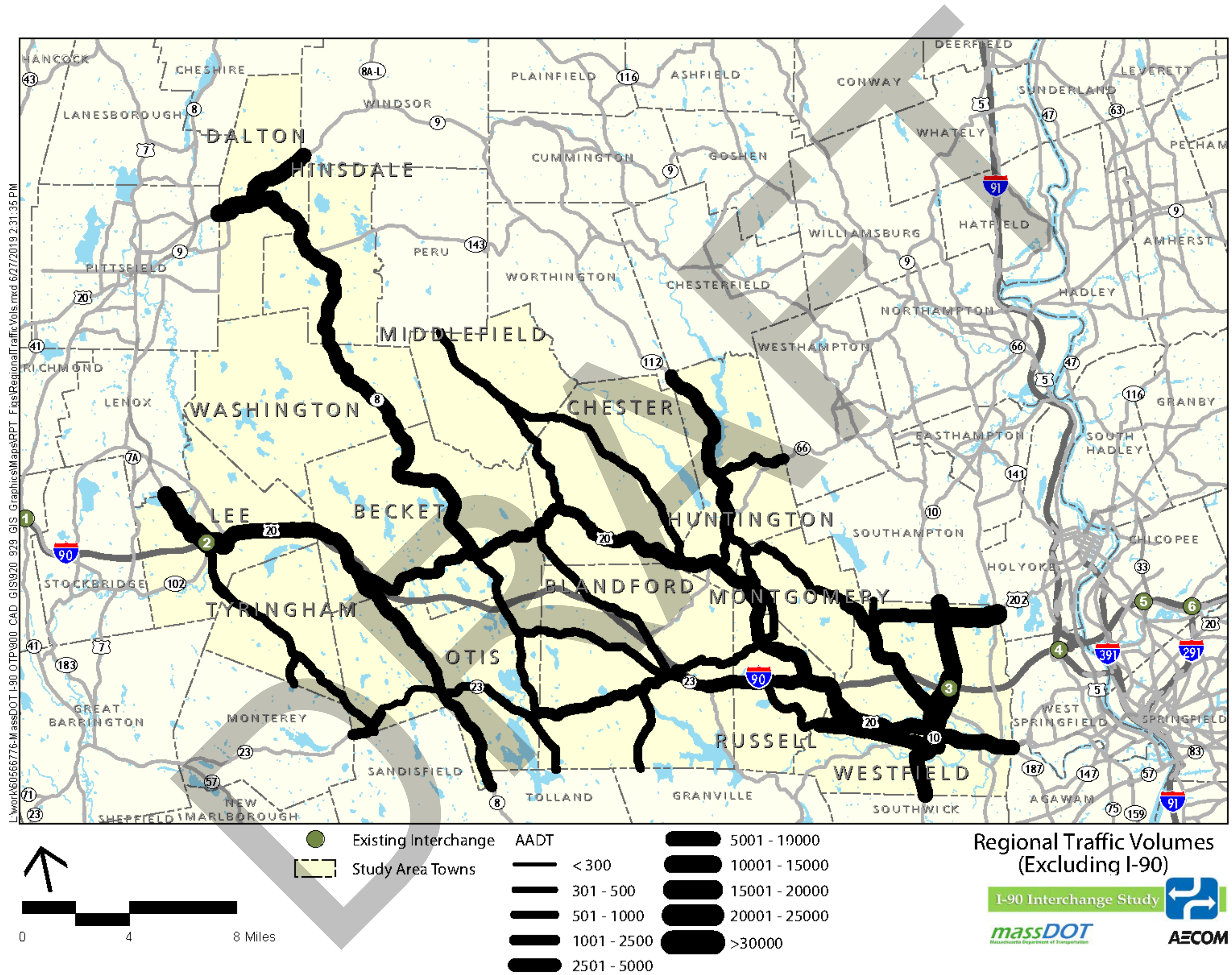
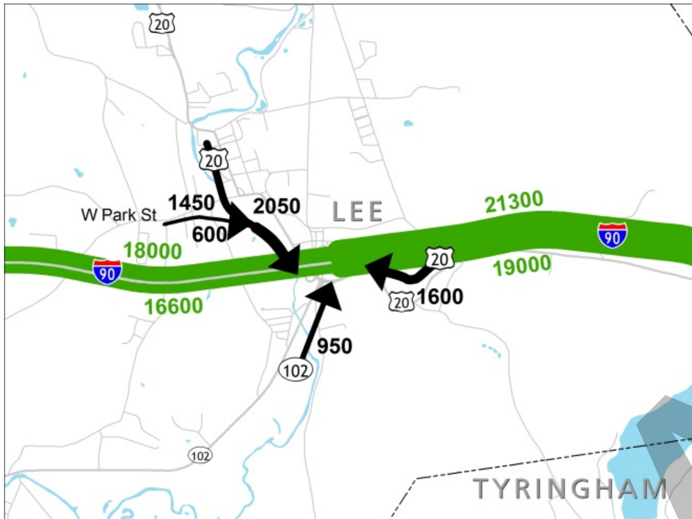
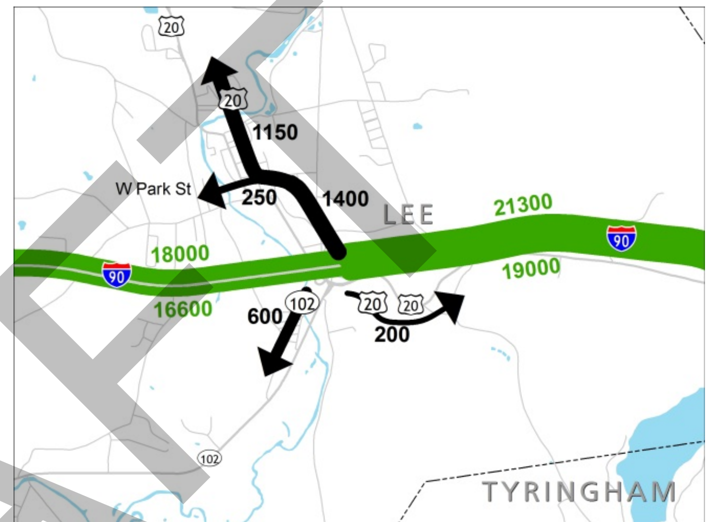


Figure 2-60. Interchange Desire Lines I-90 Exit 2, Lee

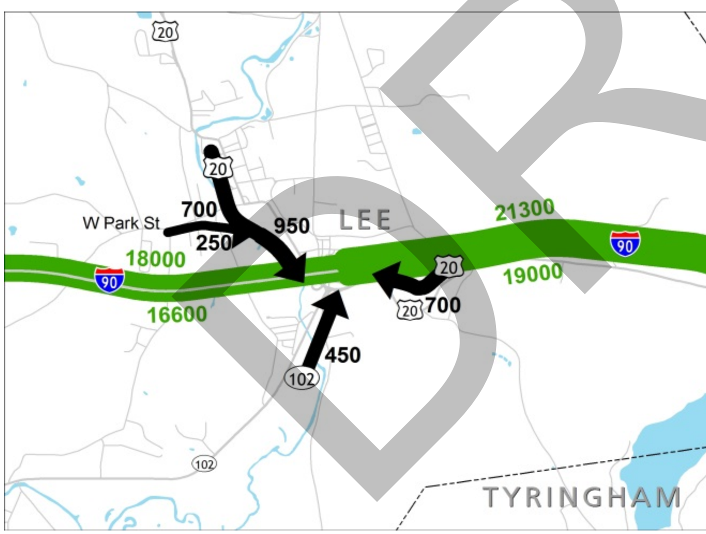
Eastbound On-Ramp Daily Traffic Volumes



Eastbound Off-Ramp Daily Traffic Volumes



Westbound On-Ramp Daily Traffic Volumes



Westbound Off-Ramp Daily Traffic Volumes

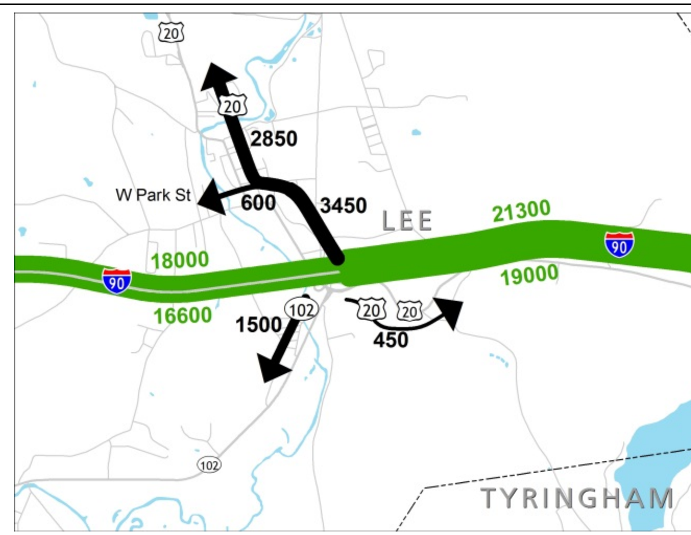
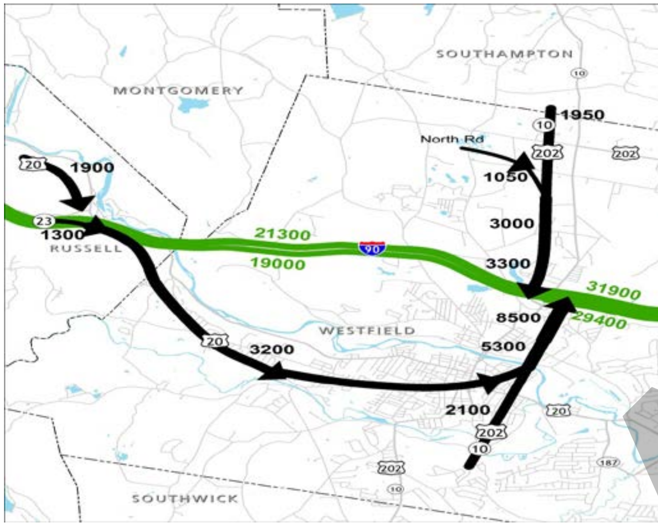
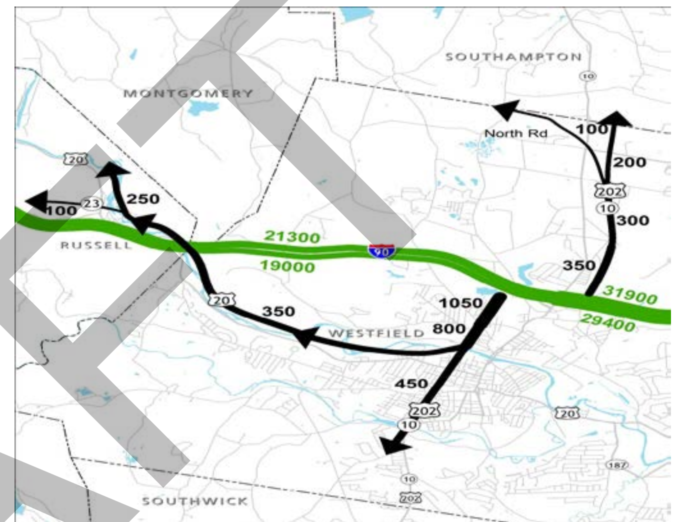


Figure 2-61. Interchange Desire Lines I-90 Exit 3, Westfield

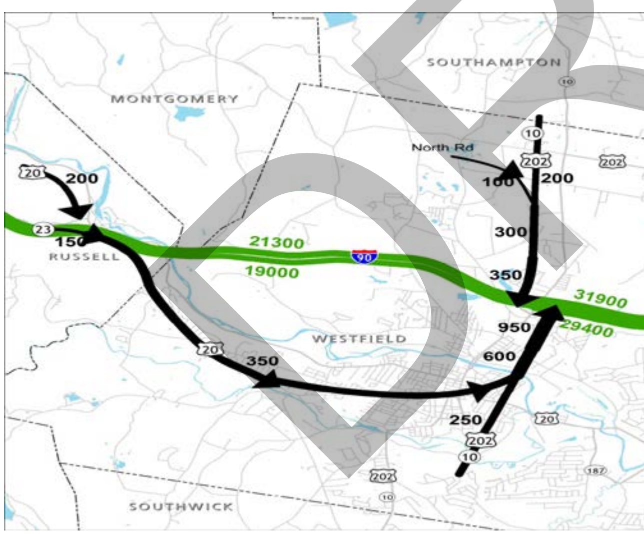
Eastbound On-Ramp Daily Traffic Volumes



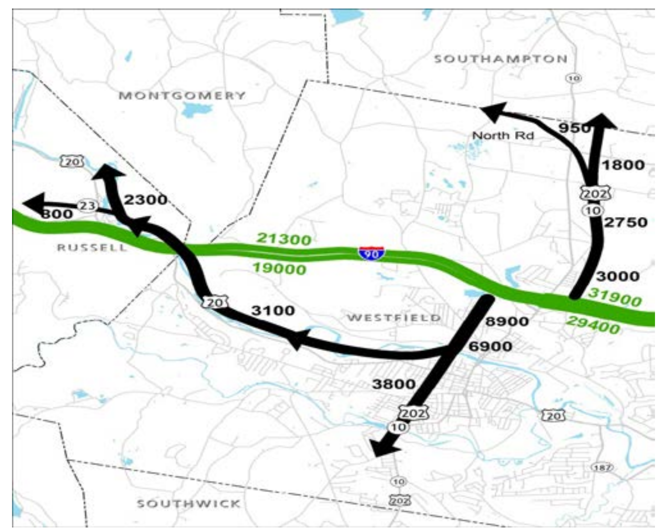
Eastbound Off-Ramp Daily Traffic Volumes



Westbound On-Ramp Daily Traffic Volumes



Westbound Off-Ramp Daily Traffic Volumes



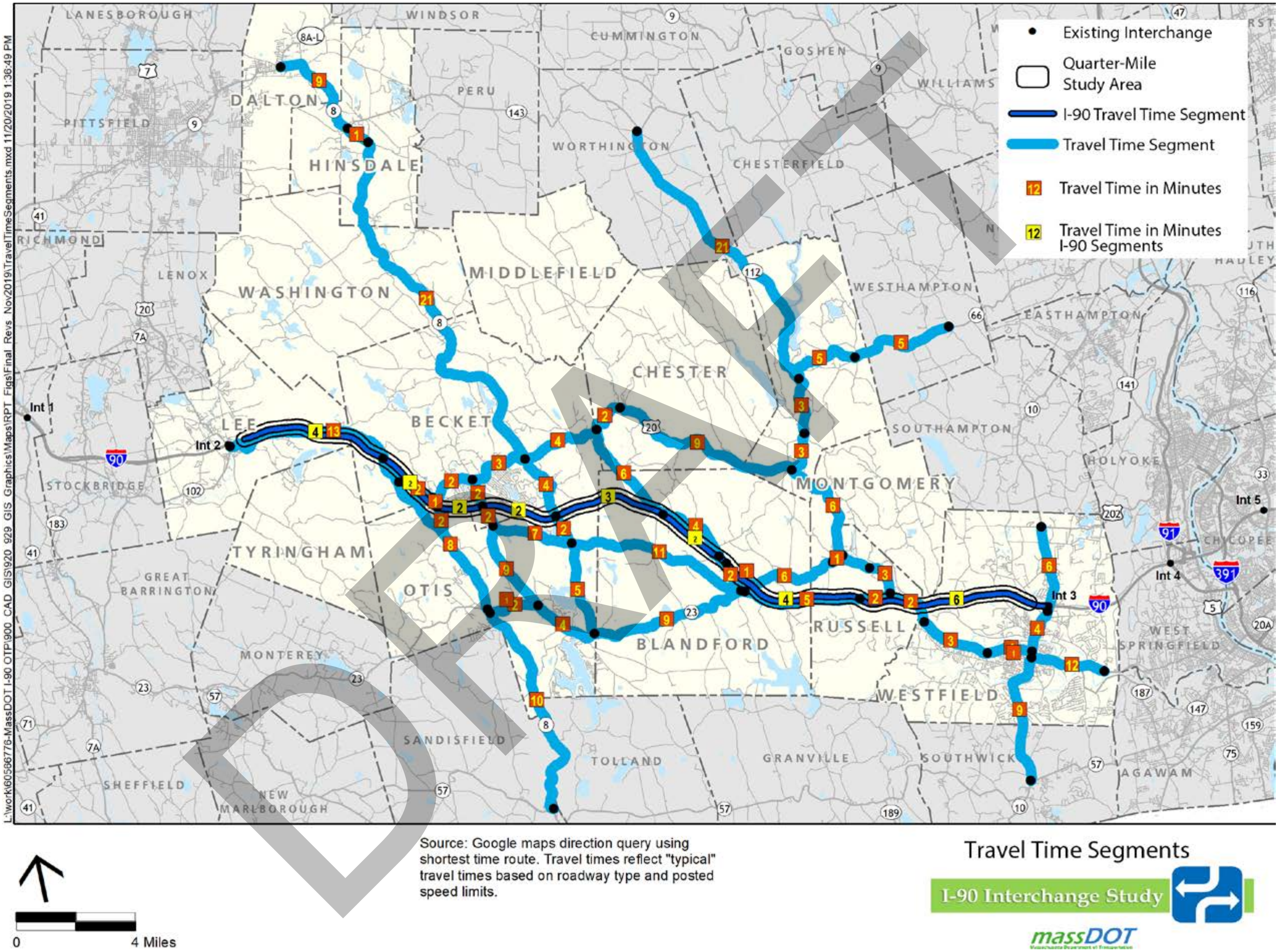
From this analysis, it can be seen that 14,000 vehicles enter and exit I-90 at Exit 2 in Lee per day. Approximately one third of traffic entering I-90 through both the eastbound and westbound on-ramps originates from the center of the study area. Conversely, less than 10% of traffic leaving I-90 through the eastbound or westbound off-ramps is oriented to center. In Westfield, over 26,000 vehicles enter and exit I-90 at Exit 3 each day, combined. Approximately one third of all traffic entering and exiting the highway is oriented to and from the central study area.

2.8.7 Representative Travel Times

A series of travel time calculations were conducted for roadway segments throughout the study area in an effort to identify potential routes to proposed interchange locations, as well as to aid in providing a baseline for regional network modeling. Given the long distances between end-to-end routes, travel times were collected using Google Maps average running times along designated segments. Figure 2-62 illustrates travel time segments on various routes throughout the study area.

The series of segments include potential interchange locations at crossroads under or over I-90. As a result, initial calculations of potential travel time savings can be estimated based on comparisons between existing routes to and from Exits 2 and 3 and potential routes that would allow access to I-90, and eventually be used to calibrate and confirm the results of regional network modeling.

Figure 2-62. Travel Time Segments



2.8.8 Network Operations and Capacity Analysis

Methodology

The analyses of study area network operations used Highway Capacity Manual Software (HCS) to calculate the level of service (LOS) of roadway operations for major highways. Synchro was used to analyze signalized and unsignalized intersection operations and SimTraffic software was used to produce simulations. These traffic analysis techniques are accepted by the Federal Highway Administration (FHWA) and state Departments of Transportation nationwide, including MassDOT.

LOS is a commonly accepted method to measure the efficiency of peak hour traffic operating conditions, and is identified in the Highway Capacity Manual (2016 edition). A LOS analysis utilizes traffic volumes, geometrics, the number of lanes and length of acceleration/deceleration lanes, travel speeds along the mainline and ramps, and the minimum number of lane changes, to assign a rating to an intersection. LOS ranges from A, optimal free-flow conditions, to F, where traffic demand exceeds roadway capacity and/or creates excessive delays.

LOS criteria for interchange ramps is based on density (vehicles per mile per lane) and looks at the interaction of merge and diverge movements with mainline through volumes. Table 2-11 provides interchange level of service criteria.

At signalized and unsignalized intersections, LOS is based primarily on the vehicle delay and queue for various movements within the intersection. Volume-to-capacity relationships also affect how intersections are shown to operate. Thus, both volume/capacity and delay must be considered to evaluate the overall operation of a signalized intersection. In addition, the 95th percentile queue, or design queue, is provided to further clarify operating conditions on individual intersection approaches. Correlation between average delay per vehicle and the respective levels of service for signalized and unsignalized intersections are provided in Table 2-12. Detailed Synchro capacity/queue analysis worksheets for the 2018 Existing Conditions can be found in Appendix C. The results of peak hour signalized intersection capacity analysis at the interchange intersections is summarized in Table 2-14.

The peak hour is identified by the morning (AM) and evening (PM) hour that experiences the highest traffic volumes on a particular facility. Generally, the morning peak hour throughout roadway facilities within the study area is 7:00AM – 8:00AM, while the evening peak hour is 4:00PM – 5:00PM.

Table 2-11. Interchange Level of Service Criteria

Level of Service	Density (vehicles/mile/lane)
LOS A	≤10
LOS B	>10 – 20
LOS C	>20 – 28
LOS D	>28 – 35
LOS E	>35
LOS F	Demand Exceeds Capacity

Table 2-12. Intersection Level of Service Criteria

Level of Service	Signalized Intersections Delay Per Vehicle (seconds)	Unsignalized Intersections Delay Per Vehicle (seconds)
A	< 10.0	0 to 10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F	> 80.0	> 50.0

Existing Interchange Ramps

LOS was identified for existing operating conditions at both Exits 2 and 3 on I-90. Analysis results are summarized for the interchange movements below in Table 2-13. Acceptable operating conditions are exhibited for all interchange merge and diverge movements at both Exit 2 in Lee and Exit 3 in Westfield.

Table 2-13. Existing (2018) Conditions Peak Hour Interchange Analysis

Location	Type	Segment	AM peak hour		PM peak hour	
			LOS	Density	LOS	Density
I-90/Exit 2	Diverge	I-90 EB	A	6.9	A	9.9
I-90/Exit 2	Merge	I-90 EB	A	8.2	B	12.9
I-90/Exit 2	Diverge	I-90 WB	A	7.8	B	11.1
I-90/Exit 2	Merge	I-90 WB	B	6.9	B	10.2
I-90/Exit 3	Diverge	I-90 EB	A	5.9	A	5.9
I-90/Exit 3	Merge	I-90 EB	B	14.2	B	18.5
I-90/Exit 3	Diverge	I-90 WB	B	13.9	B	18.3
I-90/Exit 3	Merge	I-90 WB	A	7.9	B	10.9

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound

Existing Signalized Intersections

A detailed capacity and LOS analysis was performed based on the 2018 weekday AM and PM peak hour traffic volumes at the selected study area signalized intersections. The analysis results are summarized in Table 2-14 and described in detail below. A discussion of the overall quality of the traffic flow at the local study area intersections during the weekday morning and afternoon peak hours is included. The intersections that connect to the I-90 Exits 2 and 3 on and off ramps were examined. Overall delay at these intersections is slightly higher during the PM peak hour, reflecting higher intersection volumes during that time period. Specific turning movements at many intersections exhibit increased traffic and should be monitored to identify future improvements as necessary.

During the AM peak hour at the I-90 Exit 2/Route 20/Route 102 intersection, high left-turn volumes on the Route 102 northbound approach result in reported queues approaching 200 feet (8-10 vehicles) during a normal signal cycle. This condition worsens during the PM peak hour, when LOS decreases from D to E (approaching failure conditions for this movement) due to further left-turn increases. Queues on this approach also increase to nearly 270 feet (10-13 vehicles).

At the I-90 Exit 3/Southampton Road/Friendly’s Way intersection, critical movements exist during the AM peak hour on Southampton Road (NB thru), the I-90 Exit 3 off-ramp (EB right), and Friendly's Way (WB thru). All exhibit queues over 200 feet due to high volumes, especially the Friendly's Way movement to the I-90 Exit 3 on-ramp (567 feet, or 22-28 vehicles). During the PM peak hour, returning movements from the AM peak hour influence congestion at the Northampton Road southbound approach, while congestion is still exhibited on the Friendly's Way (WB thru) and I-90 Exit 3 off-ramp (EB right) movements. The highest reported queues during the PM peak hour are 625 feet (25-31 vehicles) on the I-90 Exit 3 off-ramp (EB right) approach.

Local Signalized Intersections

Lee – Route 102 (Pleasant Street) at Tyringham Road and Big Y Plaza

Based on a review of the capacity analysis, the signalized intersection of Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza is shown to currently operate at overall LOS B during the weekday morning and weekday afternoon peak hours. Each movement at the intersection is shown to operate under capacity. During both peak hours studied, all movements are shown to operate at LOS C or better.

Lee - Route 20 at Premium Outlet Boulevard

Under the 2018 Existing capacity analysis, the intersection of Route 20 at Premium Outlet Boulevard is shown to operate at overall LOS A during each peak hour studied. The intersection movements are shown to operate at LOS B or better and well under capacity. The Route 20 approaches are shown to operate at LOS A during the weekday morning and weekday afternoon peak hours.

Westfield - Route 202/Route 10 (North Elm Street) at Arch Road and Westfield Industrial Park Road

The intersection of Route 202/Route 10 (North Elm Street) at Arch Road and Westfield Industrial Park Road is shown to currently operate at overall LOS B during the weekday morning and weekday afternoon peak hours. The intersection is controlled by peer-to-peer signal control with the master intersection at the intersection of Route 202/Route 10 (North Elm Street) and the Interstate 90 Ramps directly to the north.

Westfield - North Elm Street (Route 202/Route 10) at Notre Dame Street

Based on a review of the 2018 Existing capacity analysis, the intersection of North Elm Street (Route 202/Route 10) at Notre Dame Street is shown to operate at overall LOS D during both peak hours studied. Each movement at the intersection is shown to operate under capacity during the weekday morning peak hour and all movements but the southbound through movement are shown to operate under capacity during the weekday afternoon peak hour.

Westfield - Elm Street at Franklin Street and Mobil Gas Station Driveway

The intersection of Elm Street at Franklin Street and Mobil Gas Station Driveway is shown to operate at overall LOS D during both the weekday morning and weekday afternoon peak hours.

Local Unsignalized Intersections

The LOS analysis results for the study area unsignalized intersections are summarized in Table 2-15 and described in detail below.

Lee - West Park Street at Park Street/ Route 20 (Main Street)

The capacity analysis indicates that under the 2018 Existing conditions, the critical eastbound West Park Street shared through and right-turn movement operates at LOS F during both peak hours and over capacity. The westbound through movement is also shown to operate at LOS F during both peak periods. The southbound movement is free from Route 20 and is shown to operate at LOS A and well under capacity.

Blandford - Route 23 (Otis Stage Road/Main Street) at North Street

Under the 2018 Existing conditions, the critical southbound North Street approach is shown to operate at LOS B and well under capacity during both peak hours. The intersection is shown to operate at LOS A with minimal delay.

Blandford – Route 23 (Main Street) at Russell Stage Road

The critical southbound Russell Stage Road approach to Route 23 (Main Street) is under stop control and is shown to operate at LOS A and well under capacity during the weekday morning and weekday afternoon peak hours. Route 23 is shown to operate at LOS A with minimal delay.

Russell - Route 20 (Westfield Road) at Route 23 (Blandford Road)

Under the 2018 Existing conditions, the critical eastbound left-turn movement from Route 23 to Route 20 is shown to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday afternoon peak hour. The eastbound left-turn movement is shown to operate with minimal delay during both peak hours.

Westfield - Route 202/Route 10 (Southampton Road) at Servistar Industrial Way

The critical eastbound Servistar Industrial Way approach is under stop control and is shown to operate at LOS C during the weekday morning peak hour and at LOS F during the weekday afternoon peak hour and over capacity. The Route 202/Route 10 approach to its intersection with Servistar Industrial Way is shown to operate at LOS A with minimal delay.

Table 2-14. Existing Year (2018) Conditions/Signalized Intersections LOS Analysis, Peak Hours

Intersection	Existing (2018)					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee - Route 20 & I-90 Exit 2	A	9.5		B	16.5	
Route 20 EB Thru	A	3.1	45	A	4.6	74
I-90 Ramp SB Left	D	43.7	78	B	18.5	123
Route 20 WB Thru	A	3.8	55	D	47.8	110
Lee - Route 102/I-90 Exit 2 Entrance & Route 20	B	18.0		A	7.0	132
Route 102 NB Left	D	51.3	195	C	27.1	
Route 102 NB Thru	D	37.0	80	E	79.1	267
Route 102 NB Right	A	1.2	0	D	35.7	23
Route 20 EB Left	D	37.6	24	A	8.7	58
Route 20 EB Thru	B	12	43	D	50.8	39
Route 20 EB Right	A	6.8	135	B	11.1	164
Route 20 WB Left	D	46.5	77	D	50.6	136
Route 20 WB Thru	A	5	38	A	8	64
Westfield - Southampton Rd. (Route 10/202) & Friendly's Way/I-90 Exit 3	C	29.5		D	36.3	
Southampton Rd NB Thru	D	42.8	243	C	33.9	196
I-90 Ramp EB Left	D	47.4	177	D	48.0	179
I-90 Ramp EB Thru	B	17.1	48	B	18.4	78
I-90 Ramp EB Right	B	12.0	411	D	51.5	625
Northampton Rd SB Thru	D	46	11	D	45.2	13
Northampton Rd SB Right	C	32	120	C	34.4	226
Friendly's Way WB Left	A	5.1	50	A	5.1	30
Friendly's Way WB Thru	D	48.3	29	D	49.9	71

Intersection	Existing (2018)					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee - Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza	B	14.3		B	19.3	
Big Y Driveway EB Left	C	26.2	54	C	28.9	35
Big Y Driveway EB Thru/Right	B	14.6	26	B	13.4	4
Tyringham Road WB Left	C	24.6	19	C	25.3	15
Tyringham Road WB Thru/Right	B	10.4	33	C	20.6	2
Route 102 NB Left	A	8.2	12	B	10.2	2
Route 102 NB Thru/Right	B	15.2	173	C	20.4	76
Route 102 SB Left	A	7.8	39	A	9.9	7
Route 102 SB Thru/Right	B	14.1	359	B	16.9	64
Lee - Route 20 at Premium Outlet Boulevard	A	2.5		A	9.0	
Route 20 EB Thru/Right	A	2.9	27	A	8.7	26
Route 20 WB Left	A	1.4	3	A	4.4	1
Route 20 WB Thru	A	1.6	57	A	7.2	24
Premium Outlets NB Left/Right	B	13.5	5	B	12.0	13
Westfield - North Elm Street (Route 202/Route 10) at Arch Road and Industrial Park Road	B	14.1		B	18.7	
Arch Road EB Left/Thru	E	65.4	142	E	65.0	121
Arch Road EB Right	A	6.9	37	A	8.6	23
Rtes. 10/202 NB Left	E	57.1	79	E	68.5	105
Rtes. 10/202 NB Thru/Right	A	6.2	317	A	4.5	65
Rtes. 10/202 SB Thru/Right	B	16.2	457	C	21.2	374

Intersection	Existing (2018)					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Westfield - North Elm Street (Route 202/Route 10) at Notre Dame Street	D	43.1		D	47.7	
Notre Dame St. EB Left/Thru	E	59.5	566	D	46.8	94
Notre Dame St. EB Right	B	13.0	29	A	8.7	0
Notre Dame St. WB Left/Thru/Right	C	29.7	170	D	39.0	124
Rtes. 10/202 NB Left	C	25.0	57	C	26.4	19
Rtes. 10/202 NB Thru/Right	D	43.1	795	D	36.3	302
Rtes. 10/202 SB Left	C	26.7	51	C	25.0	29
Rtes. 10/202 SB Thru/Right	D	44.6	651	E	60.4	539
Westfield - Elm Street at Franklin Street and Mobil Gas Station	D	51.2		D	72.4	
Franklin Street EB Left/Thru	F	89.7	761	D	48.5	353
Franklin Street EB Right	A	3.0	34	A	3.0	0
Elm Street NB Left	C	27.1	72	F	86.8	142
Elm Street NB Thru/Right	C	31.7	442	D	39.5	296
Elm Street SB Thru	E	73.5	287	F	172.3	274
Elm Street SB Right	A	2.1	28	A	2.1	1

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 2-15. Local Intersections/Unsignalized Intersection Capacity Analysis Results

Intersection	No-Build AM Peak Hour LOS	AM Delay (sec)	AM 95% Queue Length (ft)	No-Build PM Peak Hour LOS	PM Delay (sec)	PM 95% Queue Length (ft)
Lee						
West Park Street at Park Street/Main Street	E	46.5		F	322.3	
West Park Street EB Left	F	306.9	94	F	n/a	n/a
West Park Street EB Thru	F	165.7	278	F	453.5	371
Park Street WB Thru	D	25.2	210	F	413.8	1173
Main Street SB Left/Thru/Right	A	7.0	29	A	7.9	45
Becket						
Route 20 at Bonny Rigg Hill Road (Route 8)	A	4		A	1.9	
Route 20 EB Left/Thru/Right	A	0.4	0	A	0.6	0
Route 20 WB Left/Thru	A	7.6	0	A	7.5	0
Route 20 WB Right	A	0	0	A	0	0
Bonny Rigg Hill Road NB Left/Thru/Right	B	10.2	0	B	10.3	0
Main Street SB Left/Thru	B	11.1	3	B	10.9	3
Main Street SB Right	A	8.9	13	A	9.2	5

Intersection	No-Build AM Peak Hour LOS	AM Delay (sec)	AM 95% Queue Length (ft)	No-Build PM Peak Hour LOS	PM Delay (sec)	PM 95% Queue Length (ft)
Blandford						
Otis Stage Road/Main Street (Route 23) at North Street	A	1.9		A	1.6	
Route 23 EB Left/Thru	A	0.6	0	A	0.5	0
Route 23 WB Thru/Right	A	0.0	0	A	0.0	0
North Street SB Left/Right	B	10.0	5	B	10.4	5
Main Street (Route 23) at Russell Stage Road	A	1.9		A	2.9	
Route 23 EB Left/Thru	A	0.9	0	A	1.9	3
Route 23 WB Thru/Right	A	0.0	0	A	0.0	0
Russell Stage Road SB Left/Right	A	9.4	3	A	9.6	8
Russell						
Westfield Road (Route 20) at Blandford Road (Route 23)	A	4.4		A	3.1	
Route 23 EB Left	B	12.3	3	C	17.7	3
Route 23 EB Right	B	11.3	25	B	10.0	10
Route 20 NB Left	A	8.0	3	A	8.0	10
Route 20 NB Through	A	0.0	0	A	0.0	0
Route 20 SB Thru	A	0.0	0	A	0.0	0
Route 20 SB Right	A	0.0	0	A	0.0	0

Intersection	No-Build AM Peak Hour LOS	AM Delay (sec)	AM 95% Queue Length (ft)	No-Build PM Peak Hour LOS	PM Delay (sec)	PM 95% Queue Length (ft)
Westfield						
Southampton Road (Route 202/Route 10) at Servistar Industrial Way	A	1.9		A	15.2	
Servistar Ind. Way EB Left/Right	C	21.8	33	F	119.3	225
Route 202/10 NB Left/Thru	A	0.7	5	A	0.6	5
Route 202/10 SB Thru/Right	A	0.0	0	A	0.0	0

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

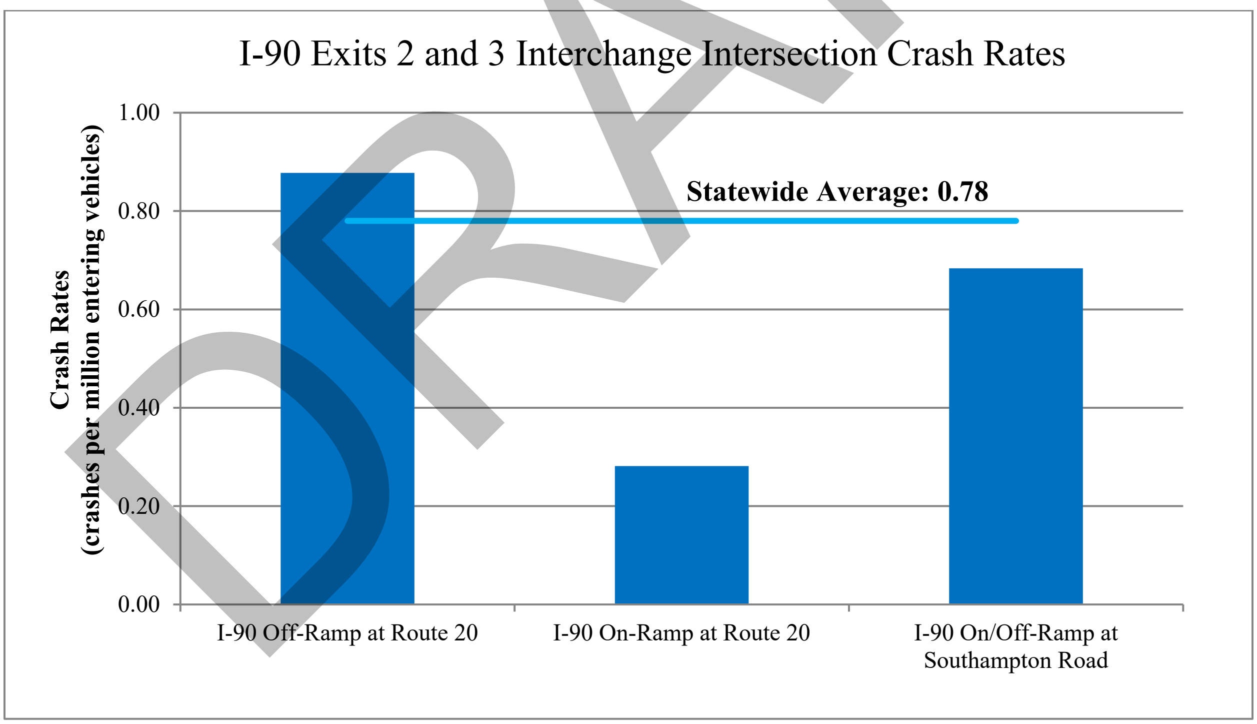
2.8.9 Crash Data

Existing Interchange Ramps

Crash data for the interchanges at I-90 Exits 2 and 3 was obtained from MassDOT for the most recent five-year period available, 2011-2015. A summary of the crash data for each local study area intersection is presented in Appendix D. It should be noted that the crash data used for analysis of these locations reflects a time period prior to the recent demolition of the I-90 toll plazas done as part of the All-Electronic Tolling (AET) program. This work, completed in 2017, may result in different traffic patterns that should be monitored for effectiveness in providing safer operating conditions in the future.

The MassDOT Crash Rate Worksheet was used to determine whether the crash frequencies at the study area intersections were unusually high given the travel demands at each location. The worksheet calculates a crash rate expressed in crashes per Million Entering Vehicles (MEV). The calculated rates were then compared to the average rate for signalized intersections statewide (0.78 crashes per MEV) and within MassDOT District 1 (0.80) and District 2 (0.89). Crash rates for unsignalized intersections statewide are 0.57 MEV, while Districts 1 and 2 exhibit rates of 0.44 MEV and 0.62 MEV, respectively. Due to low sample size in District 1, MassDOT guidance recommends using state averages to compare crash rates. The crash rates for each interchange intersection are shown in Figure 2-63. The calculated crash rates for each intersection are shown in reference to the statewide average noted above.

Figure 2-63. I-90 Exits 2 and 3 Interchange Intersection Crash Rates



Based on this analysis, the crash rate for each of the intersections within the local study area is below the statewide average rate except for the intersection of I-90 Exit Ramp & Route 20 in Lee. MassDOT Crash Rate Worksheets are provided in Appendix D.

Lee

The intersection of Route 20 and the I-90 Exit 2 off-ramps is shown to have experienced 20 crashes between 2011 and 2015. The resulting crash rate of 0.88 crashes per million entering vehicles is above the statewide and District 1 averages for signalized intersections. Of the reported crashes at this intersection, sixteen were rear-end crashes, two were angle crashes, and two were side-swipe crashes. 17 crashes resulted in property damage and three resulted in personal injury.

The intersection of Route 20 and the I-90 Exit 2 on- ramps is shown to have experienced nine crashes between 2011 and 2015. The resulting crash rate of 0.28 crashes per million entering vehicles is below the statewide and District 1 averages for signalized intersections. Of the reported crashes at this intersection, three were rear-end crashes, one was an angle crash, one was a single vehicle crash, and one was a head-on collision. All of the 9 reported crashes resulted in property damage only. This interchange location is identified by MassDOT as a Highway Safety Improvement Program (HSIP) crash cluster.

Westfield

The intersection of Route 202/Route 10 (Southampton Road) and I-90 Entrance/Exit Ramps and Friendly's Way is shown to have experienced 43 crashes between 2011 and 2015. The resulting crash rate of 0.68 crashes per million is below the District 2 average for signalized intersections. Of the reported crashes at this intersection, 15 were rear-end crashes, 13 were angle crashes, six were single vehicle crashes, and nine were side swipe collisions. Of the 43 crashes at this intersection, 29 resulted in property damage only, thirteen resulted in personal injury, and one was un-reported.

Local Intersections

Crash data for the most recent five-year period (2011-2015) was collected for local study area intersections, and MassDOT crash rate worksheets were again used to calculate rates at each intersection. The crash rates for local signalized and unsignalized intersections are shown in Figure 2-64 and Figure 2-65, respectively. The crash rates for each intersection are shown in reference to the statewide average for signalized intersections of 0.78 crashes per MEV and the statewide average for unsignalized intersections of 0.57 crashes per MEV. An explanation of the crashes at each of the intersections is included below.

Based on this analysis, the crash rate for each of the intersections within the local study area is below the statewide average rate except for the intersections of Route 202/Route 10 (North Elm Street) at Notre Dame Street and Elm Street at Franklin Street and Mobil Gas Driveway in Westfield. MassDOT Crash Rate Worksheets are provided in Appendix D.

Figure 2-64. Local Signalized Intersection Crash Rates

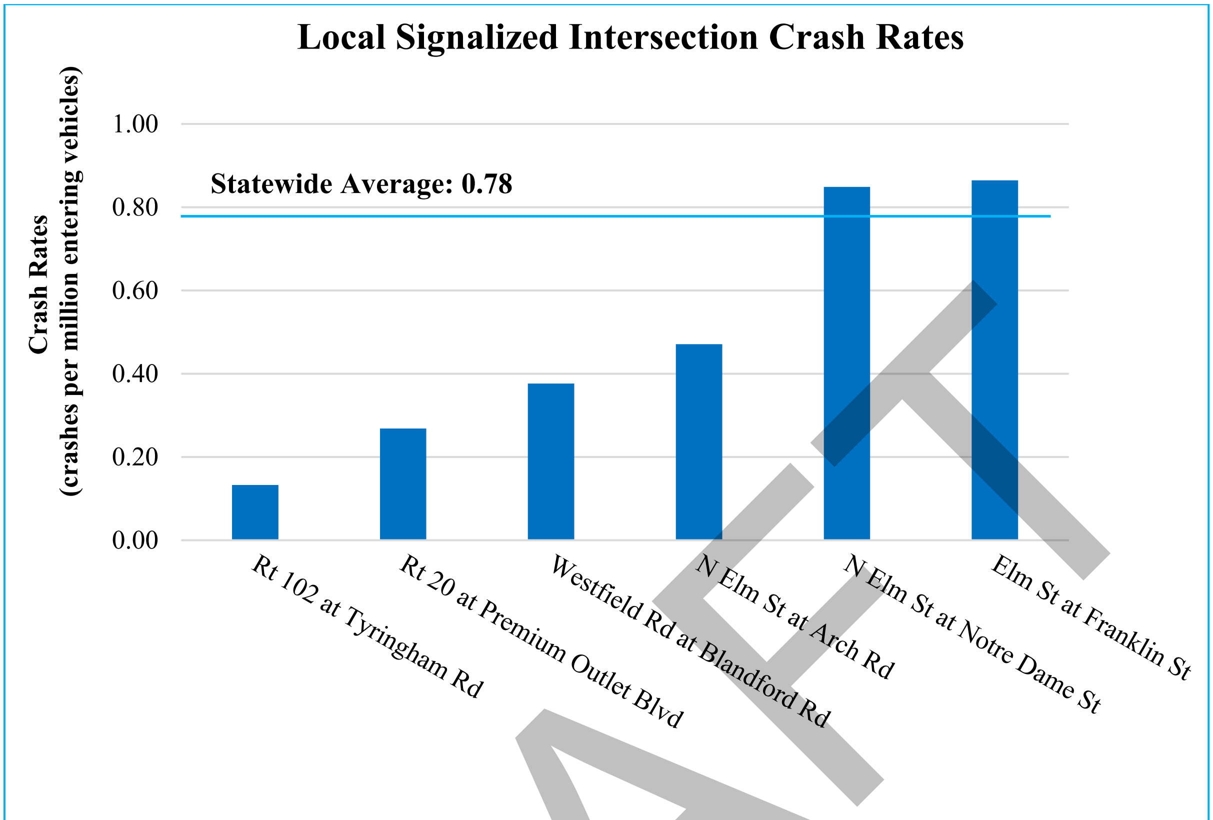
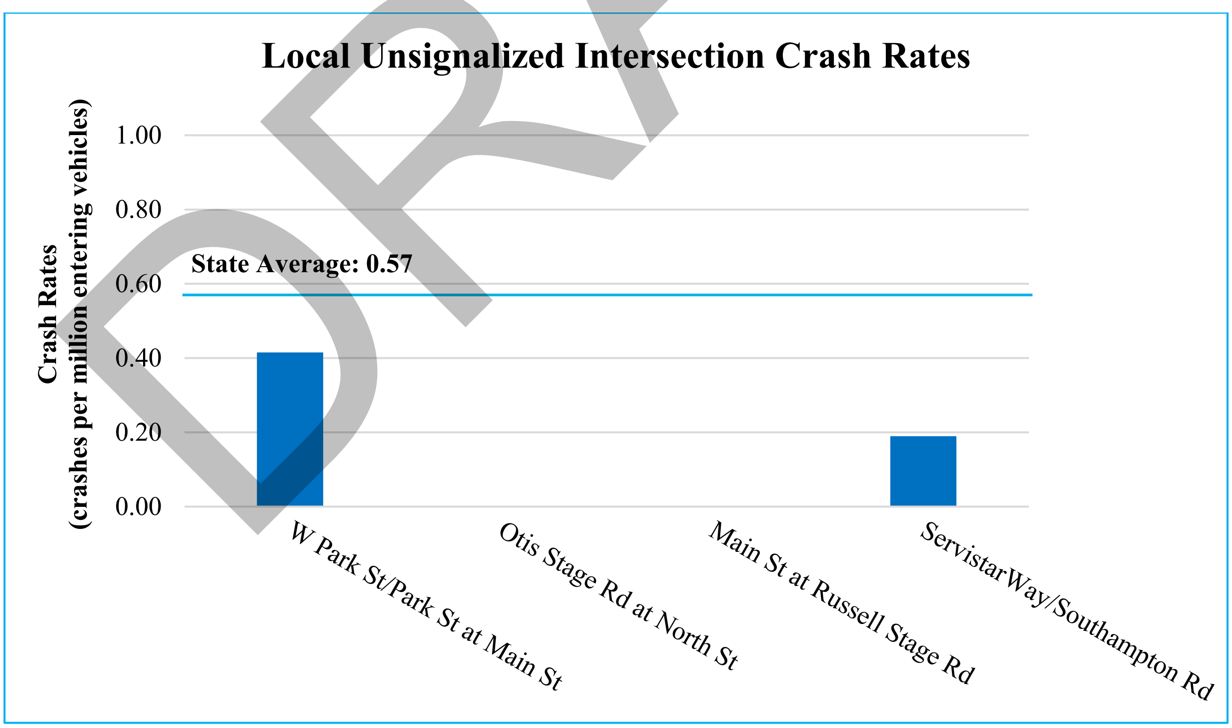


Figure 2-65. Local Unsignalized Intersection Crash Rates



Lee

The intersection of West Park Street at Park Street and Route 20 and the Carr Hardware Store Driveway is shown to have experienced 13 crashes between 2011 and 2015. The resulting crash rate of 0.42 crashes per MEV is below the statewide and District 1 averages for unsignalized intersections. Of the reported crashes at this intersection, six were angle crashes, three were rear-end collisions, one was a head-on collision, and three were single vehicle crashes. Of the 13 reported crashes, eight resulted in property damage only and five resulted in personal injury. This intersection is identified by MassDOT as a Highway Safety Improvement Program (HSIP) crash cluster.

The signalized intersection of Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza is reported to have experienced three crashes in the most recently available five-year period (2011-2015). The resulting crash rate of 0.13 crashes per MEV is well below both the statewide and District 1 averages for signalized intersections. Of the reported crashes, two were angled crashes and one was a rear-end collision. Each of the crashes resulted in property damage only.

The signalized intersection of Route 20 at Premium Outlet Boulevard is reported to have experienced five crashes between 2011 and 2015. The resulting crash rate of 0.27 crashes per MEV is well below both the statewide and District 1 averages for signalized intersections. Of the reported crashes, two were angled crashes, two were rear-end collisions, and one was a sideswipe. Each of the crashes resulted in property damage only.

Blandford

No crashes were reported at the intersections of Route 23/Otis Stage Road/Main Street at North Street and Route 23/Main Street at Russell Stage Road between 2011 and 2015.

Russell

Between the years of 2011 and 2015 the intersection of Route 20 at Route 23 is shown to have experienced five crashes. The resulting crash rate of 0.38 crashes per MEV is below the statewide and District 1 averages for unsignalized intersections. Of the reported crashes, one was an angled crash, two were rear-end collisions, one was a sideswipe, and one was a single vehicle crash. Of the five reported crashes, three resulted in property damage only and two resulted in personal injury.

Westfield

The unsignalized intersection of Route 202/Route 10 at Servistar Industrial Way is reported to have experienced six crashes between 2011 and 2015. The resulting crash rate of 0.19 crashes per MEV is well below the statewide and District 2 averages for signalized intersections. Of the reported crashes, two were angled crashes and four were rear-end collisions. Of the six reported crashes, three resulted in property damage only and three resulted in personal injury.

The signalized intersection of Route 202/Route 10 at Arch Road and Westfield Industrial Park Road is reported to have experienced 31 crashes in the five-year period between 2011 and 2015. The resulting crash rate of 0.47 crashes per MEV is below both the statewide and District 2 averages for signalized intersections. Of the reported crashes, 15 were angled crashes, five were rear-end collisions, five were sideswipes, two were head-on collisions, and four were single-vehicle crashes. Of the 31 reported crashes, 20 resulted in property damage only and 11 resulted in personal injury.

The intersection of Route 202/Route 10 at Notre Dame Street is reported to have experienced 55 crashes between 2011 and 2015. The resulting crash rate of 0.85 crashes per MEV is above the statewide average and below the District 2 average for signalized intersections. Of the reported crashes, 15 were angled crashes, 24 were rear-end collisions, nine were sideswipes, four were head-on collisions, and three were single-vehicle crashes. Of the 55 reported crashes, 44 resulted in property damage only, 10 resulted in personal injury, and one had unknown crash severity. This intersection is identified by MassDOT as a Highway Safety Improvement Program (HSIP) crash cluster, as well as a bicycle and pedestrian crash cluster.

From 2011 to 2015, 47 crashes were reported at the signalized intersection of Elm Street at Route 20 and Mobil Gas Station Driveway. The resulting crash rate of 0.86 crashes per MEV is above the statewide average and below the District 2 average for signalized intersections. Of the reported crashes, 17 were angled crashes, 15 were rear-end collisions, five were sideswipes, four were head-on collisions, and six were single-vehicle crashes. Of the 47 reported crashes, 34 resulted in property damage only and 13 resulted in personal injury. This intersection is identified by MassDOT as a Highway Safety Improvement Program (HSIP) crash cluster, as well as a bicycle and pedestrian crash cluster.

2.8.10 Multimodal Transportation

Regional Bicycle and Pedestrian Facilities

The Berkshire Regional Planning Commission (BRPC), Pioneer Valley Planning Commission (PVPC) and the Trustees of Reservations published the “Highlands Footpath Action Plan” in July, 2016. Portions of the proposed trail and spurs are contained in the study area communities of Lee, Washington, Becket, Chester, Middlefield, Blandford, Russell and Huntington. As stated in the report, the project grew out of multi-year corridor management planning efforts on both the Route 112 and Jacob’s Ladder Trail (Route 20) Scenic Byways. Project proponents envision an outcome that will connect these regional trails to nearby village centers. A summary description is provided below.

Table 2-16. Proposed Trail System Improvements

Trail System Element	Towns	Approximate Length
Highlands Footpath	Traverses Lee, Becket, Chester (north of the Westfield River), Worthington, Chesterfield, Cummington, and Goshen	40 miles
Spur	Leaves the Highlands Footpath in Chester and goes south through Chester, Blandford State Forest, and into Russell	14 miles
Connector from spur	Leaves spur in Blandford with proposed route following old Huckleberry Trolley pathway through Huntington Center to join the Highlands Footpath in Worthington or alternatively in Chesterfield	8 miles

The Upper Housatonic Valley National Heritage Area, in partnership with the National Park Service, has published a map of bike routes in Lee as part of a larger program of Berkshire Bike Routes. Among the supporters of this program are the town of Lee, BRPC and the Berkshire Bike Path Council. These routes are in mixed traffic without specific designation.

The Appalachian Trail passes through the study area towns of Tyringham, Lee, Becket, Washington, Hinsdale and Dalton as part of its 2,190 miles from Springer Mountain in Georgia to Mount Katahdin in Maine.

MassDOT has advanced the Lee Bikeway project to the 25% Design level. The Lee Bikeway will be a new 6.7-mile bicycle facility consisting of both on-road and off-road sections from the Stockbridge town line to the Lenox town line. Off-road sections would consist of 10-ft wide pavement with 2-ft graded shoulders on each side. On-road sections would consist of paved shoulders (both directions) of appropriate width adjacent to the travel way. The current project concept is for three phases (from south to north): Phase 1 would consist of 3.18 miles on-road (Route 102) plus 0.93 miles off-road. Two sections of boardwalk are proposed (1000 feet total); one 60-ft bridge is proposed over an intermittent stream; and two sections of retaining wall are proposed (500 feet total). This phase of the bikeway would begin at the Lee/Stockbridge line and end at West Park Street in downtown Lee. The project is programmed to be funded through the year 2020 Transportation Improvement Program (TIP) for the Berkshire Metropolitan Planning Organization (MPO).

Local Bicycle and Pedestrian Facilities

Lee

West Park Street at Park Street/Route 20 and Carr Hardware Store Driveway

West Park Street and Route 20 provide sidewalks on both sides of the roadway excluding the north side of Route 20 adjacent to the exclusive right-turn lane at its intersection where Route 20 runs along Main Street. Route 20 (Main Street) provides sidewalks on the western side of the roadway at the unsignalized intersection with Route 20 (Park Street) and West Park Street. Crosswalks are provided across the eastbound Route 20 (West Park Street) approach and on Park Street approximately 150 feet east of the intersection. Bicycle amenities are not currently provided in the vicinity of the intersection.

Route 102 at Tyringham Road and Big Y Plaza

Crosswalks and curb ramps are provided on each of the approaches to the intersection. The intersection provides exclusive pedestrian phasing. A separated bicycle path is provided on the eastern side of Route 102 north of the intersection which provides a connection between Tyringham Road and Premium Outlet Boulevard. A bicycle lane is provided on the western side of Route 102 south of the intersection. Bicycle detection is provided at the intersection Route 102 at Tyringham Road and Big Y Plaza.

Route 20 at Premium Outlet Boulevard

Sidewalks are provided on both sides of Route 20 to the west of Premium Outlet Boulevard and the northern side of Route 20 to the east. A crosswalk is available on the eastbound approach on Route 20 with an exclusive pedestrian phase providing a connection for pedestrians continuing to travel east on Route 20.

Blandford

Otis Stage Road/Route 23 (Main Street) at North Street

A sidewalk is provided on the east side of North Street starting approximately 100 feet north of the intersection, and continues along the north side of Main Street (Route 23). Crosswalks are provided on the southbound North Street approach to the intersection of North Street at Otis Stage Road/Main Street (Route 23).

Route 23 (Main Street) at Russell Stage Road

Route 23 (Main Street) provides sidewalks on the northern side of the roadway. A crosswalk is provided across Russell Stage Road at the intersection, and across Main Street approximately 100 feet west of the intersection. Bicycle amenities are not currently provided in the vicinity of the intersection of Route 23 (Main Street) at Russell Stage Road.

Russell

Route 20 (Westfield Road) at Route 23 (Blandford Road)

Sidewalks, crosswalks, and bicycle amenities are not currently provided in the vicinity of the intersection of Route 20 (Westfield Road) at Route 23 (Blandford Road).

Westfield

Route 202/Route 10 at Servistar Industrial Way

Sidewalks, crosswalks, and bicycle amenities are not currently provided in the vicinity of the intersection of Route 202/Route 10 at Servistar Industrial Way.

Route 202/Route 10 at Arch Road and Westfield Industrial Park Road

A sidewalk is provided on the eastern side of Route 202/Route 10 within the vicinity of its intersection with Westfield Industrial Park Road. A crosswalk is provided across Westfield Industrial Park Road at its intersection with Route 202/Route 10 and the signal provides an exclusive pedestrian phase. There are currently no bicycle amenities provided at the intersection of Route 202/Route 10 at Arch Road and Westfield Industrial Park Road.

Route 202/Route 10 at Notre Dame Street

The intersection of Route 202/Route 10 at Notre Dame Street provides sharrow bicycle pavement markings on each of the approaches. Crosswalks are provided on each of the approaches to the intersection and an exclusive pedestrian phase is provided. Bicycle detection is provided at all approaches to the intersection.

Elm Street at Franklin Street and Mobil Gas Station Driveway

Crosswalks are provided on the Franklin Street approach and the northbound Elm Street approach to the intersection. Exclusive pedestrian signalization is provided for pedestrians at the intersection. There are no bicycle amenities at the intersection of Elm Street at Franklin Street and Mobil Gas Station Driveway.

Transit Services

Lee

The Berkshire Regional Transit Authority (BRTA) Route #2 and Route #21 provide bus services along Route 20. The routes make stops at the intersection at the Lee (Main Street) stop traveling southbound and the Lee Center (Main Street) stop northbound, at the Big Y Lee stop, and the Lee Premium Outlets stop. The BRTA operates Monday through Friday from 5:45 AM to 7:20 PM and Saturday from 7:15 AM to 7:00 PM. The BRTA also provides paratransit service for those eligible.

During the latest available reporting period (August, 2018), Route #2 carried a total of 6,935 passengers and Route #21 carried a total of 2,716 passengers. It should be noted that these passenger totals represent the entire route, including segments and stops in other communities.

Dalton and Hinsdale

The BRTA Route # 4 bus serves Dalton (stop at Curtis and Main Streets) and Hinsdale (Hinsdale Post Office) with 13 weekday routes running between 5:55 AM and 6:23 PM, and seven Saturday routes running between 8:06 AM and 5:37 PM.

During the latest available reporting period (August, 2018), Route #4 carried a total of 4,577 passengers. It should be noted that these passenger totals represent the entire route, including segments and stops in other communities.

Blandford and Russell

There is no fixed route transit service within the Towns of Blandford and Russell. These towns do not participate in paratransit services.

Westfield

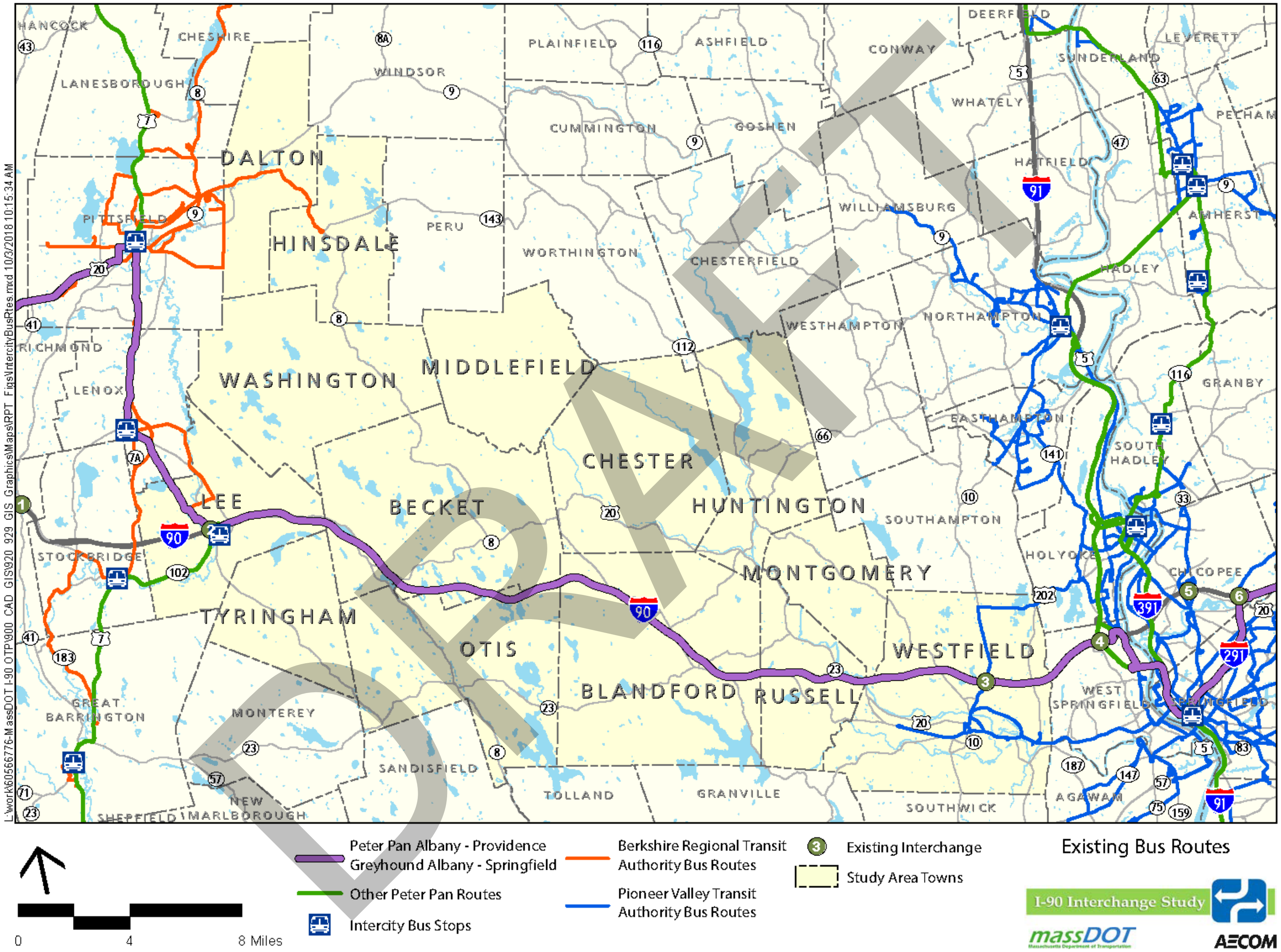
The Pioneer Valley Transit Authority (PVTA) Route B23 bus service provides service along Southampton Road and North Elm Street (Route 202/Route 10). Within the vicinity of the local study area intersections, Route B23 provides stops at Southampton/Falcon (flag stop), Southampton/Airport (flag stop), N/Elm/Arch, and N Elm/Notre Dame (flag stop). Routes B23 and Route R10 provide bus service within the vicinity of the Elm Street at Franklin Street intersection and provide a stop at the Oliver Transit Pavilion south of the intersection. Additionally, ADA and Dial-A-Ride services are provided for people with disabilities, and operate on days when the fixed-bus service operates.

During the latest available reporting period (September 2018), Route B23 carried a total of 9,016 passengers and Route R10 carried a total of 18,035 passengers. It should be noted that these passenger totals represent the entire route, including segments and stops in other communities.

Intercity

Peter Pan and Greyhound Bus Lines provide intercity service through the study area via a bus stop at the Lee Premium Outlets. Multiple trips per day serve regional destinations in Albany, Amherst, Springfield, Worcester, Boston, Providence and New York City, among other destinations. Figure 2-66 depicts the BRTA, PVTA and intercity bus routes that pass through and serve the study area.

Figure 2-66. Bus Service in Study Area Communities



2.9 Issues and Opportunities

Existing conditions serve as a starting point for investigating the feasibility and utility of a potential new interchange. Moreover, the inventory and compilation of existing conditions allows issues and opportunities to be identified for the study area. The opportunities and issues detailed below will later help guide the alternative development and analysis described in Chapter 4.

Traffic Congestion

- Traffic congestion in the study area is limited to the roadways in Lee and Westfield serving existing I-90 Exits 2 and 3. There is no reported congestion on the local roadway network serving the Hilltowns between I-90 Exits 2 and 3;
- The introduction of a new interchange between I-90 Exits 2 and 3 will attract traffic from those existing interchanges, and could reduce congestion at locations in Lee and Westfield to a degree proportionate to the change in traffic volume at those locations;
- Existing roadways in the Hilltown communities are low-volume rural facilities. The use of any of these roadways to access a new I-90 interchange could attract traffic volumes that may create new congestion, whether real or perceived.

Traffic Safety

- Several high-accident locations have been identified on the roadways in Lee and Westfield serving existing I-90 Exits 2 and 3. There are no reported high-accident locations on the local roadway network serving the Hilltowns between Exits 2 and 3;
- The reduction in traffic at Exits 2 and 3 due to diversion to a potential new interchange would reduce volumes at the high-accident locations, potentially improving safety at those locations;
- The conditions of existing roadways in the Hilltown communities will be taken into consideration as potential interchange locations are analyzed. Potential improvements to local roadways will be based on MassDOT standards and design guidelines.

Environmental

- Critical issues associated with a potential new interchange include wetland resources, public open space and conservation land, steep topography and water protection zones;
- The placement of a new interchange between I-Exits 2 and 3 has the potential to reduce study area VMT and VHT, and with it associated reductions in fuel consumption and vehicle emissions;
- Improvements to local roadways serving a potential new interchange must acknowledge the possibility of environmental impacts upstream and downstream of the new interchange.

Health Determinants

- Study area residents in Berkshire and Hampden counties report higher-than-average incidents of asthma-related incidents and outcomes. In addition, study area residents have a higher-than-average rate of adults over 65 living alone, making aspects of public health and transportation, such as access to hospitals and health clinics important in this area;

- The placement of a new interchange between Exits 2 and 3 has the potential to reduce study area VMT and VHT, and with it associated reductions in travel time to public health facilities and reductions in vehicle emissions that may improve regional air quality;
- The potential for local increases in traffic in the immediate vicinity of a potential new interchange, and associated increase in potential localized vehicle emissions, must be acknowledged.

Access and Mobility Issues

- The placement of a new interchange between Exits 2 and 3 has the potential to reduce study area VMT and VHT, and with it associated reductions in travel time and distance;
- Potential reductions in VMT and VHT may provide benefits for residents and local businesses by providing access to wider markets, services, employment and housing choices;
- Access to wider markets and services may improve economic development potential should the Hilltown communities desire those opportunities;
- The placement of a potential new interchange between I-90 Exits 2 and 3 will provide shorter travel times to regional health care and emergency care services.

Transit/Bicycle/Pedestrian Issues

- Although interstate facilities prohibit bicycle and pedestrian use, improvements to local roadways serving a potential new interchange may benefit local bicycle and pedestrian use;
- The placement of a new interchange between Exits 2 and 3 may provide opportunities for park-and-ride or rideshare activity, and possible combination with intercity bus service by providers currently using I-90.

Land Use / Community Effects

- Potential reductions in VMT and VHT may provide benefits for residents and local businesses by providing access to wider markets, services, employment and housing choices;
- Access to wider markets and services may improve economic development potential should the Hilltown communities desire those opportunities;
- The placement of a potential new interchange between I-90 Exits 2 and 3 will provide shorter travel times to regional health care and emergency care services.

Economic Development Opportunities

- Potential reductions in VMT and VHT may provide benefits for residents and local businesses by providing access to wider markets, services, employment and housing choices;
- Access to wider markets and services may improve economic development potential should the Hilltown communities desire those opportunities.

Environmental Justice Issues

- One of two U.S. Census block groups in the town of Becket is identified as an environmental justice population based on criteria for low-income households. Placement of a potential new interchange in the vicinity of this area, or with access via roadways in the vicinity of this area, must ensure that potential impacts are not disproportionate when compared to other potential locations.

Chapter 3: Future Year (2040) No-Build Conditions

This chapter describes the future year "No-Build" traffic conditions within the study area. No-Build conditions represent conditions in which no new interchange exists. Future year transportation conditions must be developed in order to assess the potential impact of a new interchange. 2040 was selected to approximate future conditions because a 20-year planning horizon is standard for feasibility studies. This ensures that the report's future conditions analysis is representative of the time it would take to complete the proposed project.

3.1 Methodology

Future year traffic volumes were developed by the Boston Region MPO's Central Transportation Planning Staff (CTPS) as part of their Statewide Travel Demand Model, ("the model"). The model forecasts future year traffic on the roadway network using various pieces of information. First, demographic data is provided by regional planning commissions across the Commonwealth. Projections of future population, households and employment are used to determine future traffic patterns and trends for each study area community based upon previous U.S. Census data and knowledge of future development plans within each region. Output from the model is compared to existing traffic counts in each corresponding region to confirm, or calibrate, that the projected demographic data is accurately representing conditions. Adjustments are made to these model inputs until the model output reasonably replicates actual conditions.

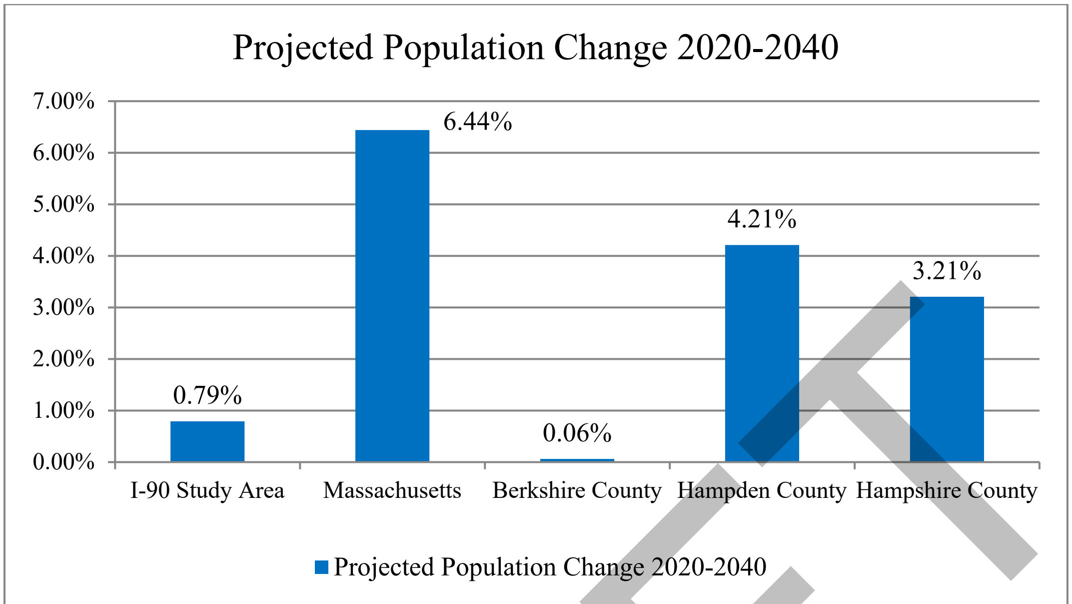
Once calibrated, the projected values are incorporated in order to obtain future year conditions used for analysis purposes. In the case of the I-90 Interchange Study, the model's base year is calibrated to 2016 conditions, and the subsequent forecast volumes are for year 2040 conditions. It is important to understand how the transportation system may function when a specific transportation improvement could be in operation and beyond. Thus, the future year No-Build conditions are used as a baseline for comparison with build scenarios that include the placement of a new interchange in the study area.

3.2 Factors Affecting Transportation Conditions

Future traffic projections are influenced by anticipated land use and demographic changes. Regional planning commissions (PVPC and BRPC) routinely work with study area communities to identify potential priority development areas, as discussed in Chapter 2. There are few of these areas located in the study area. At the same time, zoning within the Hilltown communities restricts or prohibits the development of anything other than single-family residential dwellings. As a result, the model does not include any projected changes in land use within the study area between now and the future forecast year 2040.

Demographic projections used in the model are provided by the regional planning commissions for 2020, 2030, and 2040. The data projects modest population and household increases in the study area between 2020 and 2040. The study area is expected to see a .79% increase in population, and a 6.45% change in households. For comparison, Massachusetts will see 6.44% increase in population and a 6.45% increase in households. Meanwhile, employment in the study area is expected to decline by 1.17% between 2020 and 2040. Statewide employment is projected to increase by 2.33%. This data is reflected in the charts and tables below.

Figure 3-1. Study Area, County & Statewide Population Projections



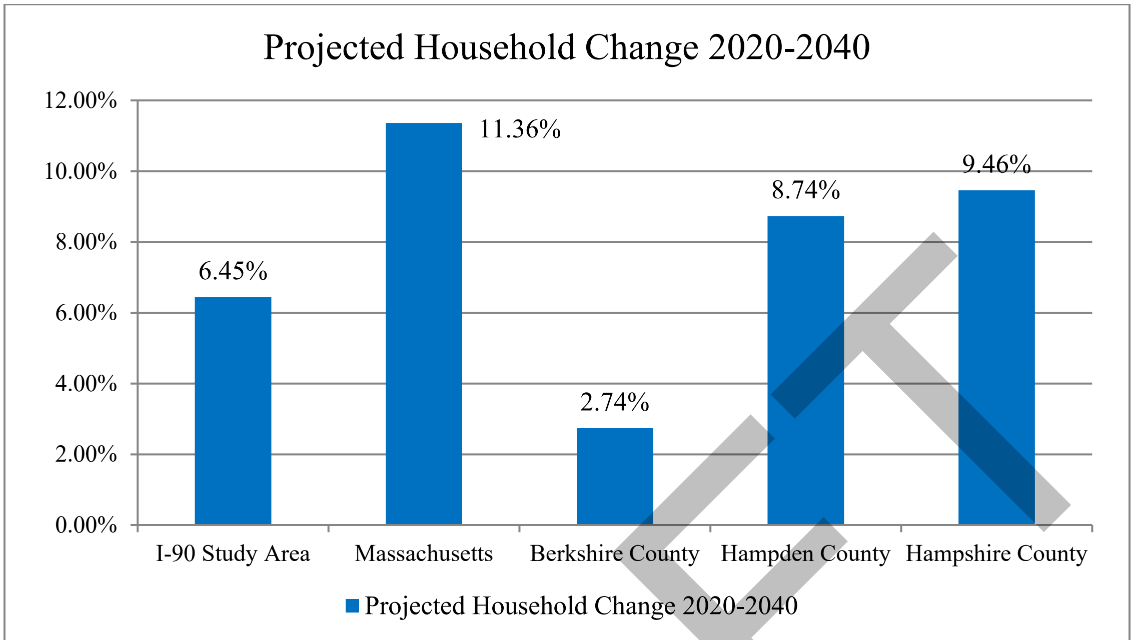
Source: CTPS

Table 3-1. Study Area Population Projections

TOWN	Census 2010	2020	2030	2040	Change 2020-2040
Becket	1,779	1,735	1,717	1,604	-7.55%
Blandford	1,233	1,205	1,234	1,252	3.90%
Chester	1,337	1,313	1,293	1,273	-3.05%
Dalton	6,756	6,607	6,511	6,260	-5.25%
Hinsdale	2,032	2,151	2,241	2,234	3.86%
Huntington	2,180	2,112	2,070	2,029	-3.93%
Lee	5,943	5,947	5,962	5,870	-1.29%
Middlefield	521	490	469	410	-16.33%
Montgomery	838	930	952	967	3.98%
Otis	1,612	1,804	2,005	2,171	20.34%
Russell	1,775	1,795	1,839	1,866	3.96%
Tyringham	327	307	288	247	-19.54%
Washington	538	500	480	428	-14.40%
Westfield	41,094	41,665	42,113	42,493	1.99%
I-90 Study Area Total	67,965	68,561	69,174	69,104	0.79%
Massachusetts	6,547,629	6,933,887	7,225,472	7,380,399	6.44%
Berkshire County	131,219	127,986	128,548	128,063	0.06%
Hampden County	463,490	470,339	482,178	490,136	4.21%
Hampshire County	158,080	161,673	165,099	166,856	3.21%

Source: CTPS

Figure 3-2. Study Area, County & Statewide Households Projections



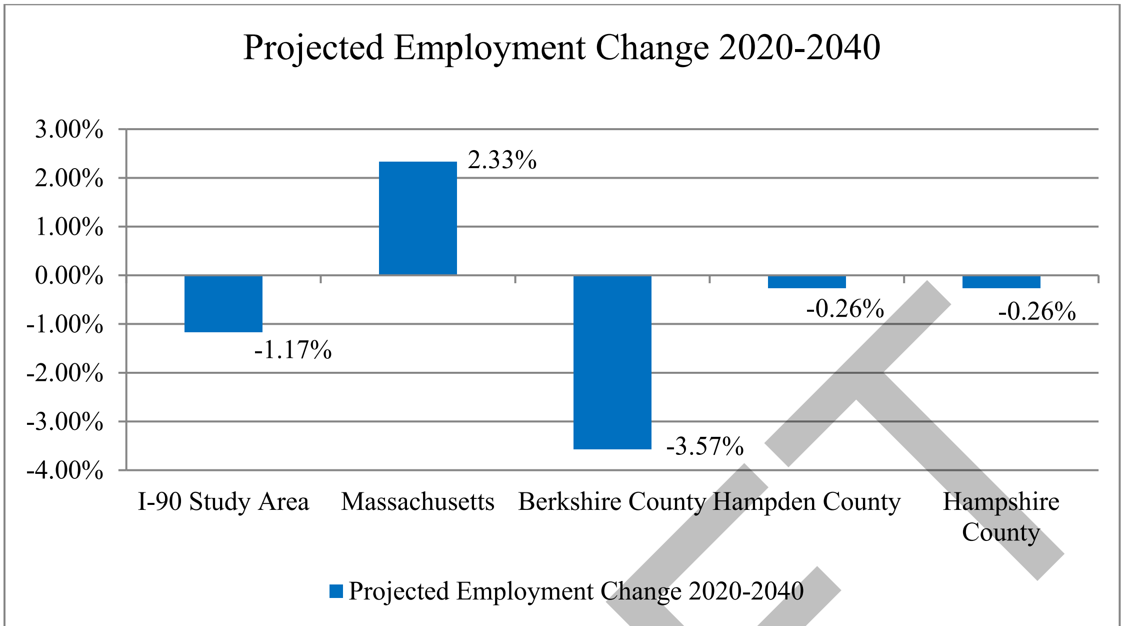
Source: CTPS

Table 3-2. Study Area Households Projects

TOWN	Census 2010	2020	2030	2040	Change 2020-2040
Becket	763	836	885	875	4.71%
Blandford	492	528	577	616	16.54%
Chester	543	585	624	653	11.62%
Dalton	2,737	2,880	2,913	2,765	-3.98%
Hinsdale	868	1,016	1,108	1,133	11.51%
Huntington	868	925	977	1,019	10.19%
Lee	2,560	2,773	2,860	2,815	1.53%
Middlefield	218	233	241	220	-5.66%
Montgomery	330	389	406	411	5.63%
Otis	708	861	981	1,064	23.67%
Russell	656	695	738	747	7.51%
Tyringham	138	145	144	126	-12.85%
Washington	225	251	272	258	2.75%
Westfield	15,335	16,512	17,314	17,770	7.62%
I-90 Study Area Total	26,441	28,628	30,040	30,473	6.45%
Massachusetts	2,547,075	2,830,145	3,044,477	3,151,722	11.36%
Berkshire County	56,091	58,453	60,341	60,055	2.74%
Hampden County	179,927	191,333	201,953	208,047	8.74%
Hampshire County	58,702	63,993	68,340	70,047	9.46%

Source: CTPS

Figure 3-3. Study Area, County & Statewide Employment Projections



Source: CTPS

Table 3-3. Study Area Employment Projections

TOWN	DET* 2010	2020	2030	2040	Change 2020-2040
Becket	365	362	351	349	-3.57%
Blandford	223	184	183	184	-0.26%
Chester	110	113	112	113	-0.26%
Dalton	1,956	1,932	1,870	1,863	-3.57%
Hinsdale	304	299	289	288	-3.57%
Huntington	420	403	401	402	-0.26%
Lee	3,801	3,805	3,684	3,669	-3.57%
Middlefield	39	41	41	41	-0.26%
Montgomery	26	37	37	37	-0.26%
Otis	335	322	312	311	-3.57%
Russell	182	151	150	150	-0.26%
Tyringham	0	0	0	0	0.00%
Washington	78	72	70	70	-3.57%
Westfield	16,736	17,149	17,065	17,103	-0.26%
I-90 Study Area	24,575	24,869	24,564	24,579	-1.17%
Massachusetts	3,199,467	3,443,242	3,481,819	3,523,510	2.33%
Berkshire County	60,150	59,772	57,864	57,639	-3.57%
Hampden County	193,871	202,450	201,463	201,916	-0.26%
Hampshire County	58,285	59,077	58,790	58,922	-0.26%

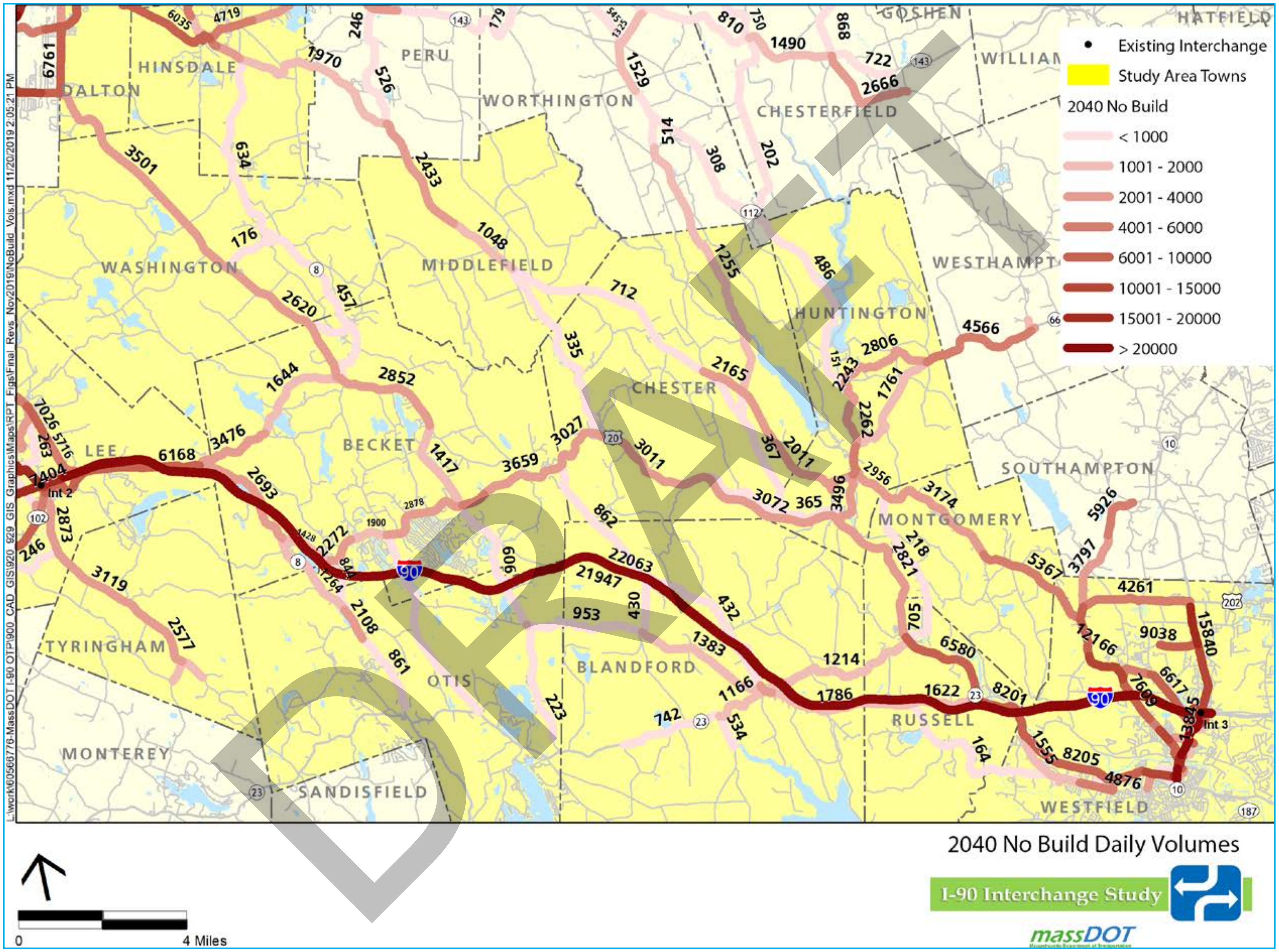
Source: CTPS

*DET – Massachusetts Department of Labor and Workforce Training

3.3 Regional Travel Demand Modeling

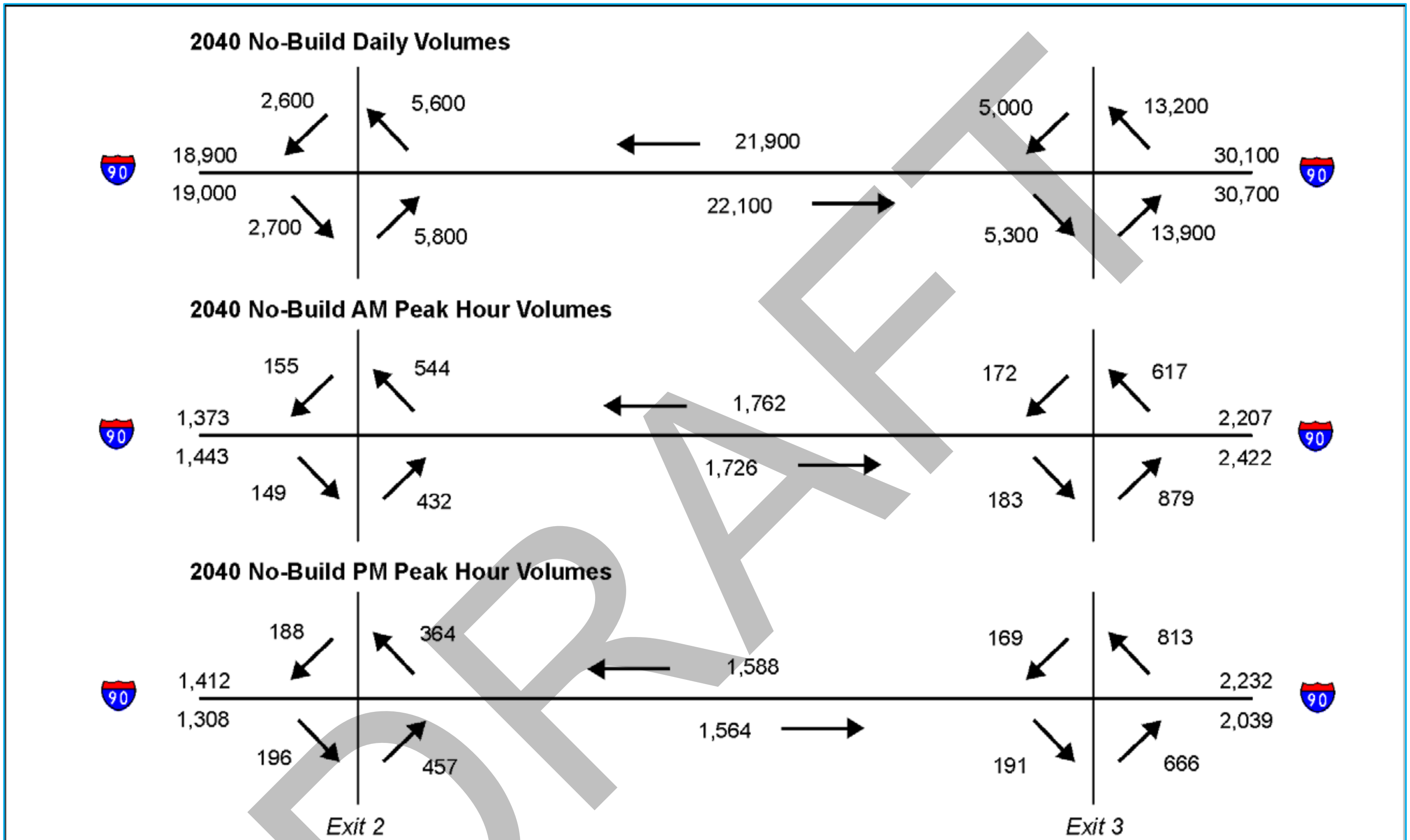
Traffic projections for a No-Build alternative were conducted based on the land use and demographic forecasts identified in the previous section. The projections will be used for interchange and intersection capacity analyses that will form the basis for comparison of conditions with and without the proposed interchange. Figure 3-4 illustrates projected overall daily traffic volumes on study area roadways, while Figure 3-5 provides a simple network diagram of projected I-90 mainline volumes and ramp volumes at Exits 2 and 3. Projected AM and PM peak hour intersection turning movement counts are shown in Figures 3-6 and 3-7.

Figure 3-4. Future Year (2040) No-Build Daily Traffic Volumes



Source: CTPS

Figure 3-5. Future Year (2040) No-Build Traffic Volumes



Source: CTPS

Figure 3-6. Future Year (2040) Turning Movement Counts No-Build AM Peak Hours

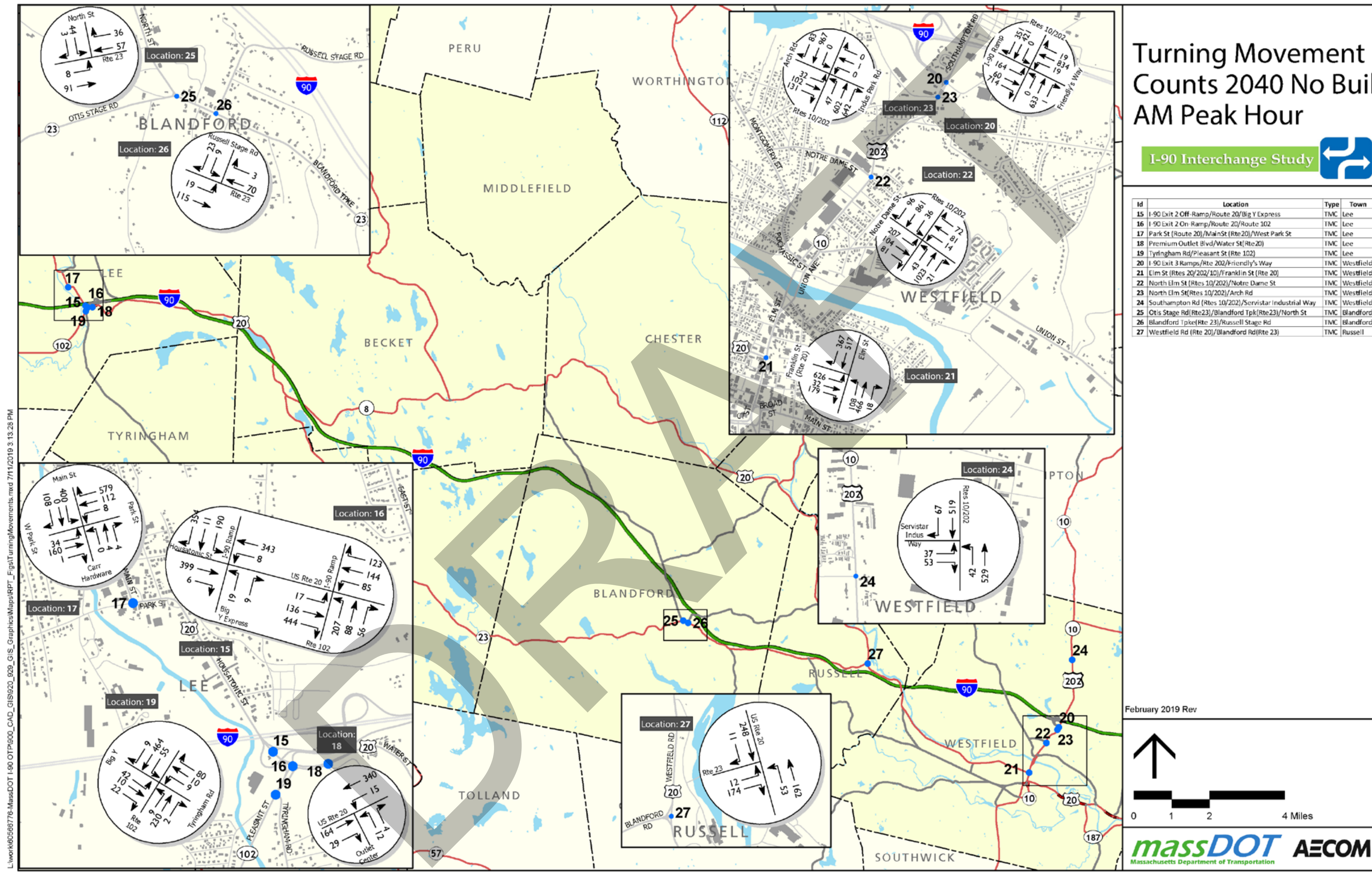


Figure 3-7. Future Year (2040) Turning Movement Counts No-Build PM Peak Hour

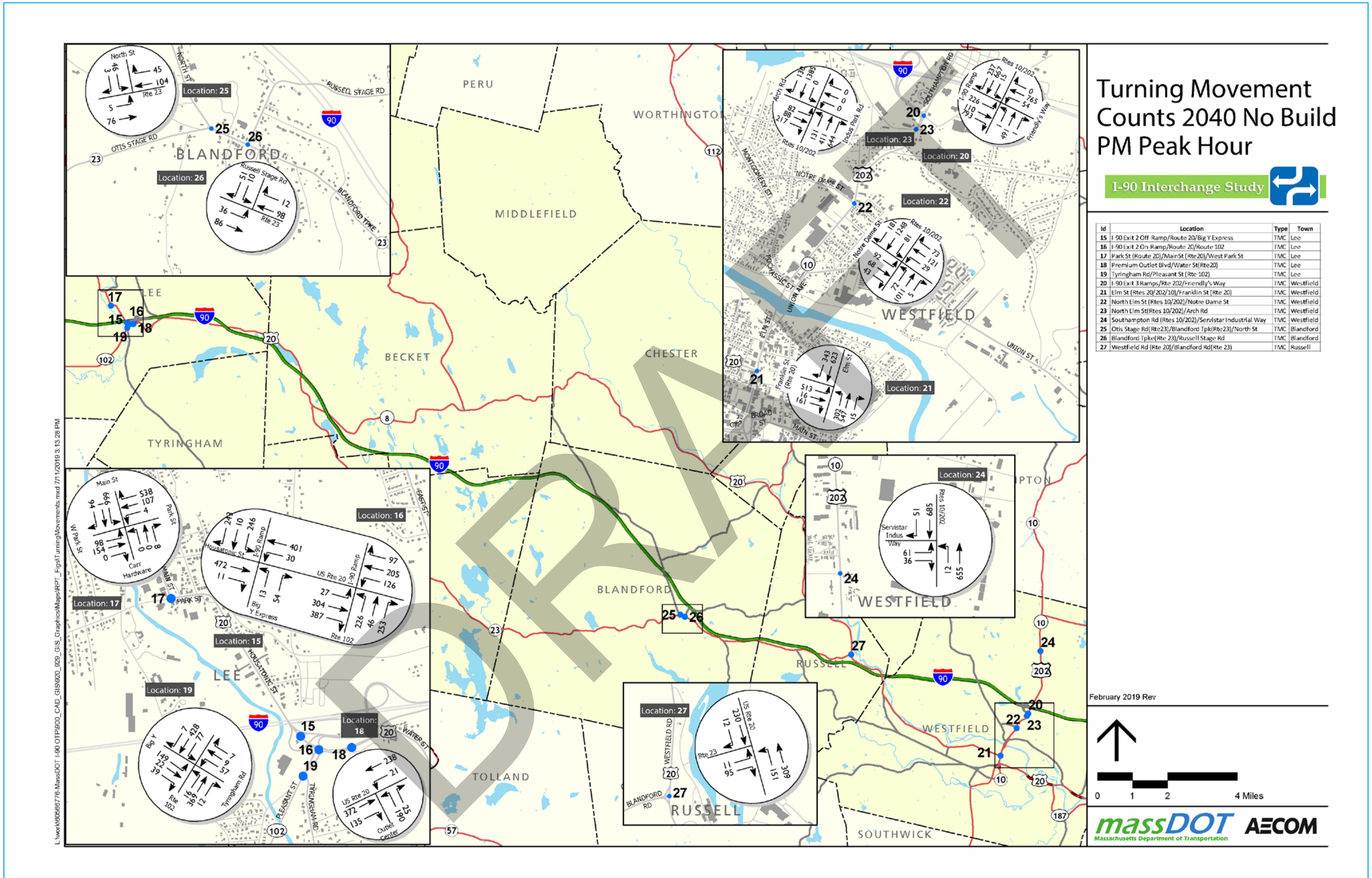


Table 3-4. Representative Future Year (2040) No-Build Daily Traffic Volumes

Location	Town	2040 No-Build (vehicles/day)
Route 20 east of Lee Town Line	Becket	2,693
Route 20 east of Bonnie Rigg Corner	Becket	3,659
Route 8 south of County Rd. Becket	Becket	2,852
Becket Road	Becket	3,476
Bonny Rigg Hill Road	Becket	606
Route 23 at Russell Town Line	Blandford	1,786
Route 23 West of Blandford Center	Blandford	1,166
North Street/Chester Road	Blandford	432
North Blandford Road	Blandford	1,383
Old Chester Road	Blandford	430
I-90 EB west of Blandford Maintenance Facility	Blandford	22,063
I-90 WB west of Blandford Maintenance Facility	Blandford	21,947
Route 20 east of Chester Center	Chester	3,011
Blandford Road	Chester	862
East River Road	Chester	1,255
Route 20 east of Route 112	Huntington	2,821
Route 66 Huntington at Westhampton Town Line	Huntington	4,566
Skyline Trail	Middlefield	2,433
Montgomery Road/Main Road	Montgomery	5,367
Route 8 south of Werden Road	Otis	2,108
Algerie Road	Otis	223
Route 20 east of Route 23	Russell	8,201
General Knox Road	Russell	164
Blandford Stage Road	Russell	1,214
Washington Mountain Road	Washington	2,620

Source: CTPS

3.4 Future Year (2040) No-Build Network Operations

3.4.1 Existing Interchange Ramps and Intersections

A LOS analysis was conducted for future year No-Build conditions. Acceptable operating conditions are expected at the merge and diverge points of I-90 Exits 2 and 3. Table 3-5 summarizes the results of merge and diverge analysis at these locations. Operations at the Exit 3 eastbound merge location should be monitored in the future as conditions cross a threshold from LOS C to D. Background growth on I-90 is responsible for the change in reported LOS as compared to existing conditions.

Table 3-5. Future Year (2040) No-Build Conditions/Peak Hour Interchange Analysis

Location	Type	Segment	No-Build			
			AM peak hour		PM peak hour	
			LOS	Density	LOS	Density
I-90/Exit 2	Diverge	I-90 EB	B	13.3	B	12
I-90/Exit 2	Merge	I-90 EB	C	20.5	B	19.3
I-90/Exit 2	Diverge	I-90 WB	B	16.7	B	15.1
I-90/Exit 2	Merge	I-90 WB	B	15.3	B	15.9
I-90/Exit 3	Diverge	I-90 EB	B	15.5	B	14
I-90/Exit 3	Merge	I-90 EB	D	28.4	C	23.4
I-90/Exit 3	Diverge	I-90 WB	C	20.5	C	20.7
I-90/Exit 3	Merge	I-90 WB	B	17.4	B	15.9

Overall operating conditions at the interchange ramp intersections with local roads in Lee and Westfield are expected to remain unchanged under future year (2040) No-Build forecasts, as summarized in Table 3-6. However, individual intersection approaches at the Route 102/I-90 Exit 2 Entrance & Route 20 intersection in Lee (Route 102 NB left turn, Route 20 EB left turn) and at the Southampton Rd. (Route 10/202) & Friendly's Way/I-90 Exit 3 intersection in Westfield (Friendly's Way WB left turn) are nearing or exceeding capacity and should be monitored to avoid future deficiencies.

Between the 2018 Existing and 2040 No-Build volumes, the majority of the increases in volume were applied to the mainline through movements at each of the intersections. In general, the decrease in traffic volumes from the 2018 Existing and 2040 No-Build volumes for some movements can be attributed to the projected drop in employment within the study area of 1.17 percent.

A discussion of the overall quality of the traffic flow at the local study area intersections during the weekday morning and weekday afternoon peak hours is below. Table 3-6 summarizes the results of intersection capacity analysis at signalized intersection locations.

Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza

Based on a review of the capacity analysis, the signalized intersection of Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza is expected to continue to operate at overall LOS B during the weekday morning peak hour and at overall LOS C during the weekday afternoon peak hour under the 2040 No-Build condition. Each movement is expected to continue to operate under capacity and operate at LOS C or better during both peak hours.

Route 20 at Premium Outlet Boulevard

Under the 2018 No-Build capacity analysis, the intersection of Route 20 at Premium Outlet Boulevard is expected to continue to operate at overall LOS A during the weekday morning and weekday afternoon peak hours. The intersection movements are expected to continue to operate at LOS B or better and well under capacity during both peak hours.

North Elm Street (Route 202/Route 10) at Arch Road and Westfield Industrial Park Road

The intersection of North Elm Street (Route 202/Route 10) at Arch Road and Westfield Industrial Park Road is expected to continue to operate at overall LOS B during the weekday morning peak hour and is shown to degrade by approximately two seconds of average vehicle delay from overall LOS B to LOS C during the weekday afternoon peak hour. Under the 2040 No-Build condition, each of the movements is expected to continue to operate under capacity.

North Elm Street (Route 202/Route 10) at Notre Dame Street

Based on a review of the 2040 No-Build capacity analysis, the intersection of North Elm Street (Route 202/Route 10) at Notre Dame Street is expected to continue to operate at overall LOS D during the weekday morning peak hour and degrade from overall LOS D to overall LOS E during the weekday afternoon peak hour. Under the 2040 No-Build condition, the southbound shared through/right-turn movement is shown to operate over capacity. All other approaches to the intersection are expected to operate under capacity.

Elm Street at Franklin Street and Mobil Gas Station Driveway

The intersection of Elm Street at Franklin Street and Mobil Gas Station Driveway is expected to continue to operate at overall LOS D during the weekday morning peak hour and degrade from overall LOS D to LOS F during the weekday afternoon peak hour. Under 2040 No-Build conditions, the eastbound shared left/through movement during the weekday morning peak hour and southbound through movement during both of the peak hours are expected to operate over capacity. All other movements are expected to operate under capacity.

3.4.2 Local Unsignalized Intersections

The critical movement capacity and LOS analysis results for the 2040 No-Build weekday morning and weekday afternoon peak hours are summarized in Table 3-7 for the unsignalized local study area intersections.

West Park Street at Park Street/Main Street (Route 20)

The capacity analysis indicates that under the 2040 No-Build condition, the critical eastbound West Park Street shared through and right-turn movement is expected to continue to operate at LOS F and over capacity during both peak hours.

Otis Stage Road/Main Street (Route 23) at North Street

Under the 2040 No-Build condition, the critical southbound North Street approach is expected to continue to operate at LOS B and well under capacity during both peak hours with minimal increase in delay.

Main Street (Route 23) at Russell Stage Road

Between the 2018 Existing and 2040 No-Build conditions, the Russell Stage Road stop control approach is expected to continue to operate at LOS A during the weekday morning and weekday afternoon peak hours.

Westfield Road (Route 20) at Blandford Road (Route 23)

Under the 2040 No-Build condition, the critical eastbound left-turn from Blandford Road (Route 23) is shown to continue to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday afternoon peak hour.

Southampton Road (Route 202/Route 10) at Servistar Industrial Way

The critical eastbound Servistar Industrial Way approach is expected to degrade from LOS C to LOS D during the weekday morning peak hour and continue to operate at LOS F during the weekday afternoon peak hour, under the 2040 No-Build conditions.

Table 3-6. Future Year (2040) No-Build Conditions/Signalized Intersections LOS Analysis, Peak Hours

Intersection	No-Build					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee - Route 20 & I-90 Exit 2	B	11.5		B	16.7	
Route 20 EB Thru	A	3.7	53	A	5.1	90
I-90 Ramp SB Left	D	43.5	97	D	47.4	118
Route 20 WB Thru	A	4.9	77	A	7.6	133
Lee - Route 102/I-90 Exit 2 Entrance & Route 20	B	19.1		C	26.5	
Route 102 NB Left	D	51.5	196	E	78.2	262
Route 102 NB Thru	D	38.4	91	D	37.7	61
Route 102 NB Right	A	1.5	0	A	8.8	60
Route 20 EB Left	D	41.7	26	E	55.1	40
Route 20 EB Thru	B	13	51	B	18.3	125
Route 20 EB Right	A	8.1	162	B	10.5	164
Route 20 WB Left	D	47.3	98	D	49.6	141
Route 20 WB Thru	A	5	40	A	8	65
Westfield - Southampton Rd. (Route 10/202) & Friendly's Way/I-90 Exit 3	C	28.9		D	48.3	
Southampton Rd NB Thru	D	41.9	257	D	36.6	215
I-90 Ramp EB Left	D	48.2	159	A	4.7	29
I-90 Ramp EB Thru	B	14.8	45	D	46.1	205
I-90 Ramp EB Right	B	14.4	485	B	19.8	96
Northampton Rd SB Thru	D	35	161	D	46.8	29
Northampton Rd SB Right	A	6	64	C	32.9	233
Friendly's Way WB Left	D	48.3	29	F	89.8	739
Friendly's Way WB Thru	C	32.1	435	D	49.9	71

Intersection	No-Build					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee - Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza	B	14.5		C	21.0	
Big Y Driveway EB Left	C	26.8	60	C	33.1	179
Big Y Driveway EB Thru/Right	B	15.8	33	B	14.6	51
Tyringham Road WB Left	C	25.1	20	C	27.1	77
Tyringham Road WB Thru/Right	B	11.2	50	C	20.6	25
Route 102 NB Left	A	7.9	11	B	10.1	18
Route 102 NB Thru/Right	B	14.9	184	C	23.3	357
Route 102 SB Left	A	7.4	40	B	10.1	60
Route 102 SB Thru/Right	B	14.5	435	B	17.3	407
Lee - Route 20 at Premium Outlets Boulevard	A	2.5		A	9.2	
Route 20 EB Thru/Right	A	3.1	31	A	8.9	94
Route 20 WB Left	A	1.5	4	A	4.5	8
Route 20 WB Thru	A	1.8	64	A	7.3	63
Premium Outlets NB Left/Right	B	11.9	7	B	12.4	53
Westfield - North Elm Street (Route 202/Route 10) at Arch Road and Industrial Park Road	B	14.5		C	20.8	
Arch Road EB Left/Thru	E	67.3	176	E	67.3	216
Arch Road EB Right	A	6.8	46	A	5.5	56
Rtes. 10/202 NB Left	E	57.0	78	E	68.5	190
Rtes. 10/202 NB Thru/Right	A	6.8	342	A	4.8	202
Rtes. 10/202 SB Thru/Right	B	15.8	445	C	24.7	853

Intersection	No-Build					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Westfield - North Elm Street (Route 202/Route 10) at Notre Dame Street	D	41.7		E	62.7	
Notre Dame St. EB Left/Thru	D	50.1	530	D	50.3	250
Notre Dame St. EB Right	B	12.0	26	A	8.5	28
Notre Dame St. WB Left/Thru/Right	C	28.4	196	D	41.9	298
Rtes. 10/202 NB Left	C	24.8	56	C	31.2	80
Rtes. 10/202 NB Thru/Right	D	42.5	781	D	37.4	617
Rtes. 10/202 SB Left	C	25.5	49	C	27.1	81
Rtes. 10/202 SB Thru/Right	D	44.2	714	F	90.5	1174
Westfield - Elm Street at Franklin Street and Mobil Gas Station	D	54.9		F	91.1	
Franklin Street EB Left/Thru	F	86.7	754	D	51.2	567
Franklin Street EB Right	A	2.9	36	A	3.0	35
Elm Street NB Left	C	30.2	97	F	174.3	385
Elm Street NB Thru/Right	C	34.2	509	D	54.2	608
Elm Street SB Thru	F	94.4	326	F	189.6	398
Elm Street SB Right	A	2.1	30	A	2.3	33

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 3-7. Future Year (2040) No-Build Conditions Unsignalized Intersections LOS Analysis, Peak Hours

Intersection	No-Build						Intersection	No-Build						Intersection	No-Build					
	AM Peak Hour			PM Peak Hour				AM Peak Hour			PM Peak Hour				AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)		LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)		LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee							**Blandford**							**Westfield**						
West Park Street at Park Street/Main Street	E	41.5		F	n/a	n/a	**Otis Stage Road/Main Street (Route 23) at North Street**	A	2.2		A	2.0		**Southampton Road (Route 202/Route 10) at Servistar Industrial Way**	A	2.5		A	4.5	
West Park Street EB Left	F	214.6	83	F	n/a	n/a	Route 23 EB Left/Thru	A	0.6	0	A	0.5	0	Servistar Ind. Way EB Left/Right	D	29.8	48	F	68.0	98
West Park Street EB Thru	F	148.4	230	F	n/a	n/a	Route 23 WB Thru/Right	A	0.0	0	A	0.0	0	Route 202/10 NB Left/Thru	A	0.7	5	A	0.2	3
Park Street WB Thru	F	n/a	n/a	F	n/a	n/a	North Street SB Left/Right	B	10.0	5	B	10.4	5	Route 202/10 SB Thru/Right	A	0.0	0	A	0.0	0
Main Street SB Left/Thru/Right	A	6.5	30	A	8.1	65	**Main Street (Route 23) at Russell Stage Road**	A	1.9		A	2.9								
Becket							Route 23 EB Left/Thru	A	1.1	0	A	2.2	3							
Route 20 at Bonny Rigg Hill Road (Route 8)	A	4		A	1.9		Route 23 WB Thru/Right	A	0.0	0	A	0.0	0							
Route 20 EB Left/Thru/Right	A	0.4	0	A	0.6	0	Russell Stage Road SB Left/Right	A	9.3	3	A	9.5	8							
Route 20 WB Left/Thru	A	7.6	0	A	7.5	0	**Russell**													
Route 20 WB Right	A	0	0	A	0	0	**Westfield Road (Route 20) at Blandford Road (Route 23)**	A	4.0		A	3.1								
Bonny Rigg Hill Road NB Left/Thru/Right	B	10.2	3	B	10.3	3	Route 23 EB Left	B	13.3	3	C	20.4	5							
Main Street SB Left/Thru	B	11.1	13	B	10.9	5	Route 23 EB Right	B	11.5	25	B	10.4	13							
Main Street SB Right	A	8.9	0	A	9.2	0	Route 20 NB Left	A	8.1	5	A	8.2	13							
							Route 20 NB Through	A	0.0	0	A	0.0	0							
							Route 20 SB Thru	A	0.0	0	A	0.0	0							
							Route 20 SB Right	A	0.0	0	A	0.0	0							

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

3.5 Future Year No-Build VMT and VHT

The CTPS model also provides overall study area totals of Vehicle Miles Travelled (VMT) and Vehicle Hours Travelled (VHT). These are useful benchmarks that allow the effects of a proposed transportation project, in this case a new interchange, to be compared on a regional scale to conditions without the project. Table 3-8 summarizes the average weekday study area VMT and VHT for existing baseline model conditions (2016) and future year (2040) No-Build conditions.

Vehicle miles traveled in the study area are anticipated to grow by 11% between 2016 and 2040 under future No-Build conditions. Vehicle hours traveled are anticipated to increase as well, by 14%. In other words, in future No-Build conditions, there will be more miles traveled and more hours spent traveling within and through the study area. Given the modest population and household projections and declining employment identified previously in section 3.2, growth in VMT and VHT is likely the result of anticipated growth in trips on I-90 passing through the study area.

Table 3-8. Existing (2016) & Future Year (2040) No-Build Average Weekday VMT and VHT in Study Area

2016	
Daily VMT	**Daily VHT**
18,557,408 miles	533,227 hours
2040 No-Build	
Daily VMT	**Daily VHT**
20,555,351 miles	608,507 hours
Change in VHT and VMT between 2016 and 2040 No-Build	
Daily VMT	Daily VHT
1,997,943 miles	75,280 hours
% Growth in VHT and VMT between 2016 and 2040 No-Build	
Daily VMT	Daily VHT
11%	14%

Source: Central Transportation Planning Staff

3.6 Transit Service Forecasts

The Statewide Travel Demand Model does not have a transit component for the study area modeling effort. As noted in Chapter 2, transit service in the study area is only provided in Westfield (PVTA) and Lee (BRTA). Recent (2018) reporting by PVTA indicates that ridership is declining within their service area. BRTA also noted declining ridership during the same reporting period.

Chapter 4: Alternatives Development and Analysis

This chapter details the alternatives design development and analysis process. The process of selecting initial locations for a potential interchange is documented, including the identification of potential constraints and resource impacts. The results of screening the initial alternatives to a smaller set of alternatives for further analysis is identified, and detailed design work is shown. Results from the Statewide Travel Demand Model showing traffic diversion and use of a potential interchange are detailed, and interchange and intersection capacity analysis with those new traffic patterns in place are conducted and compared to those without an interchange. Conceptual cost estimates are discussed, and potential changes in vehicle miles travelled, vehicle hours travelled and improved access to socioeconomic opportunities are provided.

4.1 Design Approach and Initial Alternatives

The identification of potential sites for a new interchange began by examining locations where there was already a roadway crossing above or below I-90. Not only did this narrow down the universe of possibilities along the 30-mile roadway segment, but it also acknowledged the unlikely circumstance of creating a new roadway alignment through challenging terrain. Based on this logic, seven locations were identified for initial consideration:

- Loose Tooth Road/Route 20, Becket
- Werden Road, Becket
- Johnson Road, Becket
- Algerie Road, Otis
- Blandford Maintenance Facility, Blandford
- Blandford Service Plaza, Blandford
- Route 23, Russell

Figure 4-1 identifies the location of each alternative under consideration. A brief description of each location is provided below.

Loose Tooth Road/Route 20, Becket: Route 20 (Jacob's Ladder Road) crosses underneath I-90 near Loose Tooth Road, a gravel roadway that provides access to a small pond fed by Higley Brook. The opportunity to provide access to Route 20, one of the main roadways serving the entire study area, is appealing but the significant grade difference between Route 20 and I-90 (greater than 20%) is substantial. Potential impacts to wetlands and surface water bodies, and significant right-of way impacts, are among the noticeable constraints at this location. This crossing is 5.2 miles from Exit 2 in Lee and does not fully address the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Werden Road, Becket: Werden Road is a local road connecting Route 8 and Route 20. There are wetland resources in the two southerly quadrants, and steep slopes within the potential interchange footprint that would affect constructability and cost. Over 20 residences are within ¼ mile of the interchange location, as well as Camp Lenox. This crossing is 7.7 miles from Exit 2 in Lee and does not fully address the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Johnson Road, Becket: Johnson Road is a gravel roadway that crosses over I-90 on a weight-restricted bridge. It eventually connects with Route 20/Route 8 to the north and Route 23 to the south and carries less than 100 vehicles per day. Existing roadway conditions and steep slopes would affect constructability and cost. Like the prior two alternatives, this crossing is 9.2 miles from Exit 2 in Lee and does not fully address the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Algerie Road, Otis: Algerie Road is a two-lane roadway that crosses under I-90. It intersects with Bonny Rigg Hill Road to the north before connecting with Route 20 in Becket, with Algerie Four Corners and Route 23 to the south. Algerie Road serves two sand and gravel/stone quarries which generate over 200 truck trips per day. There is an emergency access ramp to I-90 eastbound at this location. The route to the north via Algerie Road and Bonny Rigg Hill Road passes near a census block area in Becket that is designated as an Environmental Justice zone. Resource constraints at this location include wetlands and the Otis State Forest. This location is nearly 12 miles from Exit 2 and is within a distance that satisfies the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Blandford Maintenance Facility, Blandford: This location has the advantage of having existing access points on both sides of I-90 due to existing turnpike maintenance functions. The primary connection would be to the north via Chester Road: Old Chester Road to the south turns into a gravel road for much of its length. Any alternative at this location would be required to continue unimpeded use of the maintenance facility. This location is nearly at the midpoint between Exits 2 and 3 and satisfies the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Blandford Service Plaza, Blandford: The Blandford Service Plaza alternative utilizes the land surrounding the existing eastbound and westbound service plazas off of I-90. The service plazas are generally busy with customers utilizing the gas stations or restaurants. At both plazas, there is a gated entry in the back onto a local road for official use only, providing access to North Street. An interchange at this location would need to ensure uninterrupted use of the plaza's facilities and consider any needs the plaza may have for future growth. This location is 11.3 miles from Exit 3 and is within a distance that satisfies the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Route 23, Russell: Route 23 (Blandford Road) crosses over I-90 at this location. Resource areas within the interchange footprint include wetlands, floodway and surface waters. Steep slopes would affect the constructability and cost of an interchange at this location. This crossing is 6.3 miles from Exit 3 in Westfield and does not fully address the objective of finding an interchange location near the midpoint of the 30-mile distance between Exits 2 and 3.

Initial design concept development began by reviewing resource mapping to identify environmental and regulatory constraints. Then, MassDOT highway design standards were used to select an interchange type that best suited the surrounding physical conditions of each alternative location. From this, an initial concept of interchange configuration, size, and specific location was developed. This gave the study team the initial sense of what an interchange would look like at each location, and what its physical impacts might be.

After thorough review of the initial concepts, the interchange alternatives were revised in order to minimize physical impacts. This generally involved slightly altering the geometry and placement of various interchange components. This process was repeated until it was clear that the study team had developed conceptual designs which avoided or minimized impacts to physical resources and property to the extent possible. From here, it was possible to calculate impacts and determine general feasibility and operational suitability. The initial conceptual design of each of the seven alternatives (and revisions where recommended), are provided in Figures 4-2 through 4-8.

Figure 4-1. Location of Initial Alternatives

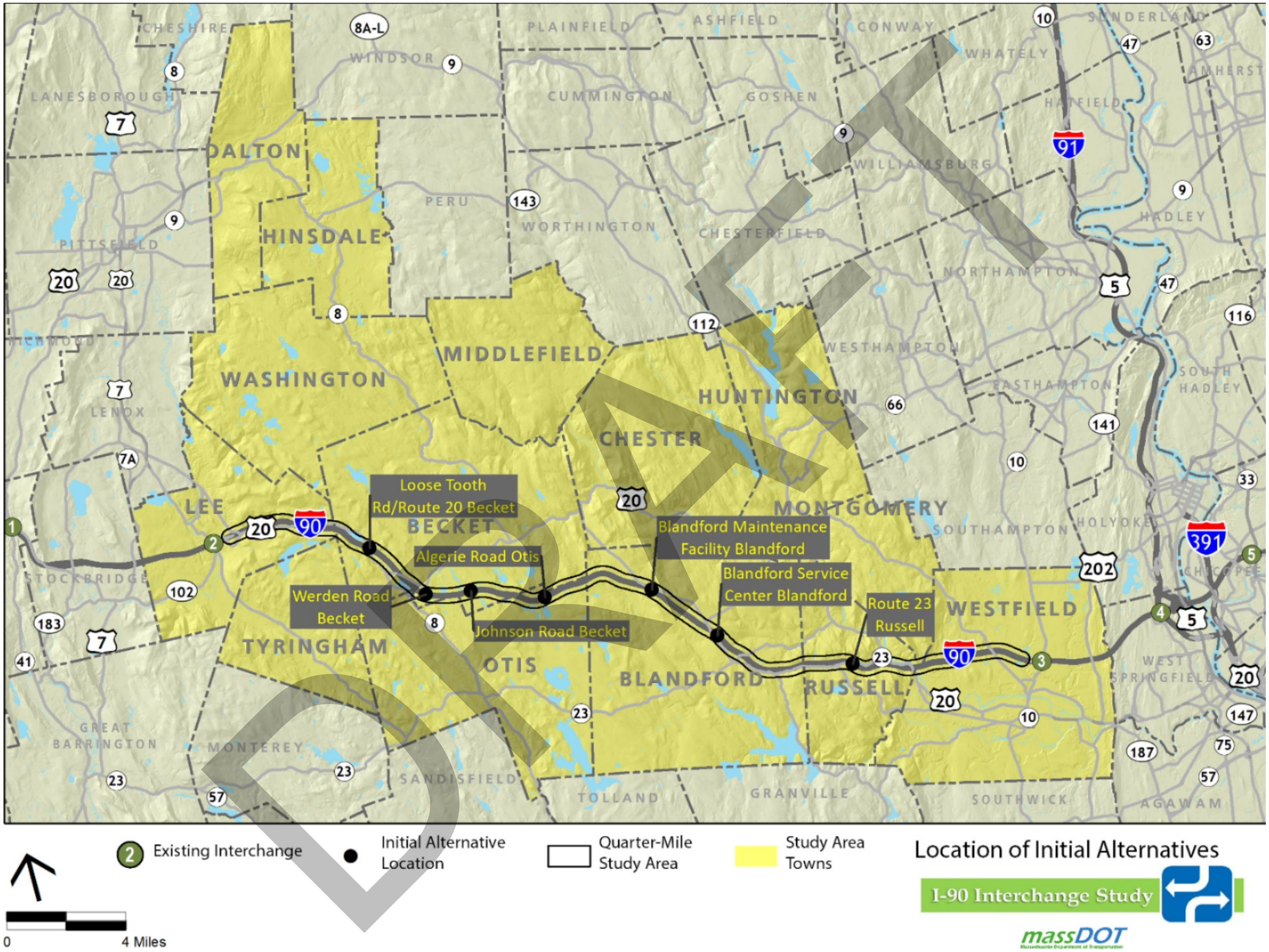


Figure 4-2. Loose Tooth Road/Route 20, Becket

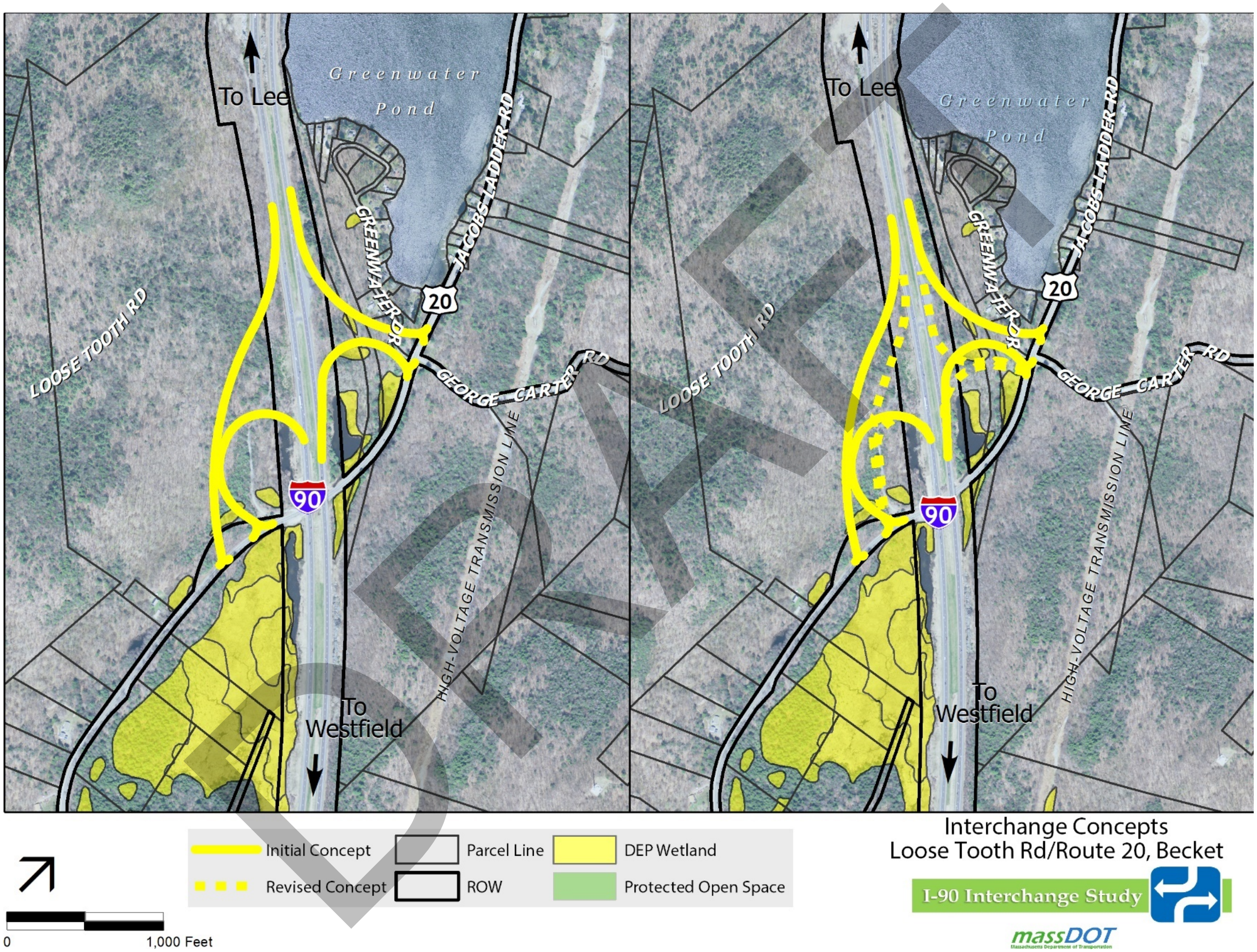


Figure 4-3. Werden Road, Becket

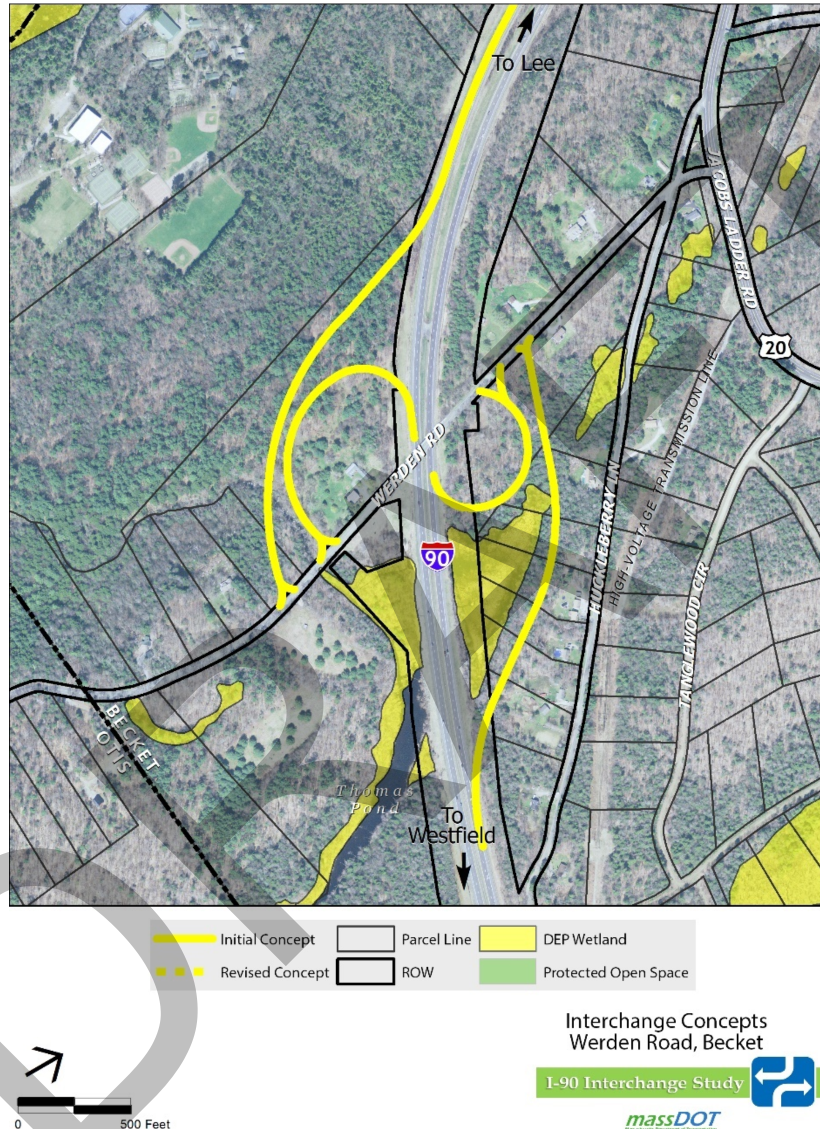


Figure 4-4. Johnson Road, Becket

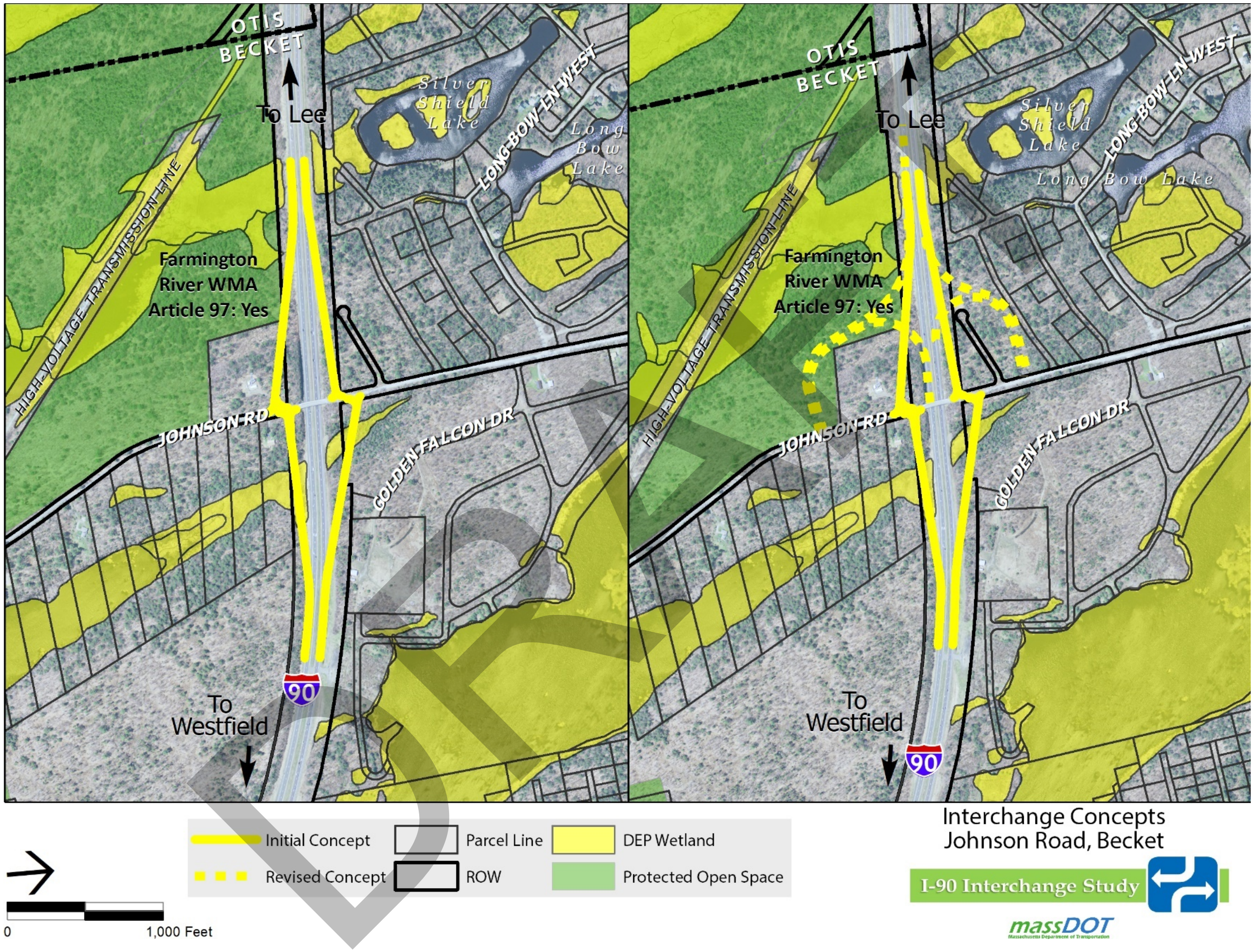


Figure 4-5. Algerie Road, Otis

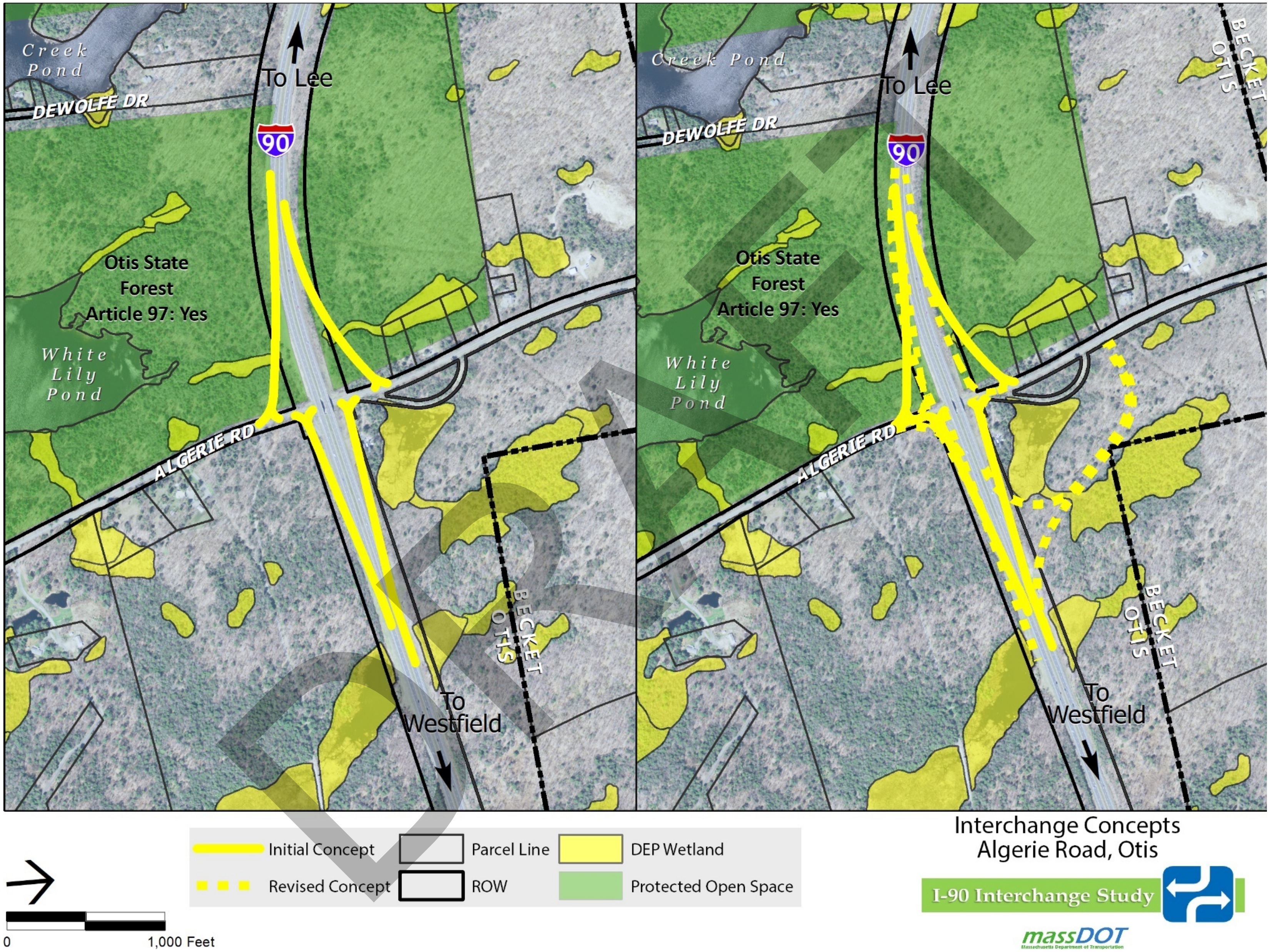


Figure 4-6. Blandford Maintenance Facility, Blandford

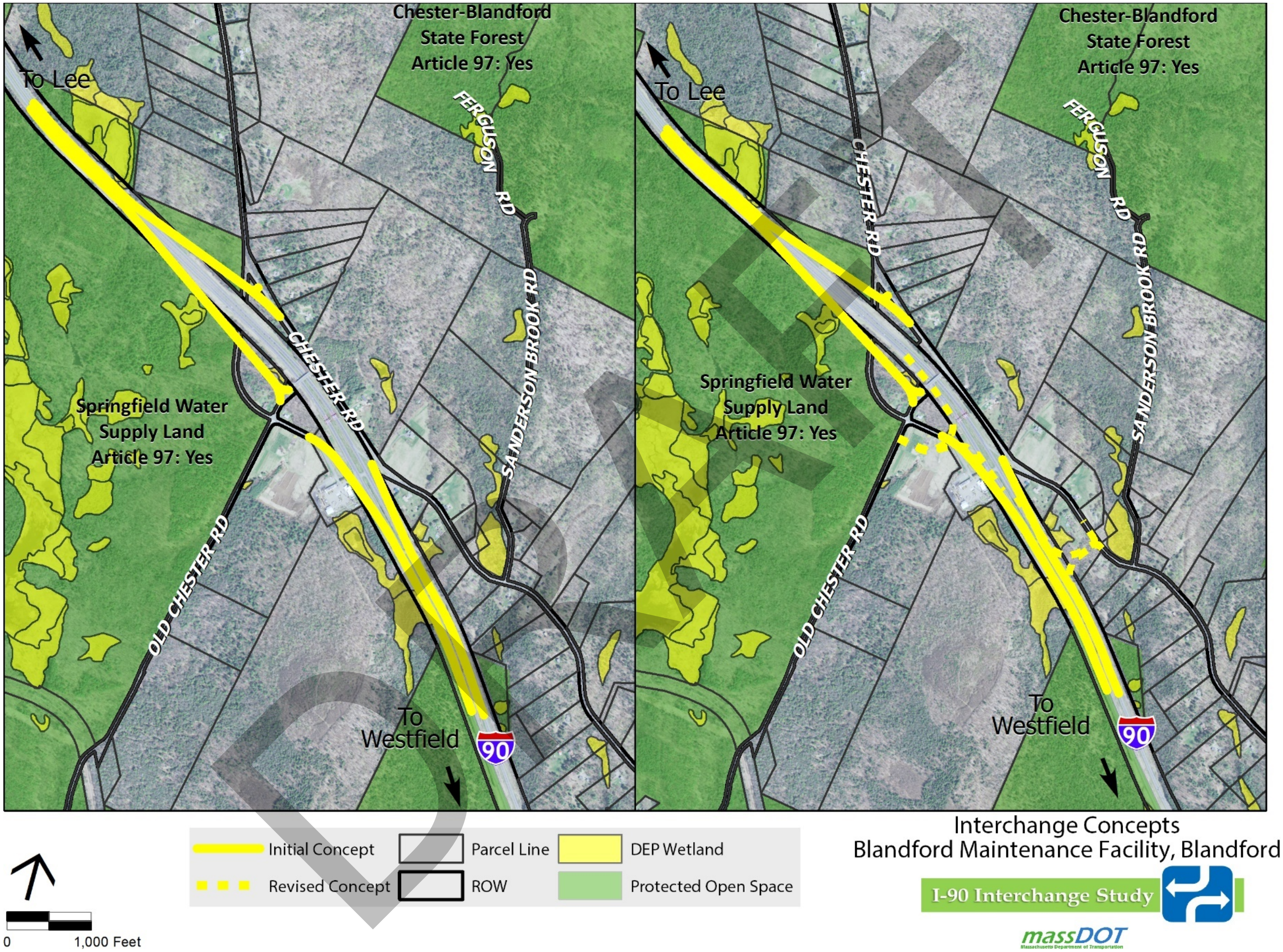


Figure 4-7. Blandford Service Plaza, Blandford

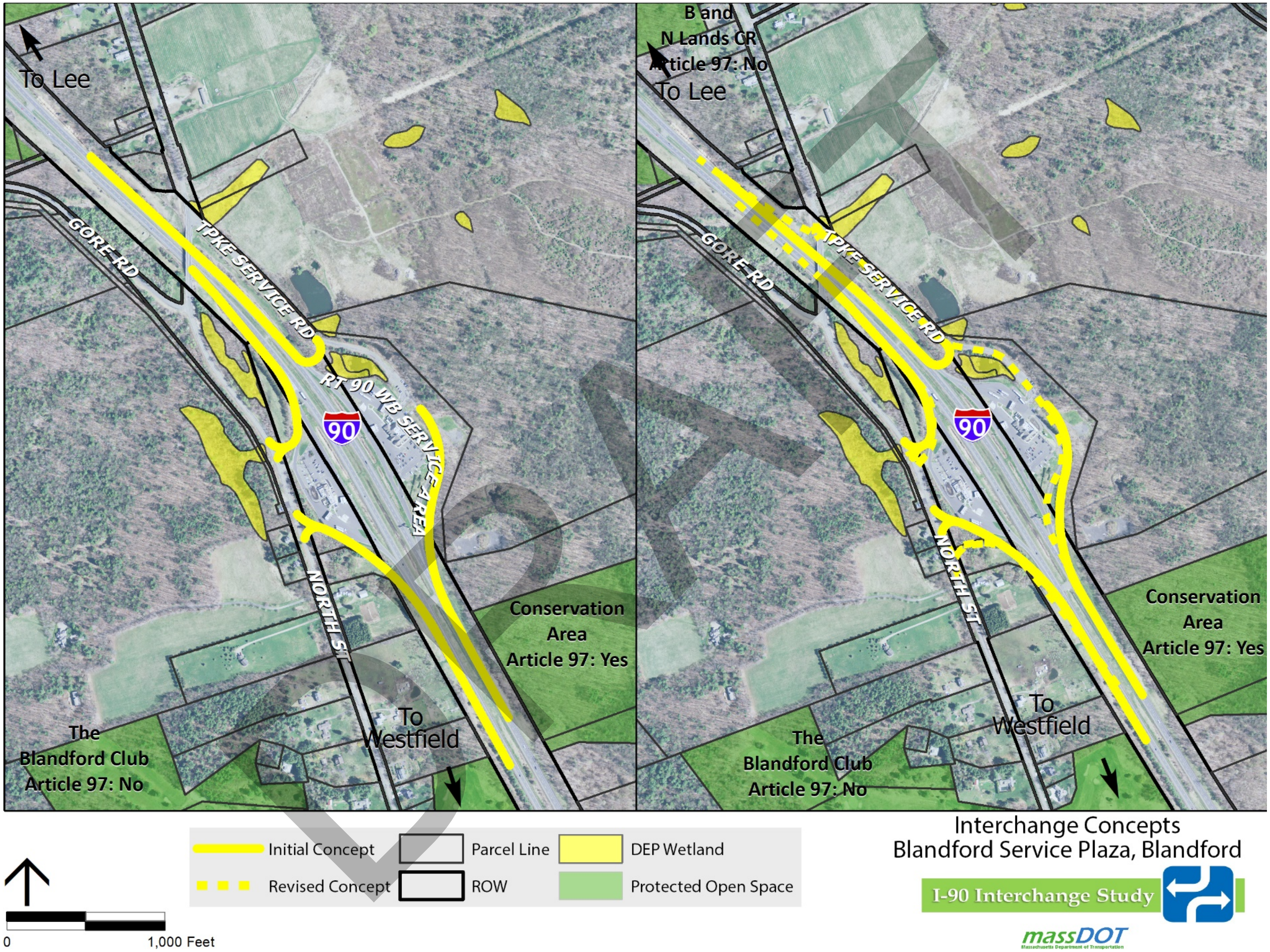
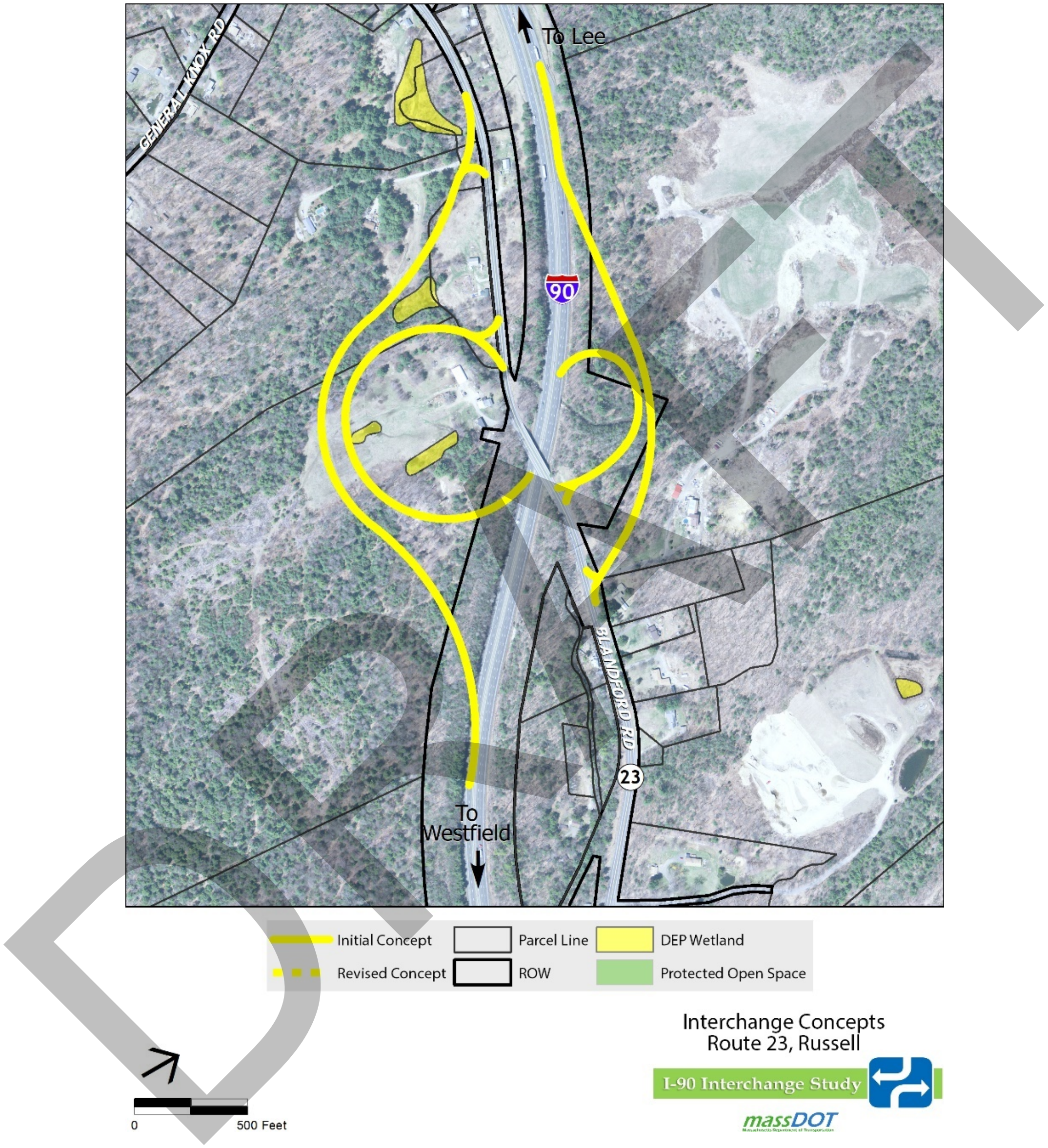


Figure 4-8. Route 23, Russell



4.2 Initial Analysis and Screening

As discussed in Chapter 1, there were numerous evaluation criteria developed for this study. These criteria were used to screen the initial seven alternatives and allowed the study team to narrow the selection of alternatives to three. Table 4-1 on the following page lists each criteria as it applies to each alternative. The data shown reflects that of the revised alternatives that were developed to minimize negative land impacts. The table is useful for examining each alternative's ability to satisfy the study purpose, while comparing potential impacts and benefits at a conceptual level.

Table 4-1. Evaluation Criteria/Screening Analysis for Initial Seven Alternatives

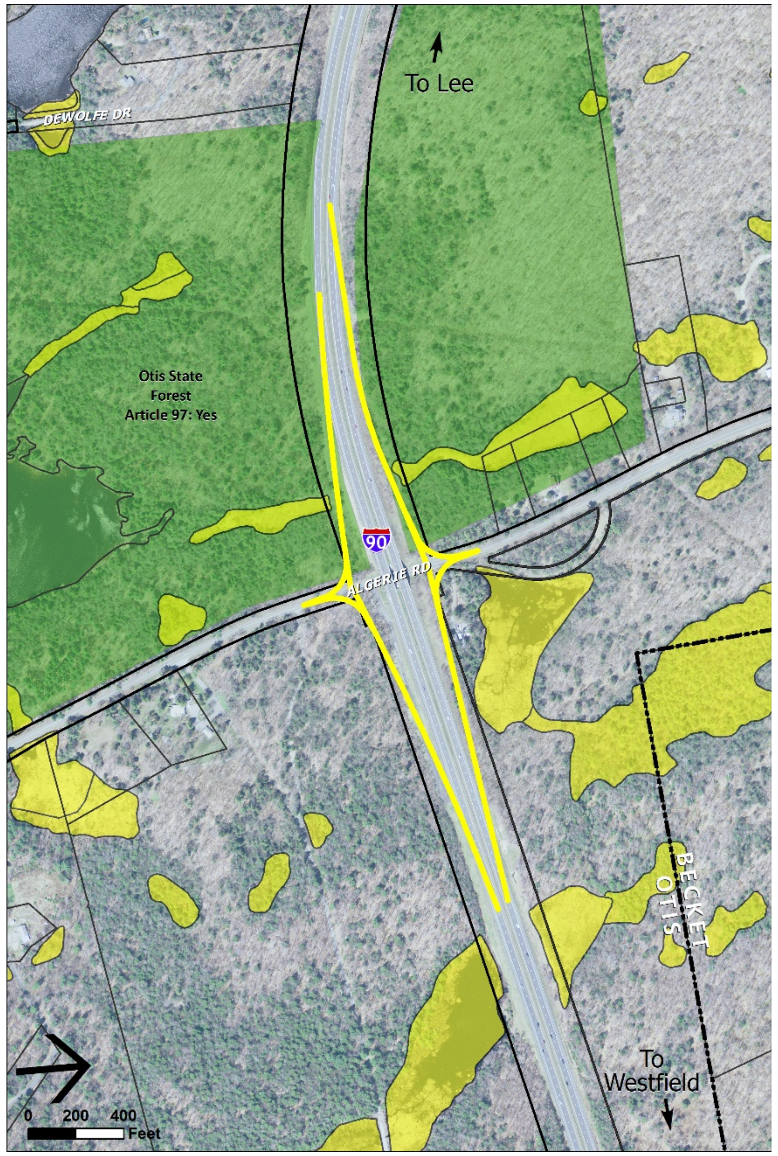
	Loose Tooth Road/Route 20 (Becket)	Werden Road (Becket)	Johnson Road (Becket)	Algerie Road (Otis)	Blandford Maintenance Facility (Blandford)	Blandford Service Plaza (Blandford)	Route 23 (Russell)
DESIGN & OPERATIONS							
Interchange Type/Configuration	Partial Cloverleaf	Partial Cloverleaf	Partial Cloverleaf	Diamond	Partial Cloverleaf	Diamond	Partial Cloverleaf
Proximity to Adjacent Interchanges	Exit 2: 5.2 Miles Exit 3: 24.5 Miles	Exit 2: 7.7 Miles Exit 3: 22 Miles	Exit 2: 9.2 Miles Exit 3: 20.5 Miles	Exit 2: 11.8 Miles Exit 3: 17.9 Miles	Exit 2: 15.7 Miles Exit 3: 14 Miles	Exit 2: 18.4 Miles Exit 3: 11.3 Miles	Exit 2: 23.4 Miles Exit 3: 6.3 Miles
Local Road Connections	Minor Arterial	Local	Local	Minor Collector	Local	Major Collector	Minor Arterial
Jurisdiction	State	Town	Town	Town	Town	State	State
NHS	Yes	No	No	No	No	No	No
Condition	Fair	Fair	Deficient	Fair	Fair	Fair	Good
ENVIRONMENTAL IMPACTS							
Wetlands (approximate sq. ft.)	3,435	797	None	194	None	310	431
Water Resources (approximate sq. ft.)	None	None	None	None	180,000	105,500	None
NHESP Habitat	CVP +/- 900 feet	None	None	None	None	None	None
Steep Slopes/Topography (sq. ft.)	15%-20%: 30,787 > 20%: 112	15%-20%: 83	15%-20%: 4,609	None	None	None	15%-20%: 42,258
Open Space/Article 97 (sq. ft.)	None	None	106,669	2,883	216	None	None
Cultural Resources	None	Camp Lenox (600 feet)	None	None	None	Blandford Golf & Tennis Club	None
Hazardous Materials	None	None	None	None	None	UST at Plaza	None
SOCIOECONOMIC EFFECTS							
Noise (residences within ¼ mile)	24	22	4	7	18	15	34
Right-of-Way Impacts (sq. ft.)	127,158	302,828	78,682	17,093	91,686	20,316	338,821
Environmental Justice	Yes	Yes	Yes	No	No	No	No
FINANCIAL & REGULATORY							
Property Takings	4 Parcels	13 Parcels	3 Parcels	4 Parcels	4 Parcels	2 Parcels	3 Parcels
Construction Cost	$$$	$$$	$$	$	$	$	$$$

In conducting this initial screening exercise, it was found that three of the seven locations did not fulfil the primary goal of the study, which was to consider alternatives that would provide access to I-90 for the center of regional study area. After discussion with the Working Group, these alternatives were eliminated from further consideration as a part of this study. The eliminated alternatives represent locations on the outskirt of the study area: Loose Tooth Road/Route 20, Werden Road in Becket, and Route 23 in Russell. Meanwhile, the alternative on Johnson Road in Becket exhibited terrain deficiencies and steep slopes that would severely limit constructability of a new interchange. As such, it was also eliminated.

With concurrence of the Working Group, the three remaining alternatives were selected for consideration in this study: Algerie Road in Otis, the Blandford Maintenance Facility in Blandford, and the Blandford Service Plaza in Blandford. The conceptual designs for these three alternatives were refined using Infraworks 3-D modeling. This design tool allowed the study team to understand and account for both vertical and horizontal design requirements. For example, the analysis identifies areas where steep slopes would require excavation or filling, or areas where curves in existing roadways would need to be flattened to provide improved sight distance and safety. The analysis also investigated areas where previously reported resource impacts might be further reduced within the constraints of design requirements.

The three final concepts, along with associated 3-D model screenshots, are shown in Figures 4-9, 4-10 and 4-11.

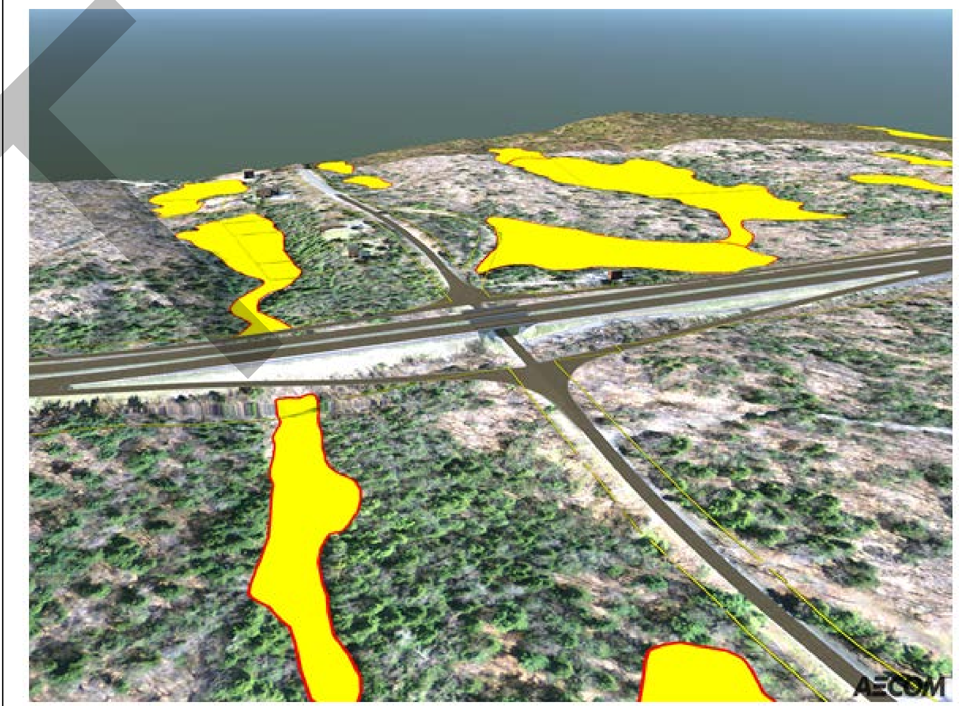
Figure 4-9. Alternative 1/Algerie Road Final Concept



DEP Wetland

Algerie Road East

Algerie Road North



Algerie Road Overhead

Algerie Road West

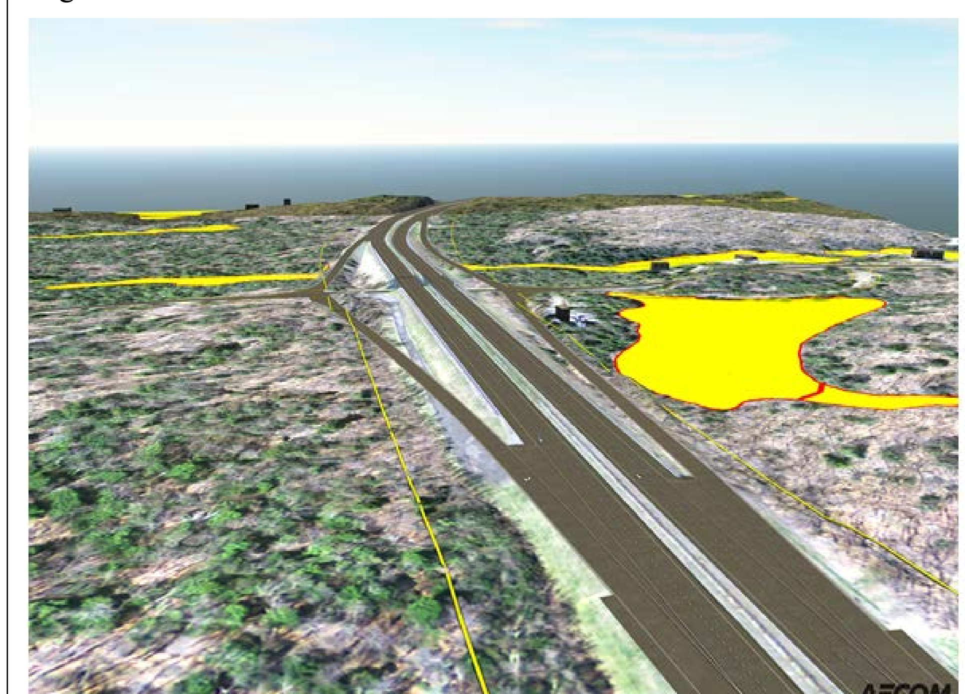
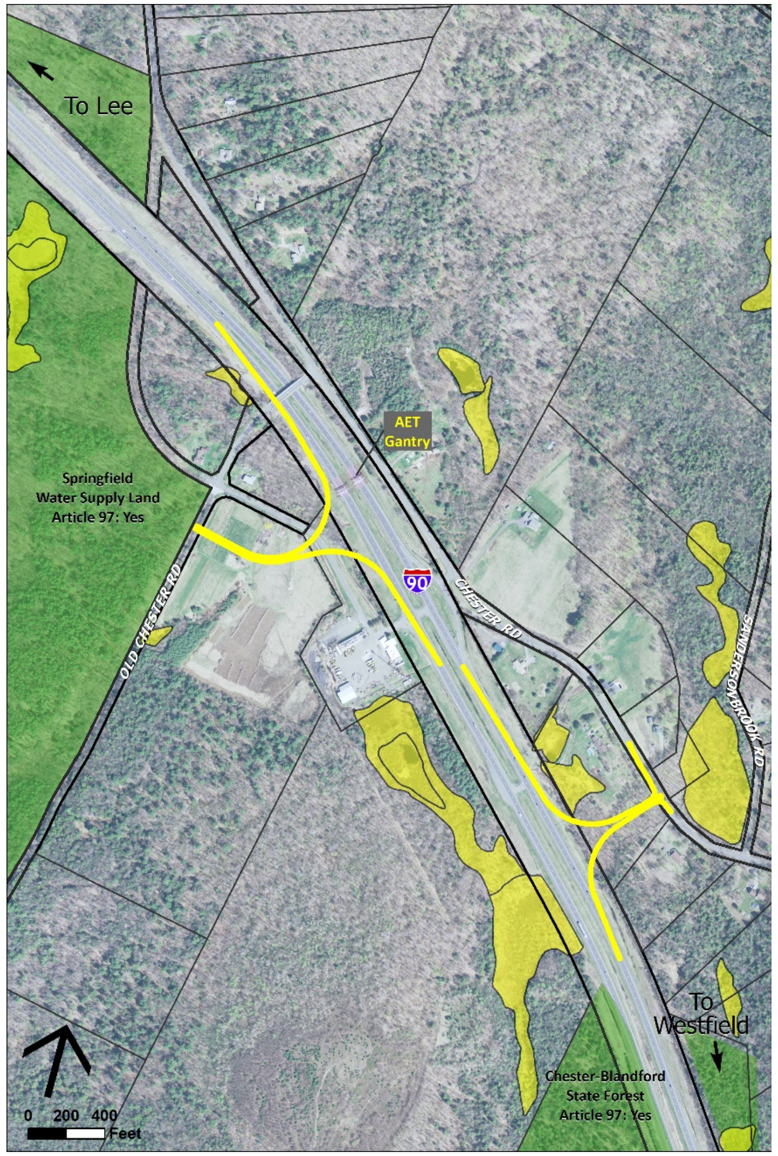


Figure 4-10. Alternative 2: Blandford Maintenance Facility Concept Design



DEP Wetland

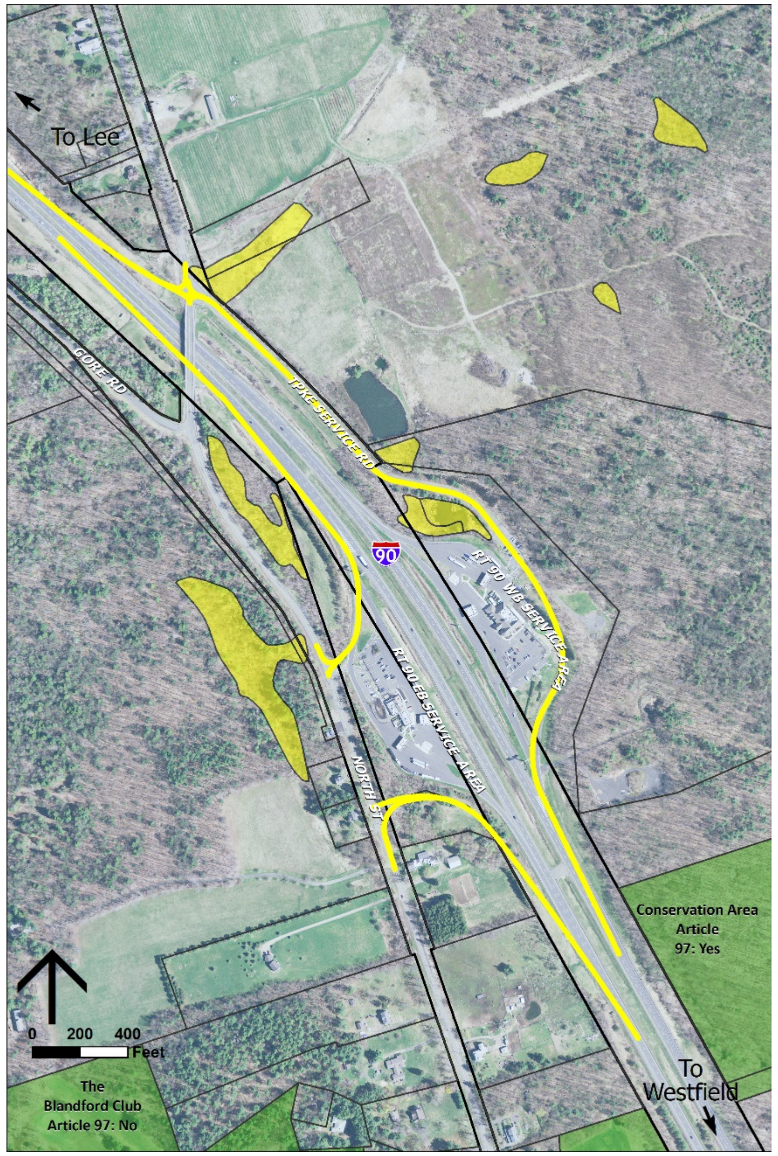
Blandford Maintenance Facility East

Blandford Maintenance Facility North

Blandford Maintenance Facility Overhead

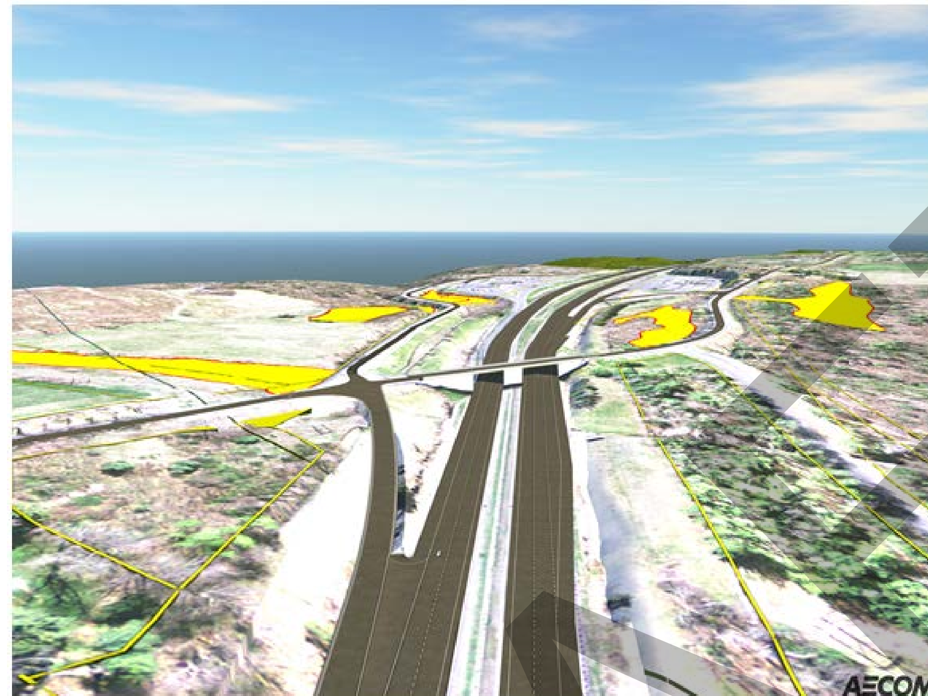
Blandford Maintenance Facility West

Figure 4-11. Alternative 3: Blandford Service Plaza Concept Design



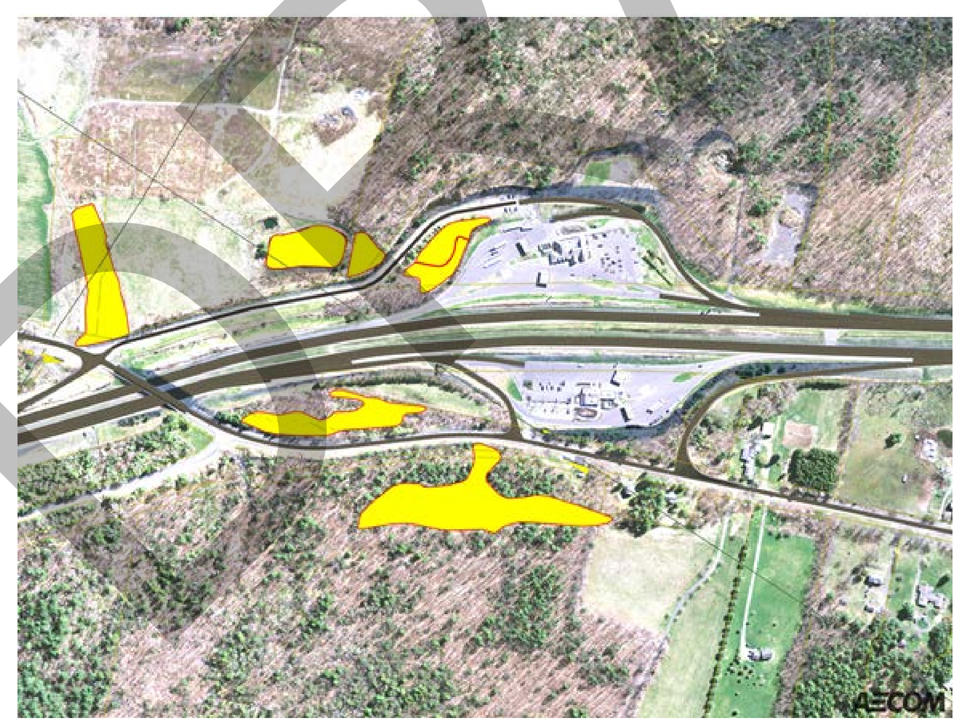
DEP Wetland

Blandford Service Plaza East



Blandford Service Plaza South

Blandford Service Plaza Overhead



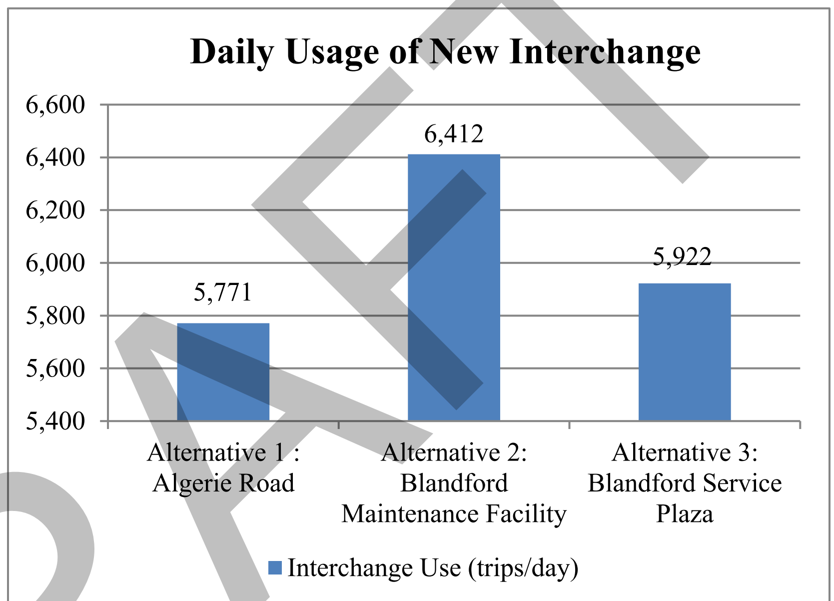
Blandford Service Plaza West

4.3 Alternatives Analysis

The three interchange alternatives were evaluated for their ability to attract trips that would have otherwise used the existing local roadway network. Each interchange location was considered separately as a new access point in the Statewide Travel Demand Model and tested to determine the magnitude of daily traffic that might use an interchange at that specific location. The model also provided information that shows potential travel paths and changes in traffic volumes on the existing local roadway network. The following pages illustrate and summarize the results of the modeling efforts.

Interchange Use

Figure 4-12. New Interchange Usage



The modeling results shown in Figure 4-12 indicate that Alternative 1 would attract the least amount of trips at 5,771 trips per day on average. Meanwhile, Alternative 2 would observe 6,412 trips per day, and Alternative 3 would experience 5,922 trips per day.

As discussed in Chapter 3, it is understood that there will be increased VHT and VMT on study area roadways in future No-Build conditions due to modest background traffic growth between 2016 and 2040. However, it is important to note that because of existing zoning regulations, projected employment decreases, and low projected population growth within the study area, there are no additional new trips attributed to the addition of a new interchange in future Build conditions. In other words, certain roadways will see traffic volume increases, and trip distances may change, but no new trips are generated within the boundaries of the study area as a result of a new interchange being present.

Table 4-2. Projected Interchange Volumes

Interchange Location	Daily	AM Peak Hour	PM Peak Hour
Alternative 1: Algerie Road	5,771 trips/day	457 trips/hour	453 trips/hour
Alternative 2: Blandford Maintenance Facility	6,412 trips/day	560 trips/hour	509 trips/hour
Alternative 3: Blandford Service Plaza	5,922 trips/day	568 trips/hour	499 trips/hour

4.3.1 Trip Diversion

Interchange volumes in 2040 Build conditions at Exits 2 and 3 are projected to be approximately 16,000 and 25,000 trips per day, respectively. These comparatively larger numbers are not entirely surprising given these exits serve larger communities and commercial areas, while a new interchange would serve a much less populated area with minimal commercial activity.

However, a new interchange could still have an impact on the existing interchanges by diverting some trips. Table 4-3 shows the trips that could be anticipated to be diverted from the existing interchange to the new interchange alternatives. At Exit 2, up to 2% of trips would be diverted to a new interchange, with Alternative 2 providing the most division of Exit 2 trips. Meanwhile at Exit 3, up to 7% of trips could be diverted to a new interchange. Alternative 3 provides the most diversion of trips from Exit 3. The impacts of these diverted trips on network operations are discussed in the next section.

Table 4-3. Trip Diversion from Adjacent Interchange

Interchange Alternative	Daily	AM Peak Hour	PM Peak Hour
Alternative 1 : Algerie Road			
Exit 2 diversion	-64 trips/day	-22 trips/hour	-2 trips/hour
Exit 3 diversion	-597 trips/day	-46 trips/hour	-44 trips/hour
Alternative 2: Blandford Maintenance Facility			
Exit 2 diversion	-346 trips/day	-28 trips/hour	-14 trips/hour
Exit 3 diversion	-1,044 trips/day	-99 trips/hour	-75 trips/hour
Alternative 3: Blandford Service Plaza			
Exit 2 diversion	-134 trips/day	-10 trips/hour	-5 trips/hour
Exit 3 diversion	-1,433 trips/day	-120 trips/hour	-138 trips/hour

As shown in Table 4-4, many trips that would have used local roadways to complete their trip in 2040 No-Build conditions would now use I-90 under Build conditions. In these cases, vehicles are able to get off local roadways and onto the interstate faster. Alternative 3 diverts the most trips off local roadways and onto the interstate, while Alternative 1 diverts the least.

Table 4-4. Trip Diversion from Local Roadways

Interchange Alternative	Daily Trips
Alternative 1: Algerie Road, Otis	726 vehicles/day (13% of total interchange use)
Alternative 2: Blandford Maintenance Center, Blandford	1,184 vehicles/day (18% of total interchange use)
Alternative 3: Blandford Service Plaza, Blandford	1,365 vehicles/day (23% of total interchange use)

Moreover, the routes that many drivers would use to complete trips would be different with a new interchange. Many local roadways would see little-to-no volume change. However, since a portion of future trips would shift to different routes, some roadways would see moderate to significant changes in anticipated traffic volumes. Figures 4-13 through 4-18 illustrate the resulting projected daily interchange volumes.

For all alternatives, the roadways directly connecting to the interchange would see an increase of over 3,000 trips per day. These trips disperse throughout the local roadway network, and as a result all alternatives correlate to increases in daily traffic volumes on several key roadways: Route 8 in Dalton, Hinsdale, Washington, and Becket, Algerie Road in Otis, North Blandford Road in Blandford and Otis, and Washington Mountain Road in Washington.

The most notable anticipated decrease in traffic volumes would be seen on Route 20 for all alternatives. The entire stretch of Route 20 from Lee to Westfield would see large volume decreases, with many segments seeing a reduction of over 1,000 trips per day. These trips would take different routes as a result of accessing the interstate. Outlying study area communities would also see a substantial decrease on some of their main roadways, including Skyline Trail and East River Road in Chester, County Road/Route 66 in Huntington, Main Road in Montgomery, and Main Road in Tyringham.

Figure 4-13. Alternative 1 – Algerie Road/Projected Daily Interchange Volumes

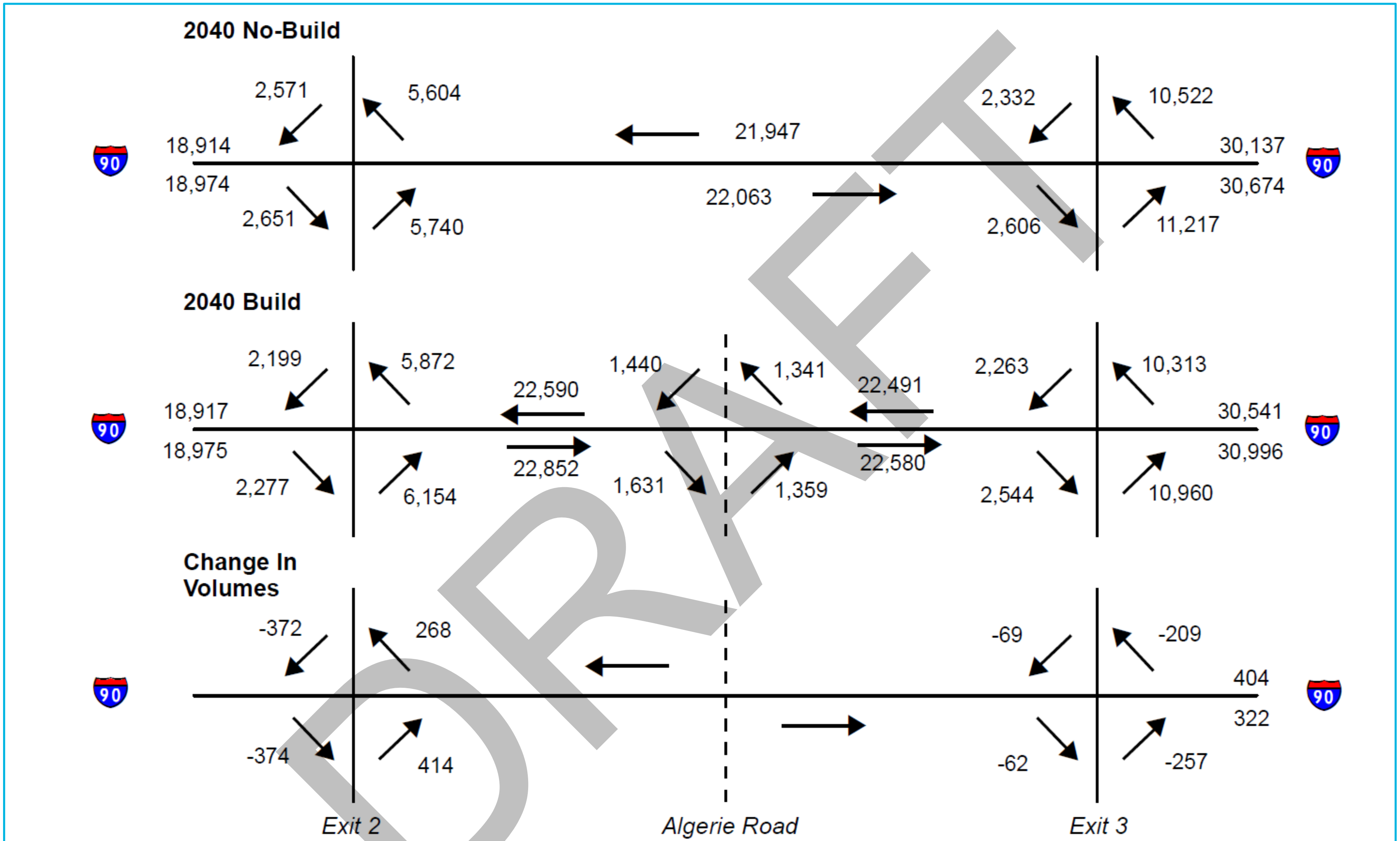


Figure 4-14. Alternative 1 – Algerie Road/Diversion to Proposed Interchange (Changes in Desired Routes)

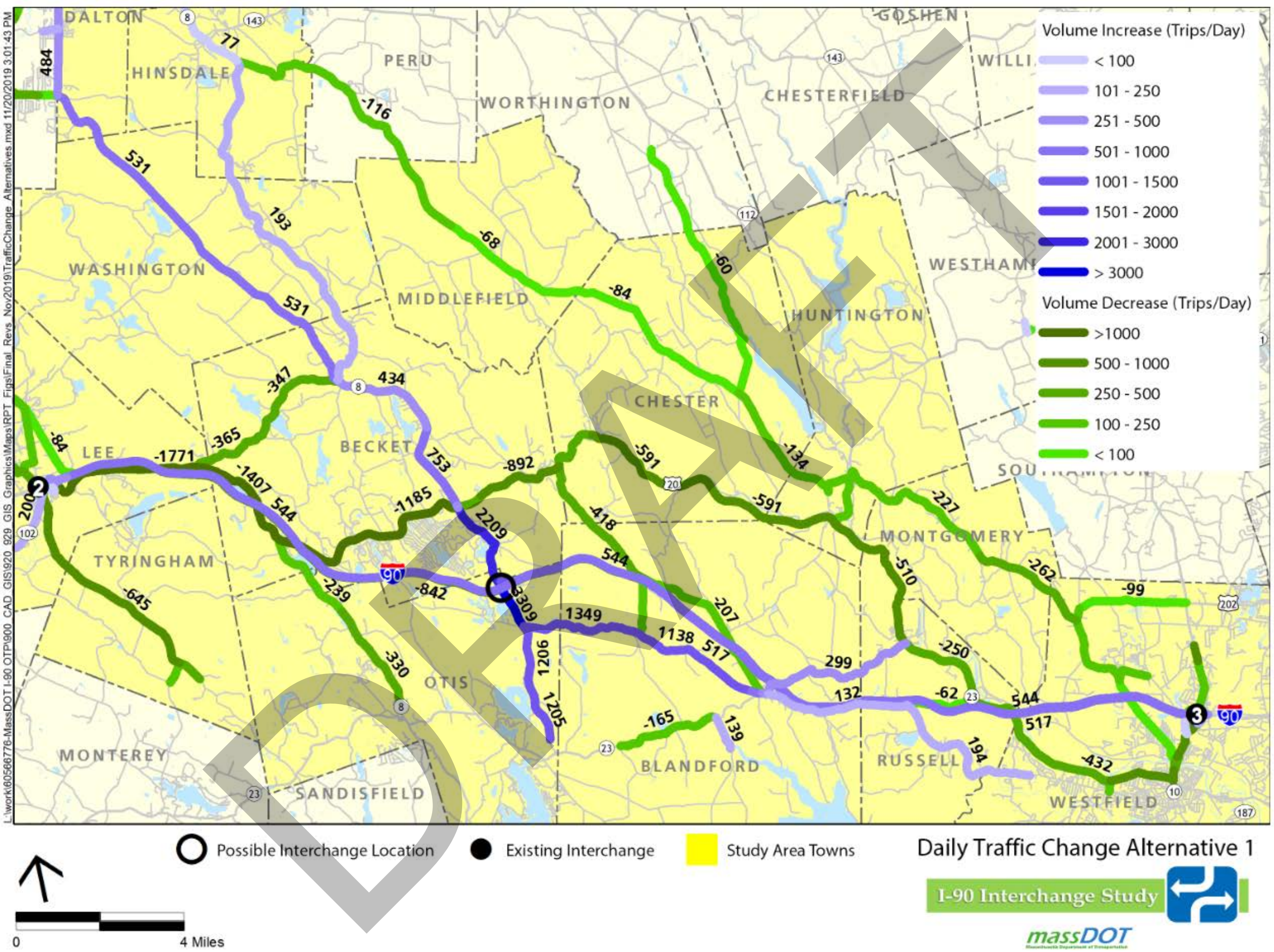


Figure 4-15. Alternative 2 – Blandford Maintenance Facility/Projected Daily Interchange Volumes

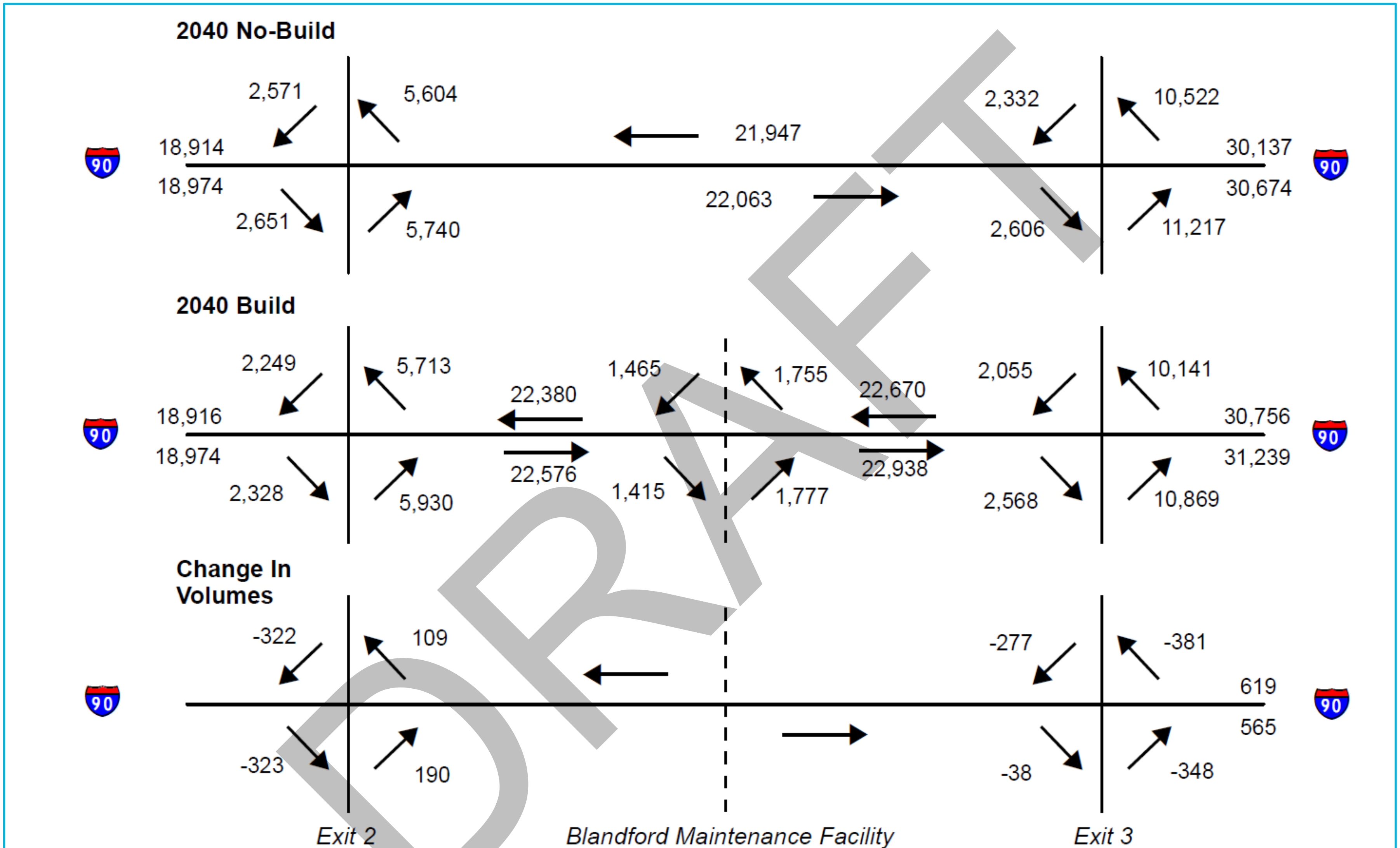


Figure 4-16. Alternative 2 – Blandford Maintenance Facility/Diversion to Proposed Interchange (Changes in Desired Routes)

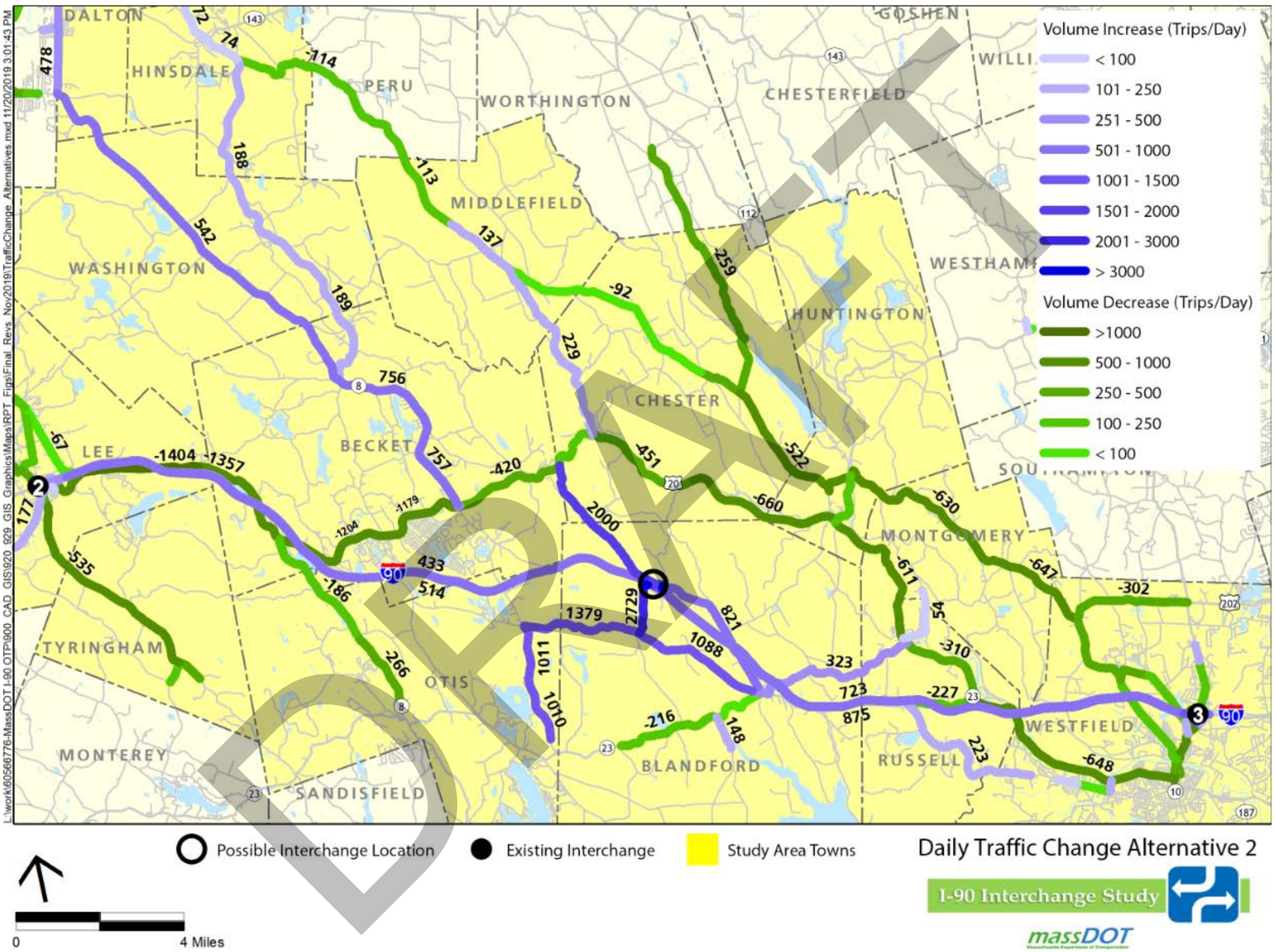


Figure 4-17. Alternative 3 – Blandford Service Plaza/Projected Daily Interchange Volumes

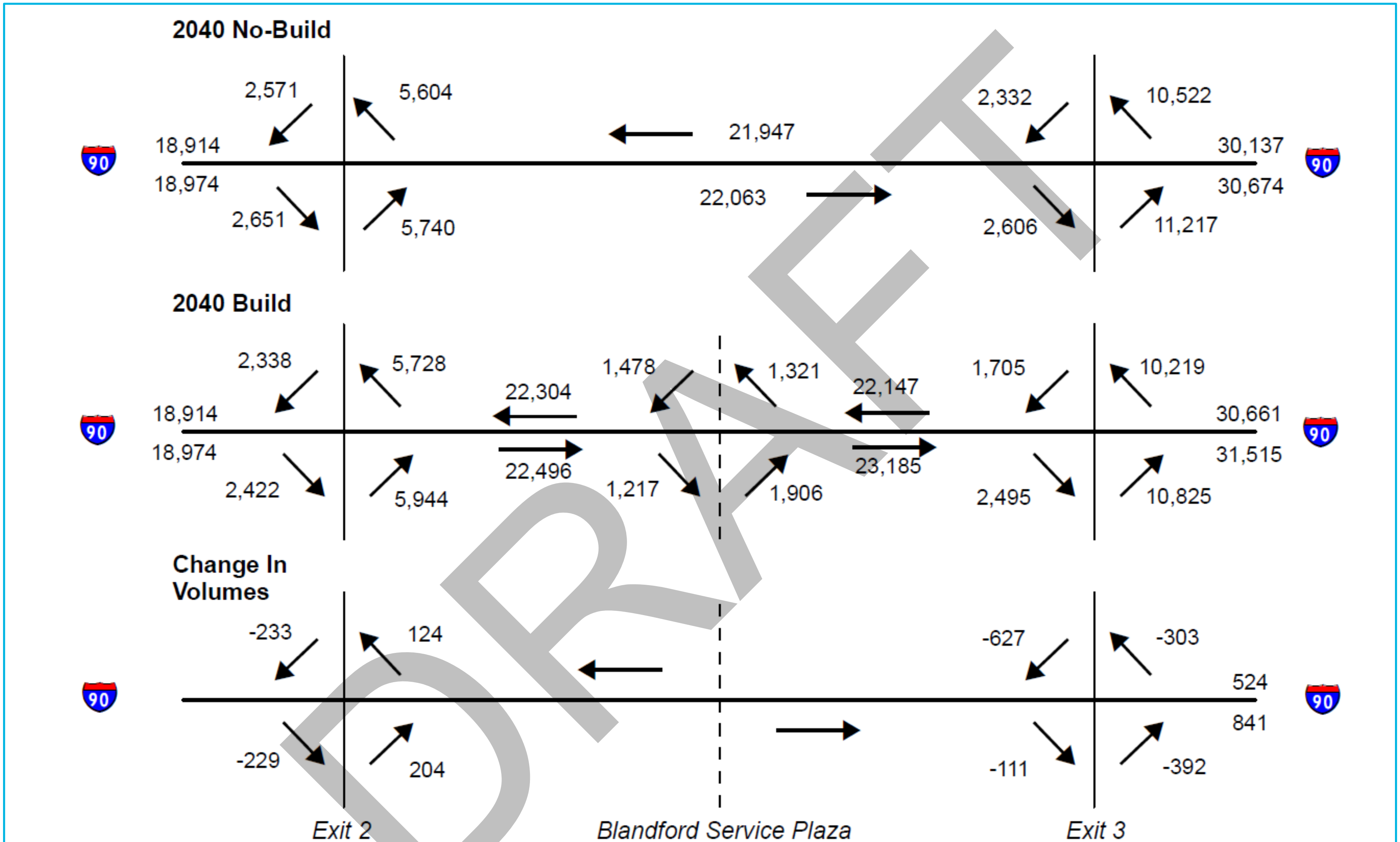


Figure 4-18. Alternative 3 – Blandford Service Plaza/Diversion to Proposed Interchange (Changes in Desired Routes)

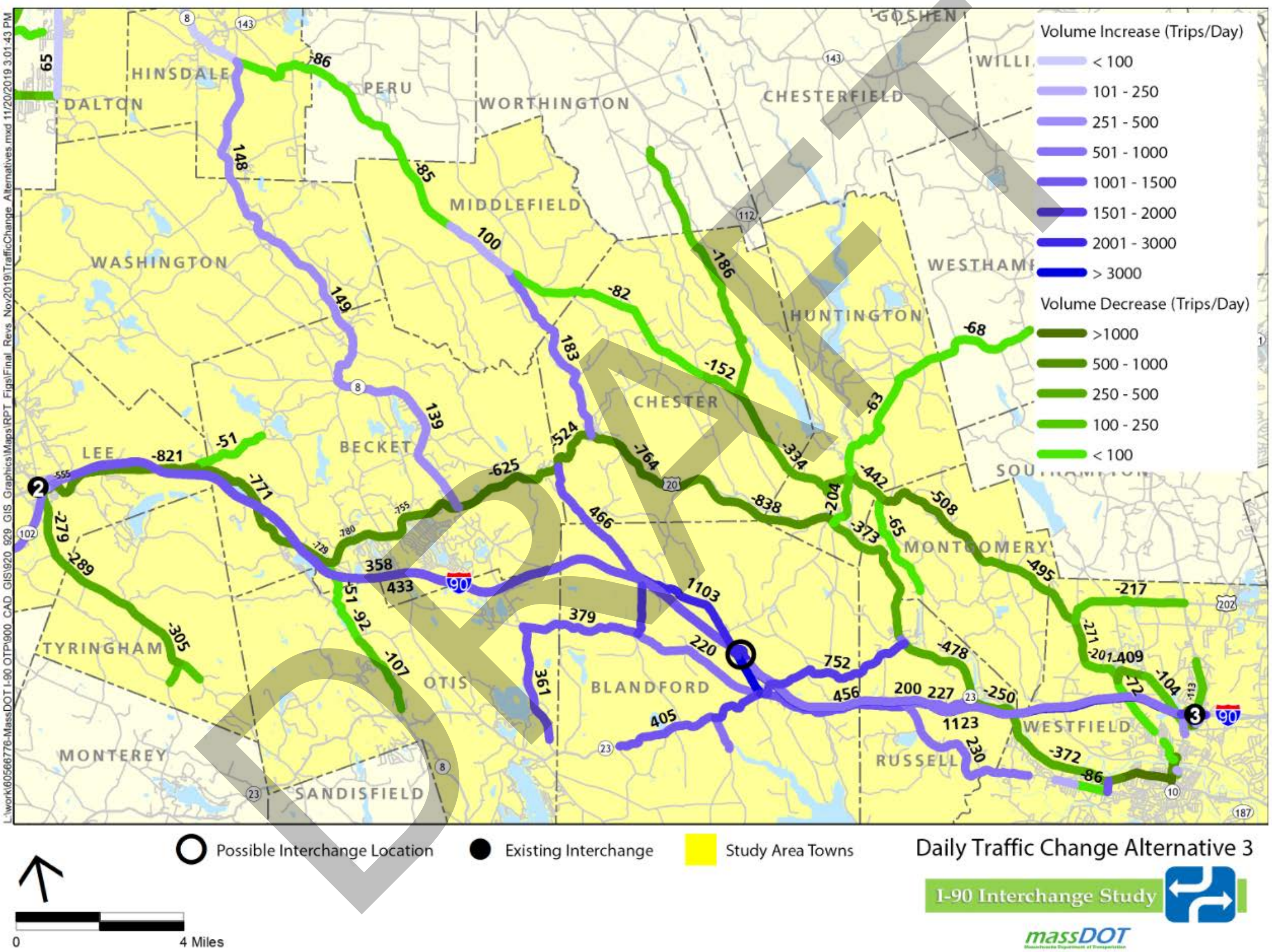


Table 4-5 compares 2040 No-Build traffic volumes on representative study area roadway segments with traffic volumes associated with diversion to each of the three interchange alternatives.

Table 4-5: Daily Traffic Volumes on Selected Study Area Roadway Segments With and Without Interchange Alternatives

Location	Town	2040 No-Build (vehicles/day)	2040 Build Alternative 1 (vehicles/day)	2040 Build Alternative 2 (vehicles/day)	2040 Build Alternative 3 (vehicles/day)
Route 20 east of Lee Town Line	Becket	2,693	1,286	1,336	1,922
Route 20 east of Bonnie Rigg Corner	Becket	3,659	2,767	3,239	3,034
Route 8 south of County Rd. Becket	Becket	2,852	3,286	3,608	2,991
Becket Road	Becket	3,476	3,111	3,428	3,425
Bonny Rigg Hill Road	Becket	606	2,815	587	594
Route 23 at Russell Town Line	Blandford	1,786	1,918	1,782	2,242
Route 23 West of Blandford Center	Blandford	1,166	1,140	1,098	1,872
North Street/Chester Road	Blandford	432	225	1,253	1,535
North Blandford Road	Blandford	1,383	2,521	2,471	1,603
Old Chester Road	Blandford	430	218	3,159	1,125
I-90 EB west of Blandford Maintenance Facility	Blandford	22,063	22,580	21,162	22,496
I-90 WB west of Blandford Maintenance Facility	Blandford	21,947	22,491	22,670	20,826
Route 20 east of Chester Center	Chester	3,011	2,420	2,560	2,247
Blandford Road	Chester	862	444	2,862	1,328
East River Road	Chester	1,255	1,195	996	1,069
Route 20 east of Route 112	Huntington	2,821	2,311	2,210	2,448
Route 66 Huntington at Westhampton Town Line	Huntington	4,566	4,528	4,527	4,498
Skyline Trail	Middlefield	2,433	2,317	2,320	2,348
Montgomery Road/Main Road	Montgomery	5,367	5,105	4,720	4,872
Route 8 south of Werden Road	Otis	2,108	1,826	1,888	2,016
Algerie Road	Otis	223	1,428	1,233	584
Route 20 east of Route 23	Russell	8,201	7,889	7,664	7,951
General Knox Road	Russell	164	358	387	394
Blandford Stage Road	Russell	1,214	1,513	1,537	1,966
Washington Mountain Road	Washington	2,620	3,151	3,162	2,587

4.3.2 Future Year (2040) Network Operations

Network operations for 2040 No-Build and build conditions were analyzed using level of service (LOS) to understand how the interchange alternatives would impact the study area transportation system during peak periods. The same criteria used for the network operations analysis in Chapters 2 and 3 was applied for future year build conditions. LOS was analyzed for the following future year (2040) build scenarios:

- Existing interchange ramps and interchange intersections
- New interchanges and interchange intersections
- Local signalized intersections
- Local unsignalized intersections

Figures 4-19 through 4-27 illustrate the future year (2040) morning (AM) and evening (PM) peak hour volumes used for analysis of the interchange alternatives and study area intersections.

Figure 4-19. Alternative 1 Future Year (2040) Traffic Volumes

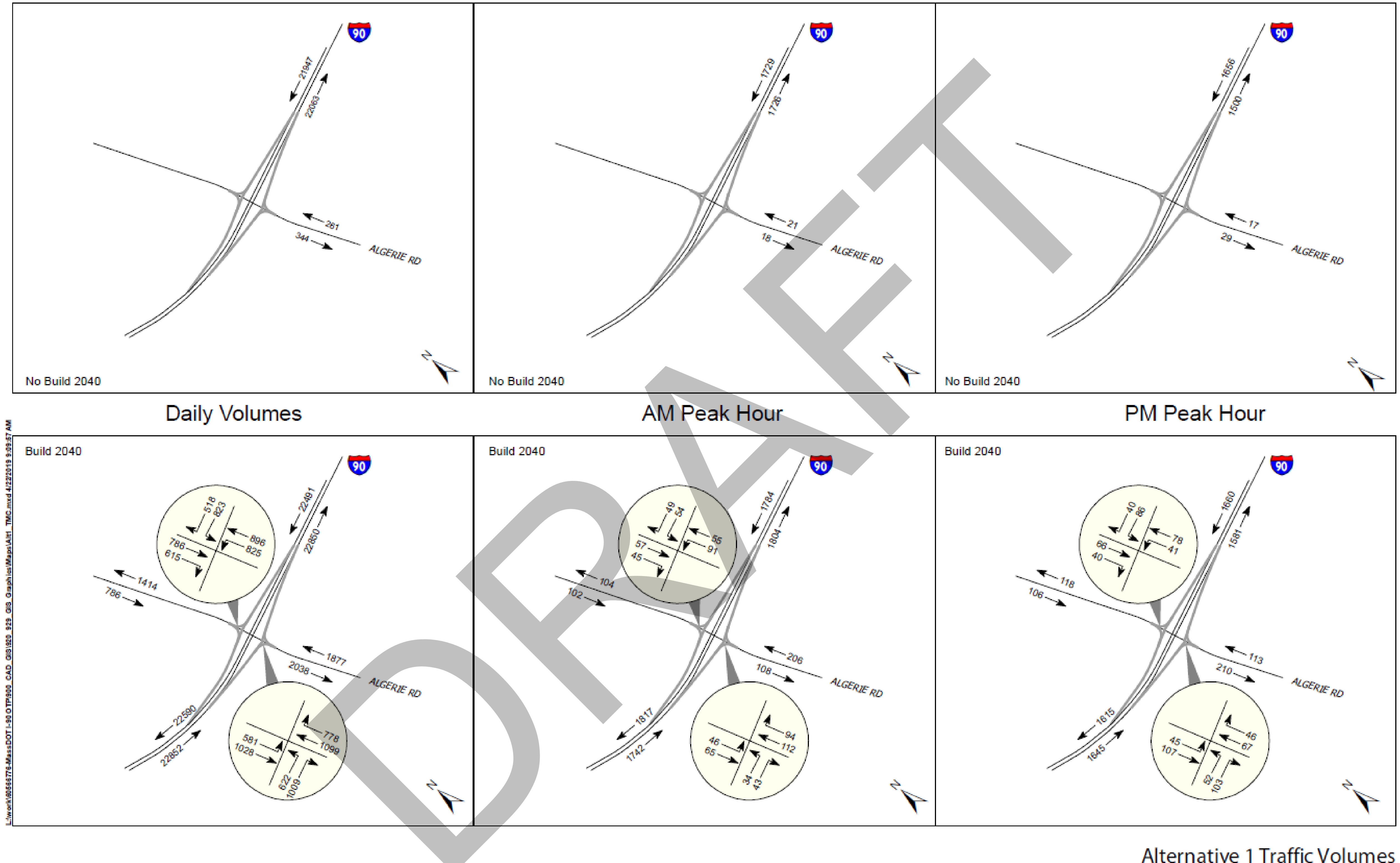


Figure 4-20. Alternative 2 Future Year (2040) Traffic Volumes

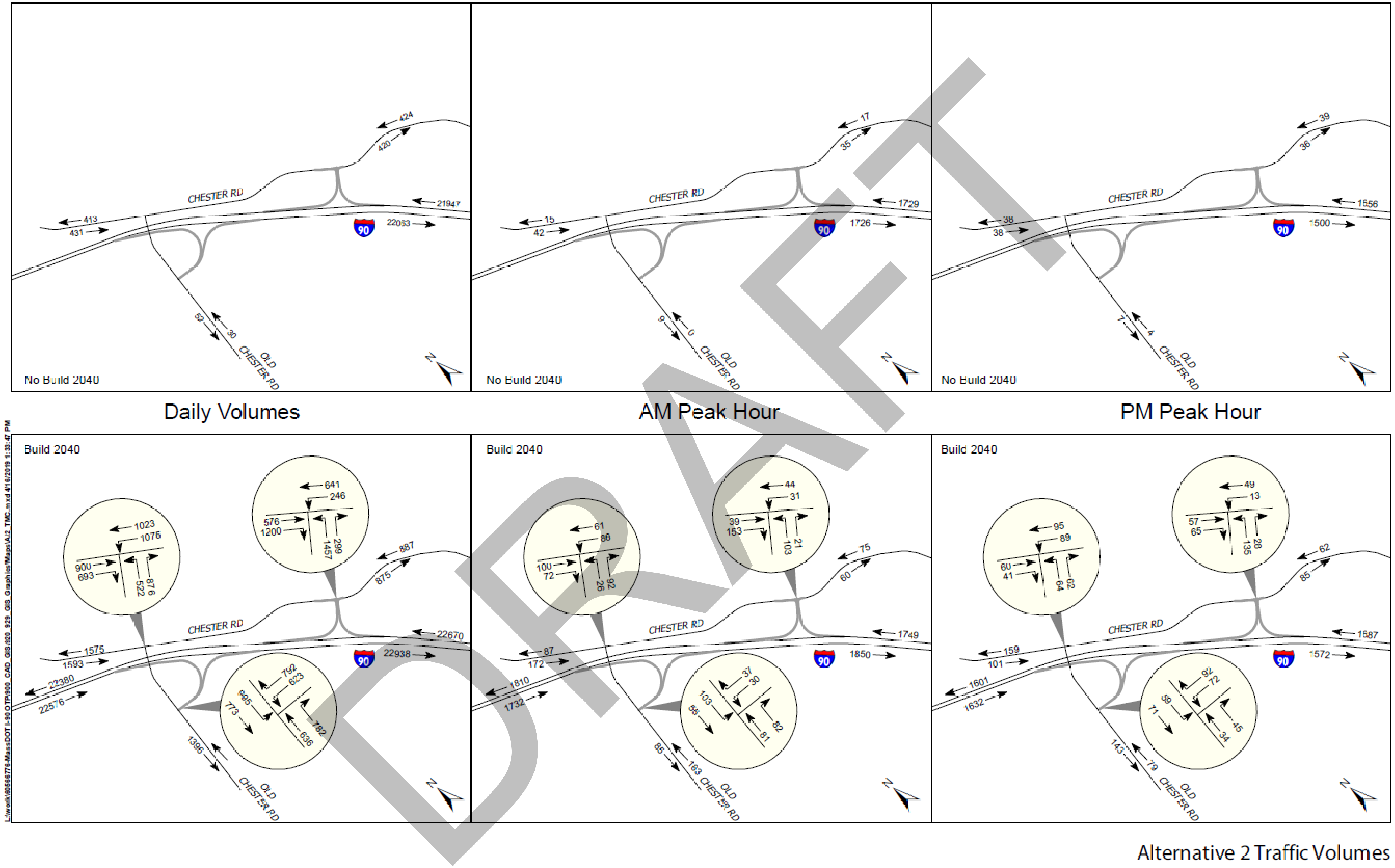
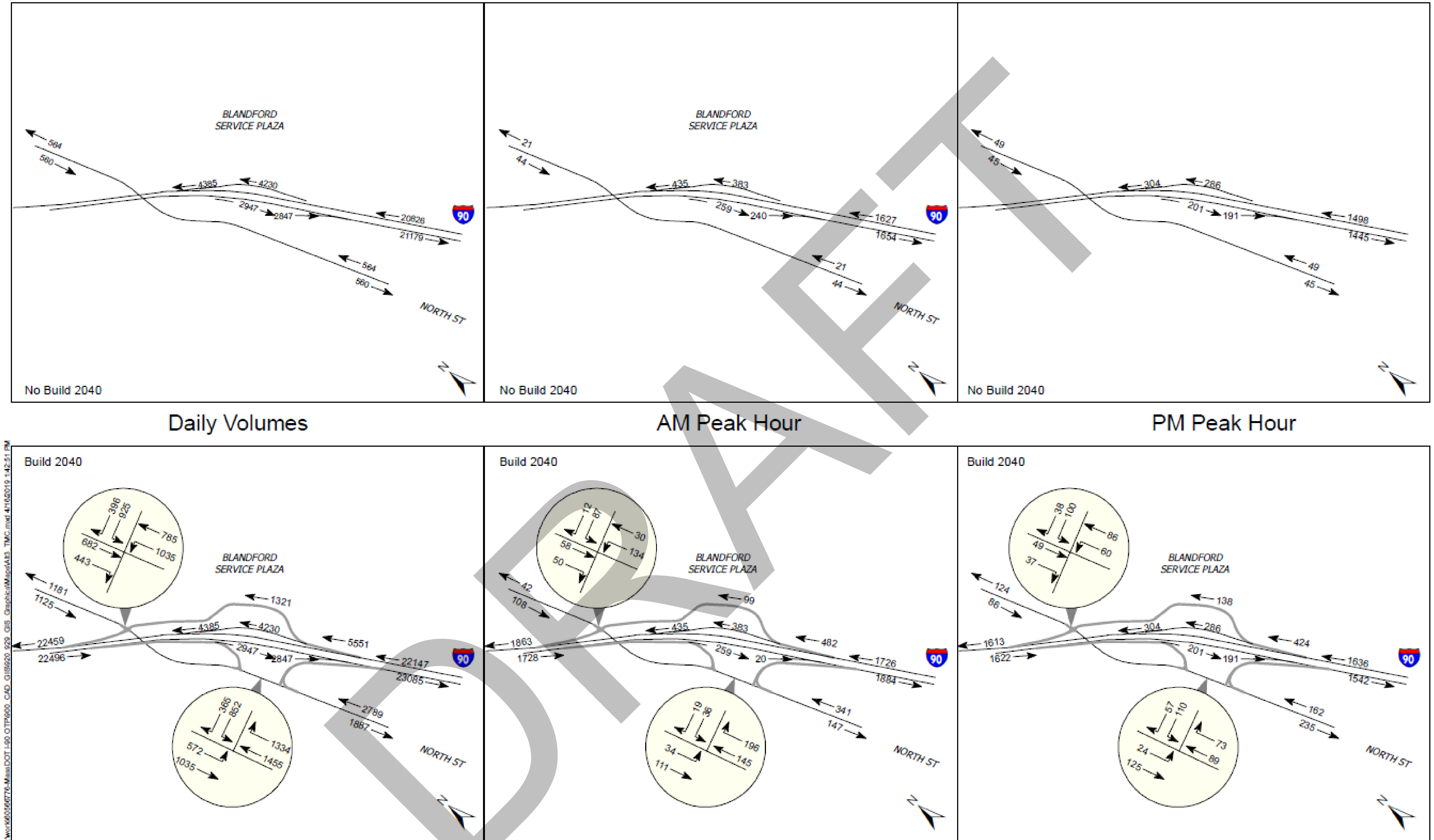


Figure 4-21. Alternative 3 Future Year (2040) Traffic Volumes



Alternative 3 Traffic Volumes

Figure 4-22. Turning Movement Counts 2040: Alternative 1, AM Peak Hour

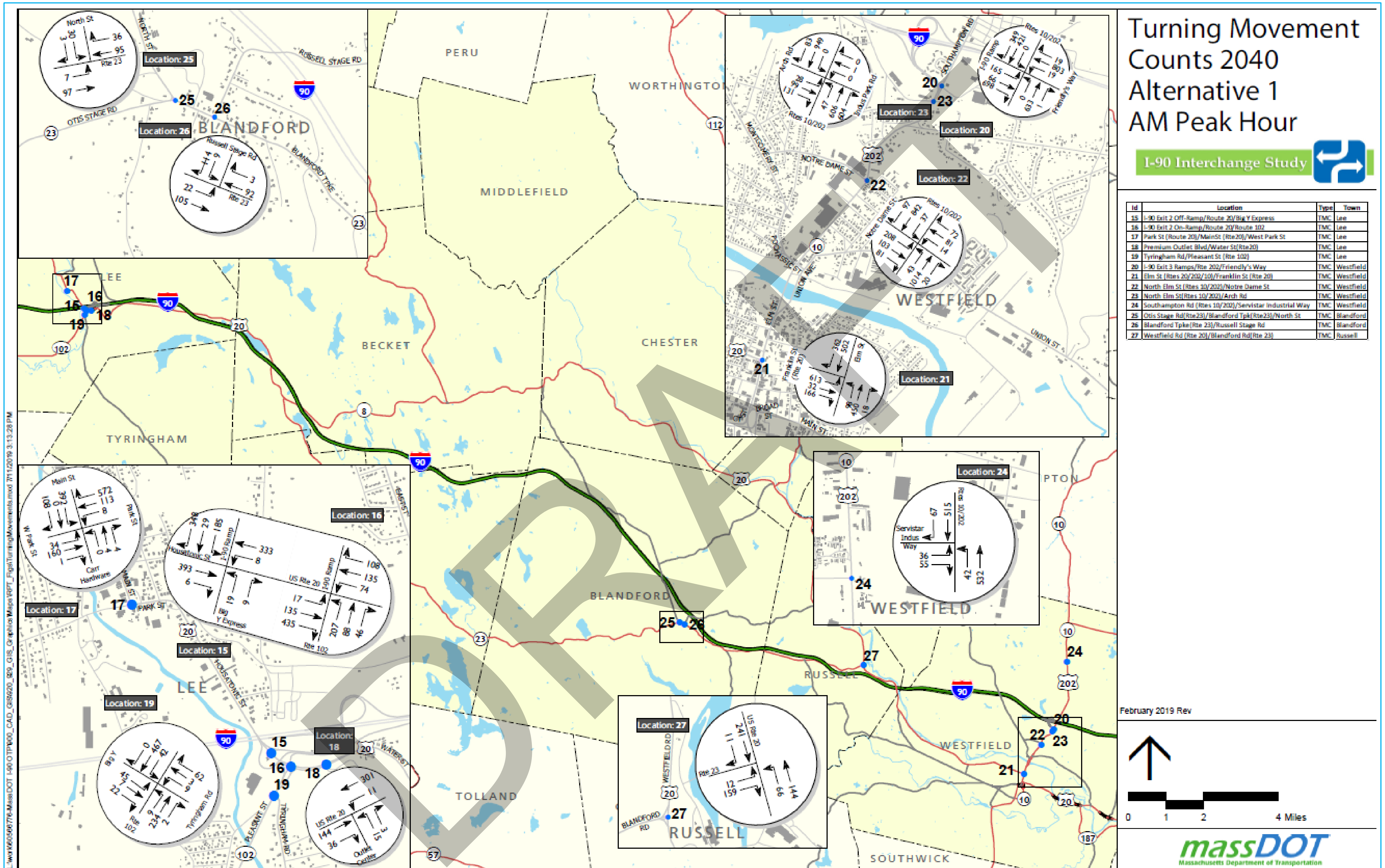


Figure 4-23. Turning Movement Counts 2040: Alternative 1, PM Peak Hour

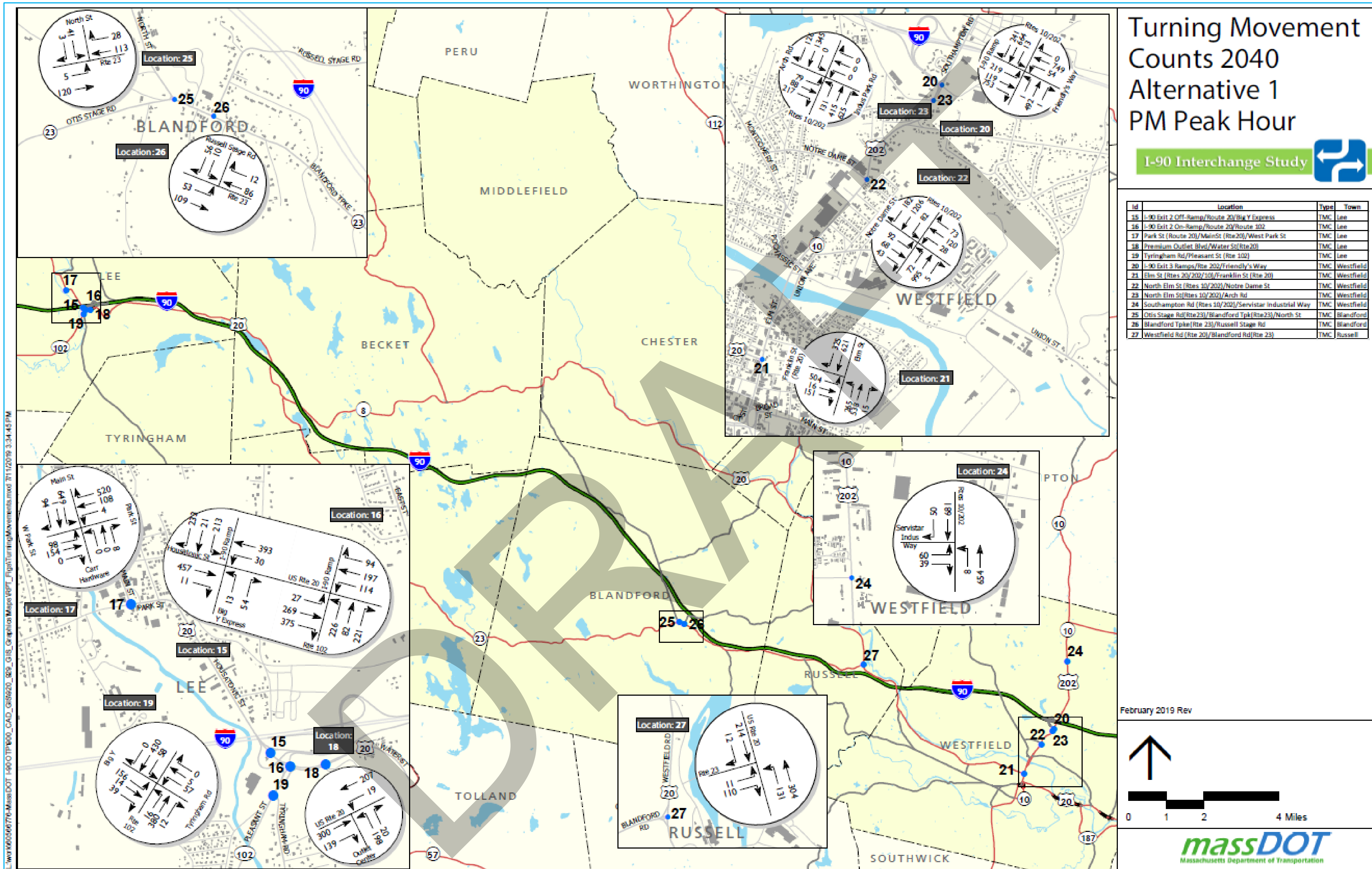


Figure 4-24. Turning Movement Counts 2040: Alternative 2, AM Peak Hour

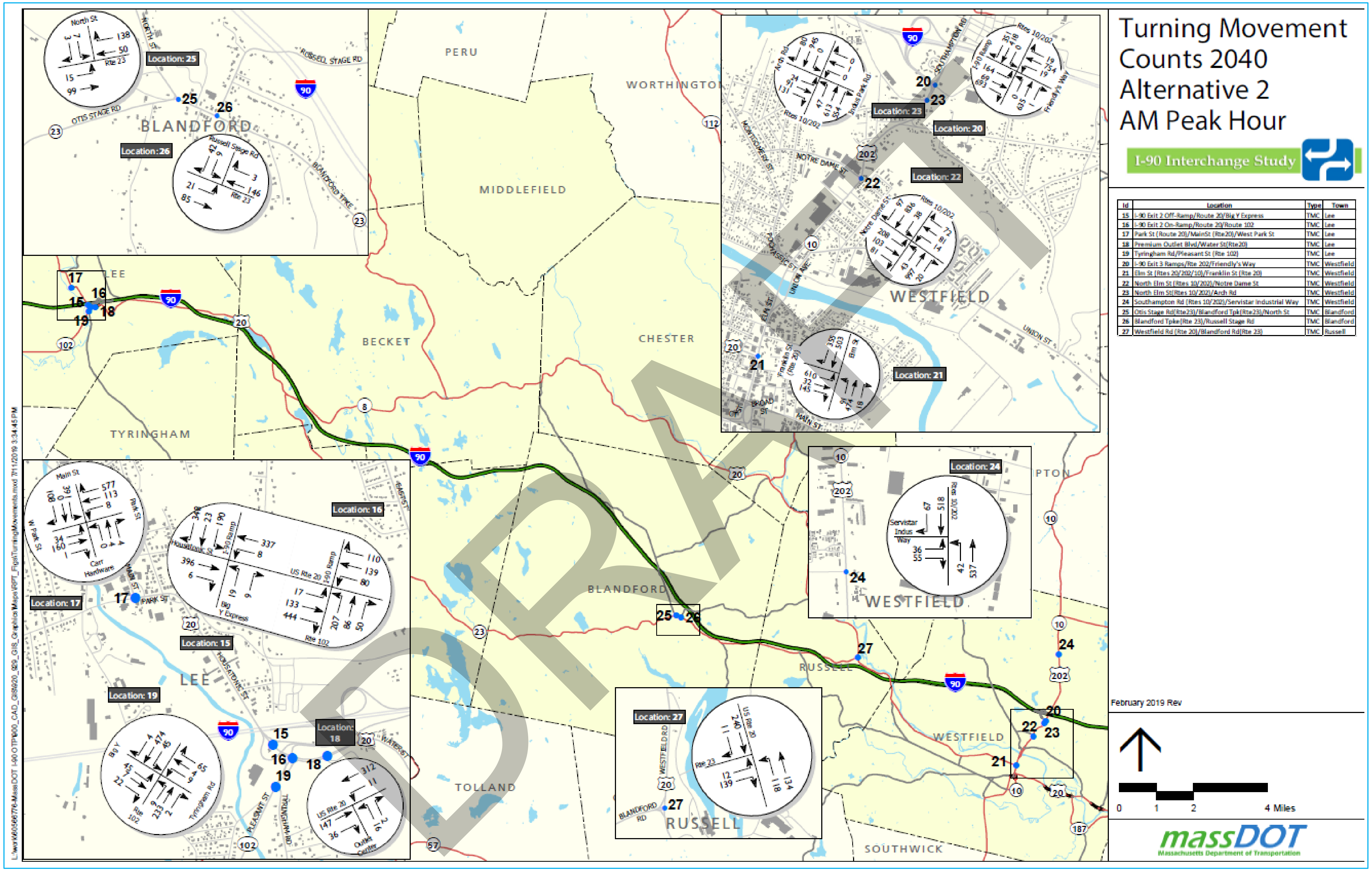


Figure 4-25. Turning Movement Counts 2040: Alternative 2, PM Peak Hour

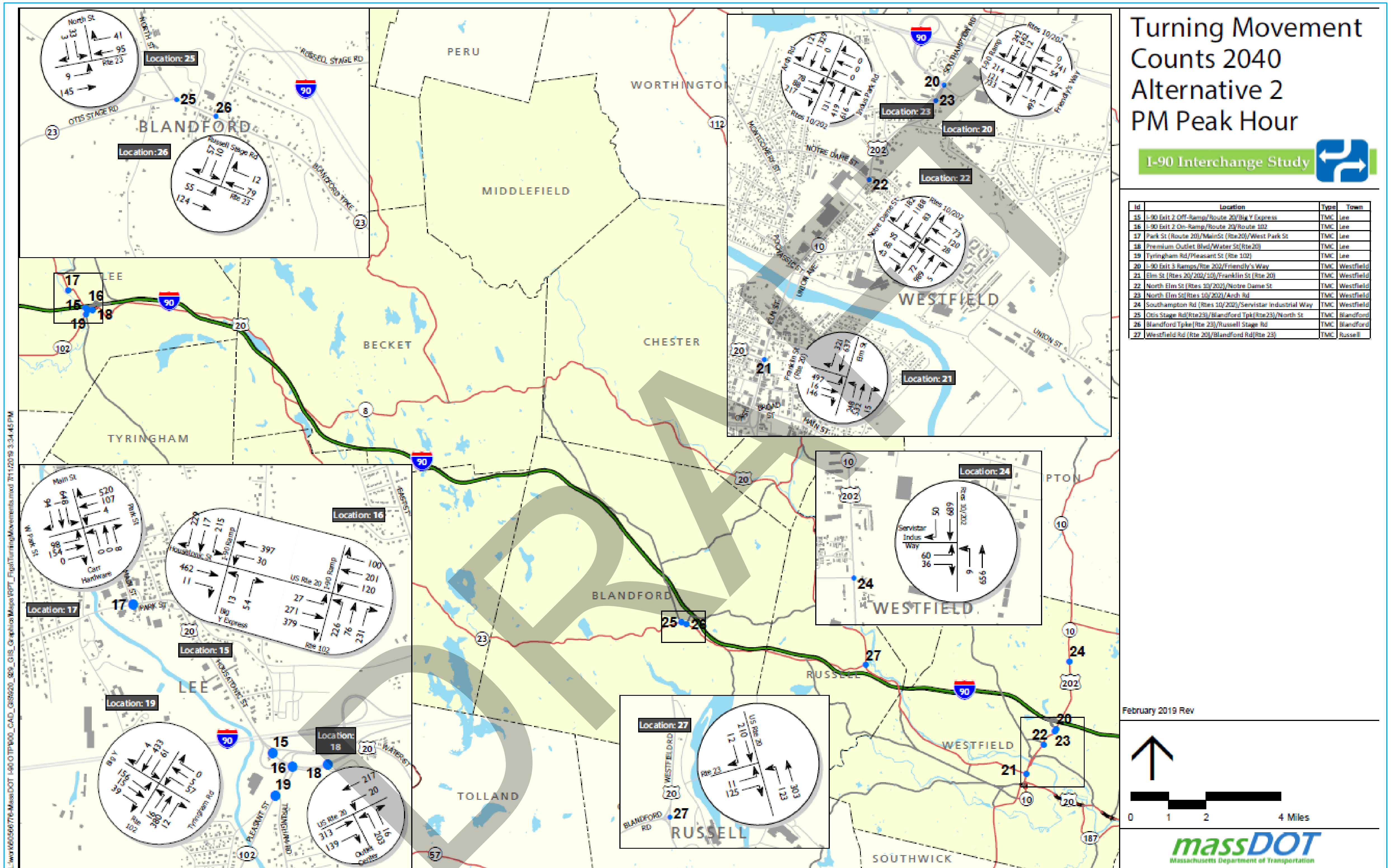


Figure 4-26. Turning Movement Counts 2040: Alternative 3, AM Peak Hour

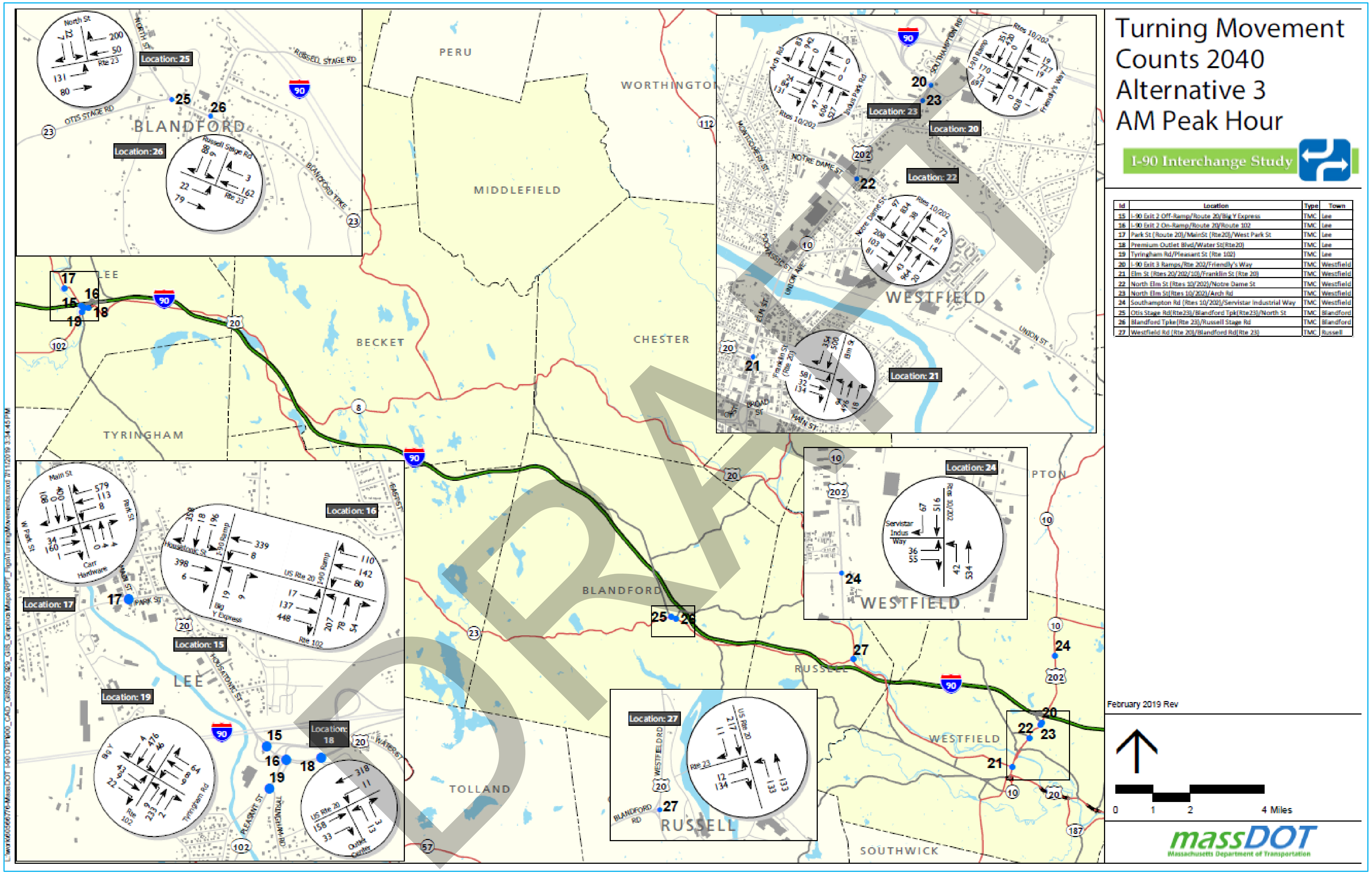
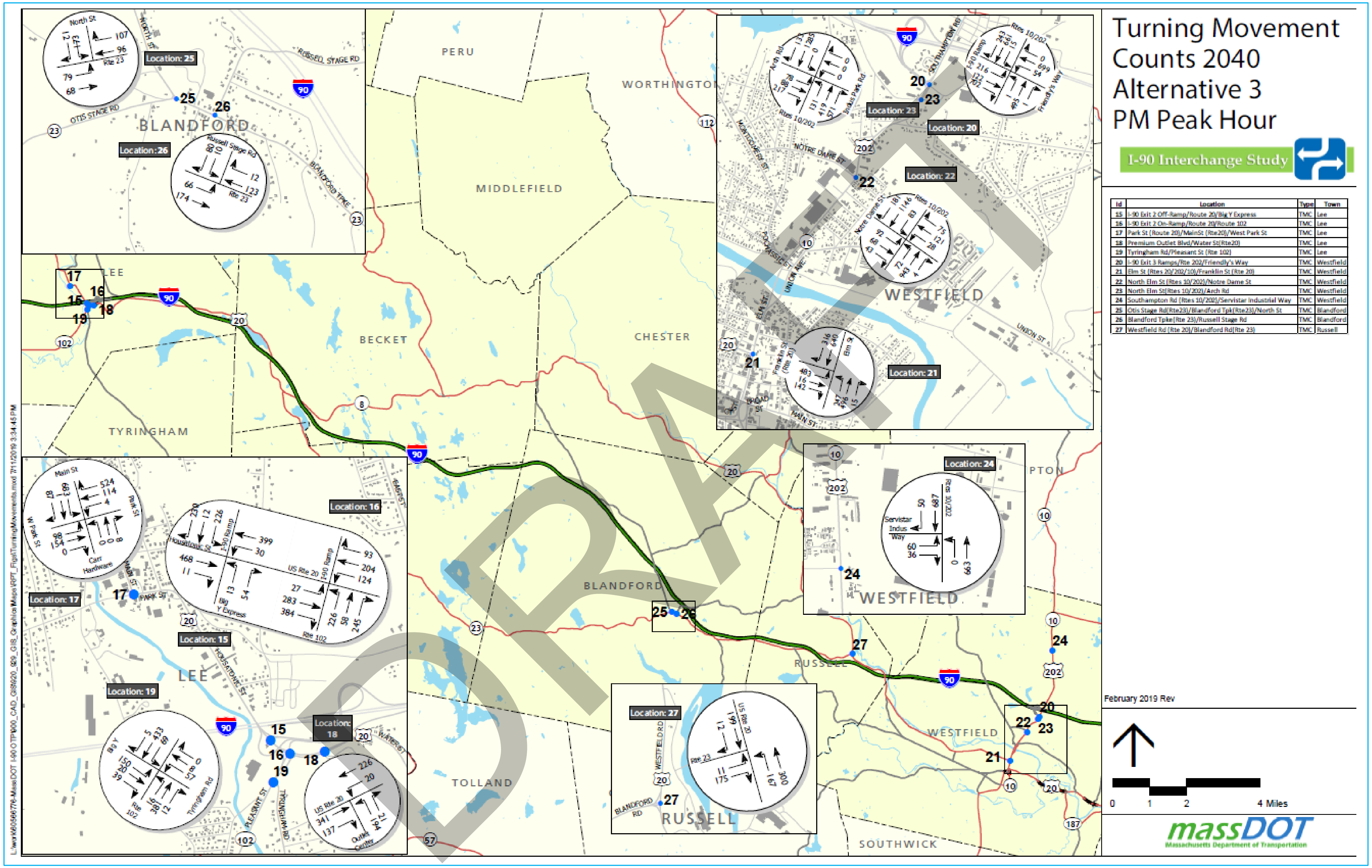


Figure 4-27. Turning Movement Counts 2040: Alternative 3 PM, Peak Hour



Existing Interchange Ramps and Intersections

Table 4-6 summarizes the results of highway/ramp merge and diverge locations under each alternative, and includes No-Build conditions for comparison. The results of these merge and diverge analyses indicate that acceptable levels of service (LOS B and C) can be provided under all three alternatives, and that conditions for vehicles merging into I-90 eastbound from both Exit 2 and 3 on-ramps during the AM peak hour will improve from LOS C and D to LOS B and C, respectively, due to diversion to any of the three potential interchange locations.

Table 4-7 summarizes the results at the existing signalized intersections where entrance and exit ramps at Exits 2 and 3 meet the local roadway network in Lee and Westfield. There are no changes in overall LOS at these intersections when comparing the No-Build condition to those with Alternatives 1, 2 and 3 in place. However, evening peak hour operations for Route 20 eastbound through movements at the Exit 2 on-ramp in Lee improve from LOS E to LOS D under all three alternatives, while operations for Friendly’s Way westbound left turns improve from LOS F to LOS E under Alternatives 1 and 2, and from LOS F to LOS D under Alternative 3 during the same evening peak hour.

New Interchange Ramps and Intersections

Alternative 1 creates new intersections at Algerie Road on either side of I-90 in Otis. Alternative 2 creates new intersections at Chester Road and Old Chester Road in Blandford, and Alternative 3 creates new intersections at two separate locations on North Street in Blandford. Figures 4-16 through 4-18 illustrate the projected daily, morning peak hour and evening peak hour volumes at the new intersection locations, along with No-Build conditions that allow a comparison of local roadway conditions with and without a new interchange. Figures 4-19 through 4-24 illustrate morning and evening peak hour turning movement counts at study area intersections.

Operating conditions for these future locations were analyzed to determine if appropriate levels of service can be provided, and under what type of traffic control. Table 4-8 summarizes the results of intersection capacity analyses at the new intersection locations.

At all three potential interchange locations, acceptable levels of service (LOS A and B) can be provided with unsignalized intersections. The inclusion of exclusive turning lanes on the main road or off-ramp approaches would further improve conditions at these intersections.

Table 4-8 summarizes the results of existing and new highway/ramp merge and diverge locations under each alternative, and includes No-Build conditions for comparison. The results of these merge and diverge analyses indicate that acceptable levels of service (LOS B and C) can be provided under all three alternatives, and that conditions for vehicles merging into I-90 eastbound from both Exit 2 and 3 on-ramps during the morning peak hour will improve from LOS C and D to LOS B and C, respectively, due to diversion to any of the three potential interchange locations. In other words, a new interchange could noticeably impact traffic conditions at the existing two interchanges.

Table 4-6. Future Year (2040) No-Build and Build Interchange Ramps LOS, Peak Hours

			No-Build				Alternative 1				Alternative 2				Alternative 3			
			AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour		PM peak hour	
Location	Type	Segment	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density
I-90/Exit 2	Diverge	I-90 EB	B	13.3	B	12	B	13.6	B	12.7	B	13.6	B	12.2	B	13.6	B	12.2
I-90/Exit 2	Merge	I-90 EB	C	20.5	B	19.3	B	16.9	B	16.1	B	16.9	B	16	B	16.8	B	15.9
I-90/Exit 2	Diverge	I-90 WB	B	16.7	B	15.1	B	17.2	B	15.3	B	17.2	B	15.2	B	17.2	B	15.1
I-90/Exit 2	Merge	I-90 WB	B	15.3	B	15.9	B	14.7	B	14.1	B	14.7	B	17.1	B	14.7	B	14
I-90/Exit 3	Diverge	I-90 EB	B	15.5	B	14	B	16.2	B	14.1	B	16.6	B	14	B	17.2	B	13.9
I-90/Exit 3	Merge	I-90 EB	D	28.4	C	23.4	C	20.6	B	19.2	C	20.9	B	19	C	21.4	B	18.9
I-90/Exit 3	Diverge	I-90 WB	C	20.5	C	20.7	C	22.1	C	20.7	C	21.8	C	21	C	21.8	C	20.8
I-90/Exit 3	Merge	I-90 WB	B	17.4	B	15.9	B	16.2	B	15.1	B	15.9	B	15.4	B	15.7	B	14.9
I-90/Algerie Road	Diverge	I-90 EB					B	16.1	B	15.2								
I-90/Algerie Road	Merge	I-90 EB					B	17.6	B	15.8								
I-90/Algerie Road	Diverge	I-90 WB					B	16.5	B	15.3								
I-90/Algerie Road	Merge	I-90 WB					B	17.7	B	16								
I-90/Blandford Maintenance Facility	Diverge	I-90 EB									B	16	B	15.1				
I-90/Blandford Maintenance Facility	Merge	I-90 EB									B	18	B	15.7				
I-90/Blandford Maintenance Facility	Diverge	I-90 WB									B	16.2	B	15.5				
I-90/Blandford Maintenance Facility	Merge	I-90 WB									B	17.6	B	15.9				
I-90/Blandford Service Plaza	Diverge	I-90 EB													B	16	B	15
I-90/Blandford Service Plaza Ramp	Merge	I-90 EB													B	16.3	B	14.5
I-90/Blandford Interchange Entrance Ramp	Merge	I-90 EB													B	18.3	B	15.4
I-90/Blandford Service Plaza	Diverge	I-90 WB													B	15.9	B	15.1
I-90/Blandford Service Plaza Ramp	Merge	I-90 WB													B	16.4	B	15.1
I-90/Blandford Interchange Entrance Ramp	Merge	I-90 WB													B	18.1	B	16

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 4-7. Future Year (2040) Existing Interchange Intersections LOS, Peak Hours

	No-Build						Alternative 1						Alternative 2						Alternative 3					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
Intersection	LOS	Delay (seconds)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Lee - Route 20 & I-90 Exit 2	**B**	**11.5**		**B**	**16.7**		**B**	**12.2**		**B**	**16**		**B**	**12.1**		**B**	**15.8**		**B**	**12.1**		**B**	**16**	
Route 20 EB Thru	A	3.7	53	A	5.1	90	A	3.8	53	A	4.7	83	A	3.8	53	A	4.7	83	A	3.8	53	A	4.8	85
I-90 Ramp SB Left	D	43.5	97	D	47.4	118	D	43.4	102	D	47.9	109	D	43.4	101	D	47.9	109	D	43.4	102	D	47.8	111
Route 20 WB Thru	A	4.9	77	A	7.6	133	A	5.2	82	A	6.9	132	A	5.1	82	A	6.9	132	A	5.1	81	A	7	132
Lee - Route 102/I-90 Exit 2 Entrance & Route 20	**B**	**19.1**		**C**	**26.5**		**B**	**19.5**		**C**	**27.2**		**B**	**19.4**		**C**	**27**		**B**	**19**		**C**	**26.7**	
Route 102 NB Left	D	51.5	196	E	78.2	262	D	51.5	196	E	78.2	262	D	51.5	196	E	78.2	262	D	51.5	196	E	78.2	262
Route 102 NB Thru	D	38.4	91	D	37.7	61	D	38.4	91	D	40.2	97	D	38.1	89	D	39.7	91	D	37.2	82	D	38.4	73
Route 102 NB Right	A	1.5	0	A	8.8	60	A	1.1	0	A	8.7	57	A	1.2	0	A	8.8	58	A	1.3	0	A	8.8	59
Route 20 EB Left	D	41.7	26	E	55.1	40	D	42.5	27	D	52.2	39	D	42.5	27	D	52.3	39	D	42.6	27	D	53.2	40
Route 20 EB Thru	B	13	51	B	18.3	125	B	12.8	51	B	17.1	110	B	13	51	B	17.5	111	B	12.9	52	B	17.9	116
Route 20 EB Right	A	8.1	162	B	10.5	164	A	8.2	164	B	10.1	157	A	8.3	167	B	10.1	157	A	8.3	168	B	10.3	160
Route 20 WB Left	D	47.3	98	D	49.6	141	D	47	88	D	51.2	130	D	47.2	94	D	50.6	136	D	47.2	94	D	49.9	138
Route 20 WB Thru	A	5	40	A	8	65	A	5.1	38	A	7.9	63	A	5.1	39	A	7.8	64	A	5.2	40	A	8.1	65
Westfield - Southampton Rd. (Route 10/202) & Friendly's Way/I-90 Exit 3	**C**	**28.9**		**D**	**48.3**		**C**	**28.5**		**D**	**42.3**		**C**	**28.1**		**D**	**39.3**		**C**	**28**		**D**	**36.2**	
Southampton Rd NB Thru	D	41.9	257	D	36.6	215	D	41.9	257	D	36.5	215	D	42	258	D	36.6	216	D	41.9	255	D	36.6	216
I-90 Ramp EB Left	D	48.2	159	A	4.7	29	D	48.3	161	A	4.7	29	D	48.2	159	A	4.8	29	D	48.3	164	A	4.7	29
I-90 Ramp EB Thru	B	14.8	45	D	46.1	205	B	14.8	49	D	46.5	200	B	14.8	51	D	46.7	196	B	14.8	53	D	46.6	197
I-90 Ramp EB Right	B	14.4	485	B	19.8	96	B	13.7	461	B	19.9	103	B	13.3	413	B	19.8	104	B	13.2	108	B	20	105
Northampton Rd SB Thru	D	35	161	D	46.8	29	D	35	161	D	46.8	29	C	34.9	160	D	46.4	25	D	35.1	160	D	46.8	29
Northampton Rd SB Right	A	6	64	C	32.9	233	A	6	64	C	32.9	232	A	6	64	C	33	231	A	6	64	C	32.8	229
Friendly's Way WB Left	D	48.3	29	F	89.8	739	D	48.3	29	E	69.3	677	D	48.3	29	E	59.3	643	D	48.3	29	D	47.9	595
Friendly's Way WB Thru	C	32.1	435	D	49.9	71	C	31.4	410	D	49.9	71	C	30.1	368	D	49.9	71	C	29.8	343	D	49.9	71

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 4-8. Future Year (2040) New Interchange Intersections LOS Analysis Results, Peak Hours

	AM Peak Hour			PM Peak Hour		
Intersection	**LOS**	**Delay (seconds)**	**95% Queue Length (ft)**	**LOS**	**Delay (seconds)**	**95% Queue Length (ft)**
Alternative 1 – Algerie Road, Otis						
Algerie Road at I-90 EB Ramps	**A**	**2.9**		**A**	**4.7**	
Left turns from Algerie Road SB	A	7.9	2.5	A	7.6	2.5
All turns from I-90 EB Off-ramp	B	10.2	10	B	10.7	20
Algerie Road at I-90 WB Ramps	**A**	**5.2**		**A**	**4.8**	
Left turns from Algerie Road NB	A	7.7	5	A	7.6	2.5
All turns from I-90 WB Off-ramp	B	10.8	12.5	B	10.9	17.5
Alternative 2 – Blandford Maintenance Facility, Blandford						
Old Chester Road at I-90 EB Ramps	**A**	**3.9**		**A**	**5.8**	
Left turns from Old Chester Road SB	A	7.8	7.5	A	7.5	2.5
All turns from I-90 EB Off-ramp	B	10.8	10	B	10.5	20
Chester Road at I-90 WB Ramps	**A**	**4.1**		**A**	**5.3**	
Left turns from Chester Road WB	A	7.7	2.5	A	7.5	0
All turns from I-90 WB Off-ramp	B	10.9	17.5	B	10.6	20
Alternative 3 – Blandford Service Plaza, Blandford						
North Street at I-90 EB Ramps	**A**	**1.7**		**A**	**4.5**	
Left turns from North Street EB	A	8.2	2.5	A	7.7	2.5
All turns from I-90 EB Off-ramp	B	11.7	7.5	B	11.7	25
North Street at I-90 WB Ramps	**A**	**6.2**		**A**	**5.3**	
Left turns from North Street SB	A	7.8	7.5	A	7.6	2.5
All turns from I-90 WB Off-ramp	B	12.9	17.5	B	11.4	20
Left turns from North Street SB	A	7.8	7.5	A	7.6	2.5
All turns from I-90 WB Off-ramp	B	12.9	17.5	B	11.4	20

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Local Signalized Intersections

In order to evaluate the impact of each alternative at local intersections, the 2040 Build capacity analysis was compared to the 2040 No-Build conditions. The 2040 Build volumes present an overall shift in traffic away from Lee and Westfield and an increase in volumes on I-90 through movements in Blandford and Russell as a result of providing an interchange between Exit 2 in Lee and Exit 3 in Westfield.

The capacity and LOS analysis results for the local intersections during the weekday morning and weekday afternoon peak hours for the three alternatives have been separated into signalized and unsignalized traffic control for the purposes of this discussion. The overall capacity and LOS analysis results for the alternatives weekday morning and weekday afternoon peak hours are summarized in Table 4-9 for the signalized local study area intersections and Table 4-10 for the unsignalized local study area intersections.

Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza

Based on a review of the 2040 Build conditions, the signalized intersection of Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza is expected to operate at overall LOS B during the weekday morning peak hour and at overall LOS C during the weekday afternoon peak hour for each of the three alternatives. Under each of the three alternatives, each of the movements is projected to operate at LOS C or better during both peak hours. The alternatives overall operations are not expected to significantly change from the 2040 No-Build condition for each of the peak hours.

Route 20 at Premium Outlet Boulevard

Under 2040 Build conditions, each of the three alternatives at the intersection of Route 20 at Premium Outlet Boulevard would be expected to continue to operate at overall LOS A during the weekday morning and weekday afternoon peak hours and well under capacity. Under the 2040 Build conditions, each of the approaches is projected to continue to operate at LOS B or better and well under capacity during each of the peak hours. The three alternatives operations are expected to remain constant from the 2040 No-Build condition for each of the peak hours. During the weekday afternoon peak hour, the operations are expected to slightly improve for each of the alternatives from the 2040 No-Build conditions.

North Elm Street (Route 202/Route 10) at Arch Road and Westfield Industrial Park Road

Between the 2040 No-Build and Build conditions, the intersection of North Elm Street (Route 202/Route 10) at Arch Road and Westfield Industrial Park Road is expected to continue to operate at overall LOS B during the weekday morning peak hour and overall LOS C during the weekday afternoon peak hour. Under each of the alternatives, the overall delay is expected to decrease by less than a second. Under the 2040 Build condition for each of the alternatives, the intersection is projected to operate under capacity during the peak hours. The three alternatives are expected to slightly improve the operations at the intersection from the 2040 No-Build conditions during each of the peak hours.

North Elm Street (Route 202/Route 10) at Notre Dame Street

A review of the proposed alternatives project that the intersection of North Elm Street (Route 202/Route 10) at Notre Dame Street would continue to operate at overall LOS D during the weekday morning peak hour and would continue to operate at overall LOS E under Alternative 1 and improve to overall LOS D for Alternatives 2 and 3. For the weekday morning peak hour, between the 2040 No-Build and Build conditions, the delay for the weekday morning peak hour would be expected to improve by approximately a second or less and for the weekday afternoon peak hour would be expected to improve by approximately 11 seconds. Under each of the alternatives, the intersection is projected to continue to operate over capacity during the peak hours.

Elm Street at Franklin Street and Mobil Gas Station Driveway

The intersection of Elm Street at Franklin Street and Mobil Gas Station Driveway is expected to continue to operate at overall LOS D during the weekday morning peak hour and overall LOS F during the weekday afternoon peak hour, and over capacity for each of the proposed alternatives. Under all alternatives, the eastbound shared left/through movement and southbound through movement are over capacity during the weekday morning peak hour and the northbound left-turn and southbound through movements are over capacity during the weekday afternoon peak hour. Between the 2040 No-Build and Build conditions, the overall intersection operations are expected to improve. During the weekday morning peak hour, the eastbound shared left/through movement would be expected to continue to operate at LOS F for Alternative 1, while Alternatives 2 and 3 would improve to LOS E; the northbound shared through/right-turn movement would be expected to degrade to LOS D under Alternatives 2 and 3.

Table 4-9. Future Year (2040) Local Signalized Intersection LOS Analysis, Peak Hours

	No-Build						Alternative 1						Alternative 2						Alternative 3					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
Intersection	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**
Lee - Pleasant Street (Route 102) at Tyringham Road and Big Y Plaza	**B**	**14.5**		**C**	**21.0**		**B**	**13.1**		**C**	**20.9**		**B**	**14.2**		**C**	**21.0**		**B**	**14.5**		**C**	**21.2**	
Big Y Driveway EB Left	C	26.8	60	C	33.1	179	C	25.1	62	C	31.7	195	C	27.4	63	C	31.6	195	C	27.4	61	C	33.1	178
Big Y Driveway EB Thru/Right	B	15.8	33	B	14.6	51	B	15.2	30	B	13.5	43	B	15.4	30	B	13.6	44	B	15.7	32	B	14.4	49
Tyringham Road WB Left	C	25.1	20	C	27.1	77	C	24.8	20	C	26.5	77	C	25.2	20	C	26.5	77	C	25.3	20	C	27.2	77
Tyringham Road WB Thru/Right	B	11.2	50	C	20.6	25	B	10.6	39	C	26.2	15	B	11.1	42	C	26.2	15	B	11.7	44	C	26.1	19
Route 102 NB Left	A	7.9	11	B	10.1	18	A	7.9	11	B	10.2	18	A	7.9	11	B	10.2	18	A	7.8	11	B	10.1	18
Route 102 NB Thru/Right	B	14.9	184	C	23.3	357	B	12.5	186	C	22.2	370	B	13.2	185	C	22.2	370	B	14.4	185	C	23.4	372
Route 102 SB Left	A	7.4	40	B	10.1	60	A	7.3	32	B	10.1	47	A	7.4	34	B	10.1	49	A	7.3	34	A	10.0	54
Route 102 SB Thru/Right	B	14.5	435	B	17.3	407	B	12.9	410	B	17.9	403	B	14.3	446	B	18.2	411	B	14.3	446	B	17.3	412
Lee - Route 20 at Premium Outlet Boulevard	**A**	**2.5**		**A**	**9.2**		**A**	**2.5**		**A**	**8.8**		**A**	**2.5**		**A**	**9.0**		**A**	**2.4**		**A**	**9.0**	
Route 20 EB Thru/Right	A	3.1	31	A	8.9	94	A	2.9	27	A	8.4	76	A	2.9	27	A	8.6	80	A	2.9	29	A	8.7	86
Route 20 WB Left	A	1.5	4	A	4.5	8	A	1.5	4	A	4.5	8	A	1.5	4	A	4.6	8	A	1.4	4	A	4.5	8
Route 20 WB Thru	A	1.8	64	A	7.3	63	A	1.7	56	A	7.4	54	A	1.7	58	A	7.5	58	A	1.7	58	A	7.4	60
Premium Outlets NB Left/Right	B	11.9	7	B	12.4	53	B	12.7	8	B	11.5	51	B	12.9	8	B	11.7	52	B	13.0	8	B	11.9	52
Westfield -North Elm Street (Route 202/Route 10) at Arch Road and Westfield Industrial Park Road	**B**	**14.5**		**C**	**20.8**		**B**	**14.1**		**C**	**20.3**		**B**	**13.6**		**C**	**20.1**		**B**	**13.2**		**C**	**20.0**	
Arch Road EB Left/Thru	E	67.3	176	E	67.3	216	E	66.4	167	E	67.0	213	E	65.1	152	E	66.9	211	E	64.6	144	E	66.9	211
Arch Road EB Right	A	6.8	46	A	5.5	56	A	6.9	46	A	5.5	56	A	7.0	46	A	5.5	56	A	7.1	47	A	5.5	56
Rtes. 10/202 NB Left	E	57.0	78	E	68.5	190	E	57.0	78	E	68.5	190	E	57.0	78	E	68.5	190	E	57.0	78	E	68.5	190
Rtes. 10/202 NB Thru/Right	A	6.8	342	A	4.8	202	A	6.6	329	A	4.8	200	A	6.2	313	A	4.9	201	A	5.9	295	A	4.8	192
Rtes. 10/202 SB Thru/Right	B	15.8	445	C	24.7	853	B	15.4	435	C	23.8	811	B	15.0	431	C	23.4	793	B	14.7	427	C	22.9	762

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 4-9. Future Year (2040) Local Signalized Intersection LOS Analysis, Peak Hours (Continued)

	No-Build						Alternative 1						Alternative 2						Alternative 3					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
Intersection	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)	LOS	Delay (sec)	95% Queue Length (ft)
Westfield - North Elm Street (Route 202/Route 10) at Notre Dame Street	**D**	**41.7**		**E**	**62.7**		**D**	**41.1**		**E**	**57.2**		**D**	**40.8**		**D**	**54.9**		**D**	**40.6**		**D**	**51.5**	
Notre Dame St. EB Left/Thru	D	50.1	530	D	50.3	250	D	50.3	531	D	50.1	250	D	50.3	531	D	50.1	250	D	49.3	530	D	49.5	250
Notre Dame St. EB Right	B	12.0	26	A	8.5	28	B	12.0	26	A	8.5	28	B	12.0	26	A	8.5	28	B	12.0	26	A	8.4	28
Notre Dame St. WB Let/Thru/Right	C	28.4	196	D	41.9	298	C	28.4	196	D	41.6	294	C	28.4	196	D	41.6	294	C	28.1	196	D	41.3	299
Rtes. 10/202 NB Left	C	24.8	56	C	31.2	80	C	24.5	56	C	31.2	80	C	24.3	56	C	31.2	80	C	24.6	56	C	31.1	79
Rtes. 10/202 NB Thru/Right	D	42.5	781	D	37.4	617	D	42.1	768	D	37.0	604	D	41.4	748	D	36.8	600	D	40.8	707	D	35.9	560
Rtes. 10/202 SB Left	C	25.5	49	C	27.1	81	C	25.3	49	C	26.7	83	C	25.2	51	C	26.7	83	C	24.8	51	C	25.7	83
Rtes. 10/202 SB Thru/Right	D	44.2	714	F	90.5	1174	D	43.3	692	E	79.8	1124	D	43.1	685	E	75.2	1102	D	43.6	683	E	68.8	1051
Westfield - Elm Street at Franklin Street and Mobil Gas Station Driveway	**D**	**54.9**		**F**	**91.1**		**D**	**50.9**		**F**	**83.8**		**D**	**51.5**		**F**	**85.5**		**D**	**47.8**		**F**	**85.3**	
Franklin Street EB Left/Thru	F	86.7	754	D	51.2	567	F	80.1	735	D	48.9	554	E	78.7	733	D	47.2	544	E	66.0	692	D	44.5	524
Franklin Street EB Right	A	2.9	36	A	3.0	35	A	2.9	35	A	3.1	33	A	3.1	33	A	3.1	33	A	3.1	32	A	3.1	33
Elm Street NB Left	C	30.2	97	F	174.3	385	C	29.1	90	F	121.3	330	C	28.6	84	F	101.8	303	C	28.7	86	F	99.9	300
Elm Street NB Thru/Right	C	34.2	509	D	54.2	608	C	32.7	486	D	51.5	595	D	35.0	520	D	49.8	586	D	37.6	553	D	42.4	534
Elm Street SB Thru	F	94.4	326	F	189.6	398	F	85.6	315	F	188.0	397	F	86.1	316	F	201.6	408	F	84.1	313	F	204.8	411
Elm Street SB Right	A	2.1	30	A	2.3	33	A	2.1	30	A	2.3	32	A	2.1	30	A	2.4	34	A	2.1	30	A	2.5	34

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Local Unsignalized Intersections

West Park Street at Park Street/Main Street (Route 20)

The capacity analysis indicates that under the three alternatives, the critical eastbound West Park Street shared through/right-turn movement is expected to continue to operate at LOS F during both peak hours with significant delay greater than 200 seconds and over capacity. It should be noted that due to the unconventional geometry of the intersection, results provided by Synchro may not accurately reflect the expected operations at the intersection. The westbound and southbound approaches are expected to operate at LOS A and well under capacity during the peak hours. Between 2040 No-Build conditions and the alternatives, the intersection operations are expected to slightly improve for Alternatives 1 and 2 and slightly degrade under Alternative 3 by less than a second in delay.

Otis Stage Road/Main Street (Route 23) at North Street

Under the alternatives, the critical southbound North Street approach is expected to continue to operate at LOS B during the weekday morning peak hour and operate at LOS B during the weekday afternoon peak hour for Alternatives 1 and 2 and LOS C for Alternative 3 with an increase in delay of less than six seconds from the 2040 No-Build condition. The critical approach is expected to operate with minimal queueing for each of the alternatives. Otis Stage Road/Main Street (Route 23) is expected to continue to operate at LOS A with minimal delay.

Main Street (Route 23) at Russell Stage Road

Between the 2040 No-Build and Build conditions, the Russell Stage Road approach is expected to continue to operate at LOS A under the weekday morning and weekday afternoon peak hours for Alternatives 1 and 2 and degrade to LOS B under the weekday morning and weekday afternoon peak hours for Alternative 3 and add less than a second in delay. Under the alternatives, each of the approaches are projected to operate at LOS B or better and well under capacity during each of the peak hours. Between the 2040 No-Build and 2040 Build conditions, the overall intersection operations are expected to degrade slightly and the most under Alternative 1 by an additional two seconds of delay during the weekday morning peak hour and less than half a second of delay during the weekday afternoon peak hour.

Westfield Road (Route 20) at Blandford Road (Route 23)

Under 2040 Build conditions, the critical eastbound left-turn movement from Blandford Road (Route 23) is expected to operate at LOS B for Alternative 1 and LOS C for Alternatives 2 and 3 during the weekday morning peak hour and operate at LOS C for the weekday afternoon peak hour for each of the alternatives. For each of the three alternatives, the eastbound left-turn movement delay during the peak hours is expected to increase by less than three seconds. Under 2040 Build conditions, each of the movements at the intersection are projected to operate at LOS C or better and well under capacity during each of the peak hours.

Southampton Road (Route 202/Route 10) at Servistar Industrial Way

The critical eastbound Servistar Industrial Way approach delay is expected to slightly improve under each of the alternatives and is expected to continue to operate under capacity for each of the peak hours. For each of the alternatives, the critical eastbound approach is projected to operate at LOS D during the weekday morning peak hour and operate at LOS F during the weekday afternoon peak hour. The northbound and southbound approaches to the intersection are projected to operate at LOS A and well under capacity during each of the peak hours. Compared to No-Build conditions, the eastbound movement delay decreases by less than a second during the weekday morning peak hour and by approximately 7.5 seconds or less during the weekday afternoon peak hour. The overall intersection operations are expected to improve by less than a second for the weekday morning and weekday afternoon peak hours for each of the alternatives.

Table 4-10. Future Year (2040) Local Unsignalized Intersection LOS, Peak Hours

	No-Build						Alternative 1						Alternative 2						Alternative 3					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
Intersection	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**
Lee																								
West Park Street at Park Street/Main Street	**E**	41.5		**F**	**n/a**	**n/a**	**E**	**37.3**		**F**	**n/a**	**n/a**	**E**	**37.1**		**F**	**n/a**	**n/a**	**E**	**41.8**		**F**	**n/a**	**n/a**
West Park Street EB Left	F	214.6	83	F	n/a	n/a	F	173.2	75	F	n/a	n/a	F	167.5	75	F	n/a	n/a	F	223.0	85	F	n/a	n/a
West Park Street EB Thru	F	148.4	230	F	n/a	n/a	F	134.7	220	F	n/a	n/a	F	134.7	220	F	n/a	n/a	F	148.4	230	F	n/a	n/a
Park Street WB Thru	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a	F	n/a	n/a
Main Street SB Left/Thru/Right	A	6.5	30	A	8.1	65	A	6.4	30	A	8.0	63	A	6.4	30	A	8.0	63	A	6.5	30	A	8.3	70
Becket																								
Route 20 at Bonny Rigg Hill Road (Route 8)	A	4.0		A	1.9		A	7.7		A	6.1		A	4.8		A	2.4		A	4.5		A	2.8	
Route 20 EB Left/Thru/Right	A	0.4	0	A	0.6	0	A	0.6	0	A	0.9	0	A	0.5	0	A	0.9	0	A	0.5	0	A	0.7	0
Route 20 WB Left/Thru	**A**	**7.6**	0	**A**	**7.5**	0	**A**	**7.5**	3	**A**	**7.5**	3	**A**	**7.5**	0	**A**	**7.4**	0	**A**	**7.5**	0	**A**	**7.5**	0
Route 20 WB Right	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0
Bonny Rigg Hill Road NB Left/Thru/Right	B	10.2	3	B	10.3	3	B	10.9	15	B	11.4	18	A	9.8	3	A	9.5	3	A	9.9	3	A	9.9	3
Main Street SB Left/Thru	B	11.1	13	B	10.9	5	B	12.8	23	B	12.1	10	B	10.7	15	A	9.9	5	B	10.7	13	B	10.4	5
Main Street SB Right	A	8.9	0	A	9.2	0	A	8.7	0	A	8.8	0	A	8.7	0	A	8.8	0	A	8.8	0	A	8.9	0
Blandford																								
Otis Stage Road/Main Street (Route 23) at North Street	A	2.2		A	2.0		A	1.5		A	1.6		A	0.7		A	1.4		A	3.0		A	6.7	
Route 23 EB Left/Thru	A	0.6	0	A	0.5	0	A	0.5	0	A	0.3	0	A	1.0	0	A	0.4	0	A	5.1	10	A	4.2	5
Route 23 WB Thru/Right	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0
North Street SB Left/Right	B	10.0	5	B	10.4	5	B	10.2	5	B	10.7	5	B	10.0	0	B	10.8	5	B	13.1	5	C	16.0	45
Main Street (Route 23) at Russell Stage Road	A	1.9		A	2.9		A	3.9		A	3.2		A	2.1		A	3.1		A	3.2		A	3.0	
Route 23 EB Left/Thru	A	1.1	0	A	2.2	3	A	1.3	3	A	2.5	3	A	1.5	3	A	2.3	3	A	1.7	3	A	2.1	5
Route 23 WB Thru/Right	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0
Russell Stage Road SB Left/Right	A	9.3	3	A	9.5	8	A	9.7	13	A	9.6	8	A	9.7	5	A	9.5	8	B	10.1	13	B	10.1	10

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

Table 4-10: Future Year (2040) Local Unsignalized Intersection LOS, Peak Hours (Continued)

	No-Build						Alternative 1						Alternative 2						Alternative 3					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
Intersection	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**	**LOS**	**Delay (sec)**	**95% Queue Length (ft)**
Russell																								
Westfield Road (Route 20) at Blandford Road (Route 23)	**A**	**4.0**		**A**	**3.1**		**A**	**4.0**		**A**	**3.1**		**A**	**4.2**		**A**	**3.2**		**A**	**4.3**		**A**	**4.1**	
Route 23 EB Left	B	13.3	3	C	20.4	5	B	13.4	3	C	18.6	3	C	15.3	3	C	18.1	3	C	15.5	3	C	20.4	5
Route 23 EB Right	B	11.5	25	B	10.4	13	B	11.2	23	B	10.4	15	B	10.9	20	B	10.5	15	B	10.7	18	B	10.9	25
Route 20 NB Left	A	8.1	5	A	8.2	13	A	8.1	5	A	8.1	10	A	8.3	10	A	8.0	8	A	8.2	10	A	8.1	13
Route 20 NB Through	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0
Route 20 SB Thru	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0
Route 20 SB Right	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0
Westfield																								
Southampton Road (Route 202/Route 10) at Servistar Industrial Way	**A**	**2.5**		**A**	**4.5**		**A**	**2.4**		**A**	**4.2**		**A**	**2.5**		**A**	**4.2**		**A**	**2.4**		**A**	**3.9**	
Servistar Ind. Way EB Left/Right	D	29.8	48	F	68.0	98	D	29.0	45	F	62.8	95	D	29.5	48	F	64.5	95	D	29.1	45	F	60.5	90
Route 202/10 NB Left/Thru	A	0.7	5	A	0.2	3	A	0.7	5	A	0.1	0	A	0.7	5	A	0.1	0	A	0.7	5	A	0.0	0
Route 202/10 SB Thru/Right	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0	A	0.0	0

EB = Eastbound NB = Northbound WB = Westbound SB = Southbound
sec = seconds

4.3.3 Travel Time and Mileage Savings

The placement of a new interchange between Exits 2 and 3 is expected to provide travel time savings to study area residents and businesses. Many drivers who today use the local roadway network to complete their trips will instead be able to complete a portion of those trips on an interstate highway at higher travel speeds, thereby reaching their destination faster. As part of the modeling effort using the Statewide Travel Demand Model, overall daily vehicle hours traveled (VHT) and vehicle miles traveled (VMT) are provided for the 2040 Build Conditions for all three alternatives. These values are shown in Tables 4-11 and 4-12. Analyzing these numbers allowed the study team to compare potential benefits between interchange alternatives.

Table 4-11. Travel Time Savings by Interchange Alternative

	Alternative 1 Algerie Road Interchange	Alternative 2 Blandford Maintenance Facility Interchange	Alternative 3 Blandford Service Plaza Interchange
Total Daily Trips	5,771 trips/day	6,412 trips/day	5,922 trips/day
Decrease in VHT	900 hours/day	1,146 hours/day	1,295 hours/day
Travel Time Savings	9.36 minutes/trip	10.72 minutes/trip	13.12 minutes/trip

Table 4-12. Mileage Savings by Interchange Alternative

	Alternative 1 Algerie Road Interchange	Alternative 2 Blandford Maintenance Facility Interchange	Alternative 3 Blandford Service Plaza Interchange
Total Daily Trips	5,771 trips/day	6,412 trips/day	5,922 trips/day
Decrease in VMT	14,914 miles/day	12,874 miles/day	17,326 miles/day
Mileage Savings	2.58 miles/trip	2.01 miles/trip	2.93 miles/trip

Alternative 3 would provide the most benefit in travel time savings with a total savings of 1,295 hours a day and an average of 13.12 minutes per trip in 2040 Build conditions. Meanwhile, Alternative 1 provides the least travel time benefit with a total savings of 900 hours a day in and an average of 9.36 minutes per trip.

Similarly to travel time, Alternative 3 also provides the most mileage savings of the three alternatives with a savings of 17,326 miles per day, or 2.93 miles per trip. Alternative 2 exhibits the least mileage savings, with 12,874 miles per day, or 2.01 miles per trip.

It is helpful to note that the projected travel time and mileage savings are exclusively attributed to the users of a new interchange. In other words, only drivers using a new interchange to complete their trip would save time and mileage. Since there is projected to be little change in network operations across the study area in future Build conditions, people who continue to use the existing interchanges in Lee and Westfield would not be likely to see a notable change in travel time or mileage as a result of a new interchange elsewhere.

4.3.4 Truck Traffic and Truck Routes

The amount of truck traffic within the study area is expected to rise proportionally to the overall change in traffic volumes in 2040. However, the routes that these trucks take may change if more efficient access to I-90, and thus truck destinations, is available. As a result, it is likely that there would be an increase in truck traffic on the specific roadway segments leading to and from the potential interchange locations. On the other hand, some roads would see a decrease in truck traffic due to diversions from existing routes given the potential savings in travel time offered by a new interchange. Also important to consider is that the existing complicated terrain of the study area will limit the routes a truck can take. Many roadways in the region are steep and winding. Moreover, facilities leading to and from a new interchange would need to be upgraded to accommodate safe travel by both passenger vehicles and trucks. Truck traffic and truck routes would need to be investigated if a new interchange project were to move forward.

4.3.5 Multimodal Transportation

The placement of a new interchange between Exits 2 and 3 is not expected to affect local bus routes or public transit activity within the Hilltowns. Transit service is generally limited to Westfield and Lee, and as a result, transit is unlikely to utilize or be impacted by a new interchange in this study area. However, a new interchange has the potential to attract regional transit providers to consider service to the central study area if more efficient highway access is available. Similarly, Park and Ride services are also a realistic opportunity.

Bicycles and pedestrians are prohibited from using interstate facilities, so the placement of a new interchange within the study area is not anticipated to change bicycle and pedestrian use at that location. However, associated improvements to local roadways leading to and from a new interchange may result in widened shoulders or other improvements to the bicycle and pedestrian experience.

4.3.6 Safety

MassDOT employs strict design criteria for its projects. The intent of this criteria is, among many things, to ensure projects meet acceptable safety standards. The conceptual interchange designs for each of the alternatives have been prepared according to MassDOT design standards and require no design exceptions.

As the data presented in Chapter 2 shows, both Lee and Westfield have higher than average motor vehicle related injury deaths. The Exit 2 interchange at Route 20 in Lee has been identified as a Highway Safety Improvement Program (HSIP) crash cluster by MassDOT. Meanwhile in Westfield, the intersections of North Elm Street at Notre Dame Street and Elm Street at Franklin Street and the Mobile Gas Station Driveway have also been identified as HSIP crash clusters. It is unlikely that a new interchange would impact the safety of these intersections given its minimal impact on network operations.

There are no existing high-crash intersections in the vicinity of the three new interchange alternatives. However, notable increases in traffic volumes on local roadways within the vicinity of any new interchange could impact crash rates. Appropriate traffic control at local intersections, sufficient roadway signage, posted speed limits, and proper local police enforcement would be necessary to help ensure safety and avoid crashes.

Finally, if an interchange project were to advance, further design work would need to consider pedestrian and bicycle accommodations when designing roadways receiving upgrades. This is particularly important for roadways that are projected to have much larger traffic volumes in future Build conditions than they do today. Consideration would need to be given to ensure pedestrian and bicycle safety.

4.3.7 Environmental Considerations

As discussed in Chapter 2, environmental resource mapping was prepared for the entire study area and I-90 corridor. These resources were acknowledged throughout the design process in order to be avoided, minimized, or mitigated as much as possible. A summary of various environmental impacts for the three interchange alternatives is shown in Table 4-13 below.

Table 4-13. Environmental Impacts of Interchange Alternatives

	Alternative 1 Algerie Road, Otis	Alternative 2 Blandford Maintenance Facility	Alternative 3 Blandford Service Plaza
Wetland Impact	Less than 500 SF	None	Less than 500 SF
Water Resource Impact	None	180,000 SF	105,500 SF
Open Space/Article 97 Impacts	2,900 SF	Less than 300 SF	None
Natural Heritage & Endangered Species Program (NHESP) Impact	None	None	None
Steep Slopes/Terrain Constraints	Yes	No	No
Hazardous Materials	None	None	Yes

SF = Square Feet

Though impacts were reduced through revised design work, all three alternatives impact environmental resources in various ways. Alternative 1 impacts wetlands, though it is a relatively small amount at less than 500 square feet of impact. It has no water resource or Natural Heritage & Endangered Species Program (NHESP) impacts. Meanwhile, Alterative 1 impacts 2,900 square feet of open space/Article 97 land, more than any other alternative. This alternative is also located among very steep and rocky terrain. It has no hazardous materials sites in near proximity.

Alternative 2 has no wetland impacts, but impacts 180,000 square feet of water resources. It has a small impact on open space/Article 97 lands at just under 300 square feet of impact. Finally, it has no NHESP impacts, no steep slopes or terrain constraints, and is not near a hazardous materials site. Meanwhile, Alternative 3 has less than 500 square feet of wetland impacts and 105,500 square feet of water resource impacts. And while it has no NHESP impacts or steep slope/terrain constraints, it is located near a hazardous materials site associated with the fueling operations at the Blandford Service Plaza.

4.3.8 Public Health Analysis

Air Quality

A new interchange could positively impact study area air quality as a result of overall reduced vehicle miles traveled (VMT). As discussed previously, each alternative provides mileage savings to interchange users. The mileage savings correlates to fuel savings, which in turn translates to a reduction in greenhouse gas emissions study area wide, as measured by the CO^2 equivalent. A reduction in greenhouse gas emissions positively impacts air quality. As shown in Table 4-14 below, based on VMT reduction, Alternative 3 offers the most potential reduction in greenhouse gas emissions overall with 1,890 metric tons of CO^2 equivalent per day being reduced.

Air quality could also be expected to improve at intersections that showed improvement in network operations. However, most delay and LOS changes were minimal, and as such, anticipated air quality changes as a result of improved operations would be minimal as well. Finally, it is important to note that for this conceptual planning study, air quality was examined for the study area overall. Air quality changes on individual roadways as a result of increased or decreased traffic volumes in future year Build conditions could be examined if an interchange project advanced.

Table 4-14. Potential Air Quality Benefits

Alternative	Annual Weekday VMT Reduction (miles/year)	Annual Weekday Fuel Savings (gallons/year)	Annual Weekday Greenhouse Gas Reduction (metric tons/day)
Alternative 1: Algerie Road	4.0 million	183,000	1,627
Alternative 2: Blandford Maintenance Facility	3.5 million	158,000	1,404
Alternative 3: Blandford Service Plaza	4.7 million	212,000	1,890

Noise

High traffic volumes, particularly from heavy vehicles, results in exposure to traffic-related noise. To assess the potential for residences to be impacted by noise, the study team examined three factors: the number of future anticipated peak hour trips, the number of residences within immediate proximity to each alternative, and existing noise generators. Morning peak hour trips were used for this analysis because more trips are anticipated in the morning than in the evening peak hour. Meanwhile, the quarter-mile buffer is often used in planning studies to assess noise impacts at the conceptual level. Table 4-15 lists the noise impact factors for each alternative.

Table 4-15. Noise Impact Factors for Interchange Alternatives

Alternative	Daily AM Peak Hour Trips	Residences within ¼ mile	Existing Noise Generators
Alternative 1: Algerie Road	457 trips/hour	7	I-90 highway noise/truck traffic from local quarries
Alternative 2: Blandford Maintenance Facility	560 trips/hour	18	I-90 highway noise/MassDOT maintenance facility functions
Alternative 3: Blandford Service Plaza	568 trips/hour	15	I-90 highway noise/MassDOT service plaza facility functions

Alternatives 2 and 3 have a very similar amount of anticipated daily morning peak hour trips: 560 and 568, respectively. This is higher than Alternative 1 with 457 trips. Alternatives 2 and 3 also have more than double as many residences within a quarter mile of the interchange itself compared to Alternative 1 with 18 and 15 residences within one quarter mile, respectively. Overall, this data shows that an interchange facility in Alternative 2 and 3 would have similar noise impacts, and that they could be higher than the interchange in Alternative 1.

Each alternative also has its own existing noise generators that are notable. The space encompassing the footprint of an interchange at Alternative 1 currently experiences truck traffic from local stone quarries. Likewise, the Alternative 2 location is currently used for maintenance operations and Alternative 3 is used as a service plaza for I-90 users. All of these functions would continue to operate and generate noise under Build conditions.

If an interchange project advanced, it would be important for the next phase of analysis and design to consider noise impacts outside a one-quarter mile buffer, as well as on local roads that would experience much higher traffic volumes under Build conditions.

Open Space

The availability and accessibility of green space can play a role in the overall wellbeing of the public. Each interchange concept was developed in order to minimize impacts on the physical environment as much as possible. However, as detailed in the previous section, each interchange footprint would overlap with various environmental resources. More specifically, Alternative 1 in particular would impact green space. This alternative is anticipated to impact approximately 2,900 square feet of open space/Article 97 land. Alternative 2 also impacts green space, though its impact is on less than 300 square feet of open space/Article 97 land. Alternative 3 does not overlap with protected green space.

4.3.9 Connectivity

Any of the three interchange alternatives could improve connectivity for people living within the study area. Travel time savings provided by using the interchange could give drivers access to employment centers, shopping and businesses, as well as medical services in less time than before. An analysis was conducted to understand the specific connectivity and mobility impacts of each alternative as a result of travel time savings.

This involved a comparison of what geographic limits and how many opportunities could be reached within 45 minutes from each alternative's location with or without an interchange. For the purpose of this analysis, opportunities include existing population, households, income, employment, business establishments, and business sales. 45 minutes represents a typical commute time statewide, though it is slightly longer than study area residents' average commute times, as discussed in Chapter 2.

The blue contours on the maps in Figures 4-28 through 4-30 show the approximate geographic limits a driver could reach within 45 minutes without an interchange at each alternative location. For all alternatives, 45 minutes allows drivers to go from the interchange location to the outskirts of the study area. Meanwhile, the green contours on the maps show the approximate limits a driver could reach if there were an interchange at that location providing direct access to I-90. These travel limits extend much further east and west for all alternatives, while also extending a bit further north and south. Accessing I-90 allows drivers to go faster, further, or make a more direct trip in the same amount of time compared to using local roadways.

Table 4-16. Connectivity Changes with New Interchange

	Population	Households	Household Income	Employment	Establishments	Business Sales
Alternative 1, Algerie Road						
Existing	140,000	58,000	$ 5,118,984,000	89,000	9,000	$ 15,743,461,000
Build	410,000	169,000	$ 13,871,639,000	257,000	25,000	$ 49,299,649,000
Difference	270,000	111,000	$ 8,752,654,000	168,000	16,000	$ 33,556,188,000
% Difference	193%	191%	171%	189%	178%	213%
Alternative 2, Blandford Maintenance Facility						
Existing	185,000	76,000	$ 6,668,065,000	111,000	11,000	$ 21,859,321,000
Build	546,000	220,000	$ 17,425,597,000	341,000	33,000	$ 59,429,151,000
Difference	361,000	144,000	$ 10,737,532,000	230,000	22,000	$ 37,569,830,000
% Difference	195%	189%	161%	207%	200%	172%
Alternative 3, Blandford Service Plaza						
Existing	453,000	183,000	$ 14,256,507,000	274,000	26,000	$ 47,759,369,000
Build	628,000	251,000	$ 20,488,053,000	392,000	38,000	$ 69,470,834,000
Difference	175,000	68,000	$ 6,231,546,000	117,000	12,000	$ 21,711,465,000
% Difference	39%	37%	44%	43%	42%	45%

Sources: CTPS Statewide Travel Demand Model; Environics Analytics, 2018; and FXM Associates

With many major employment, shopping, and medical centers located at the peripherals of the study area in cities like Westfield, Pittsfield, and Springfield, even slight improvements in connectivity result in big changes. As detailed above in Table 4-16, an interchange at Alternative 1 could provide connections to nearly double the amount of opportunities that currently exist within 45 minutes travel time. Traveling from an interchange located at Algerie Road, drivers could reach an additional 270,000 people (a 193% increase over existing conditions), 111,000 households (a 191% increase), $8.7 billion in household income (a 171% increase), 168,000 jobs (a 189% increase), 16,000 business establishments (a 178% increase), and $33.5 billion in business sales (a 213% increase).

Alternative 2 could provide access to slightly more opportunities compared to existing conditions than Alternative 1. Beginning at that interchange, in 45 minutes drivers could reach an additional 361,000 people (a 195% increase), 144,000 households (a 189% increase), $10.7 billion in household income (a 161% increase), 230,000 jobs (a 207% increase), 22,000 business establishments (a 200% increase), and $37.5 billion in business sales (a 172% increase).

Alternative 3 provides the least change in connectivity to opportunities. With a new interchange, drivers could reach an additional 175,000 people (a 39% increase), 68,000 households (a 37% increase), $6.2 billion in household income (a 44% increase), 117,000 jobs (a 43% increase), 11,000 business establishments (a 42% increase), and $21.7 billion in business sales (a 45% increase) in 45 minutes. This relatively smaller change is due to this alternative's existing proximity to Westfield and West Springfield. Drivers at that interchange location could already access those areas in 45 minutes. Moreover, being the easternmost option, it provides less connectivity with areas west of the study area. However, Alternative 3 does provide the greatest increase in absolute reach, and as demonstrated earlier in this chapter, provides the highest average travel time savings per trip.

Figure 4-28. Alternative 1, Algerie Road/Change in Geographic Access

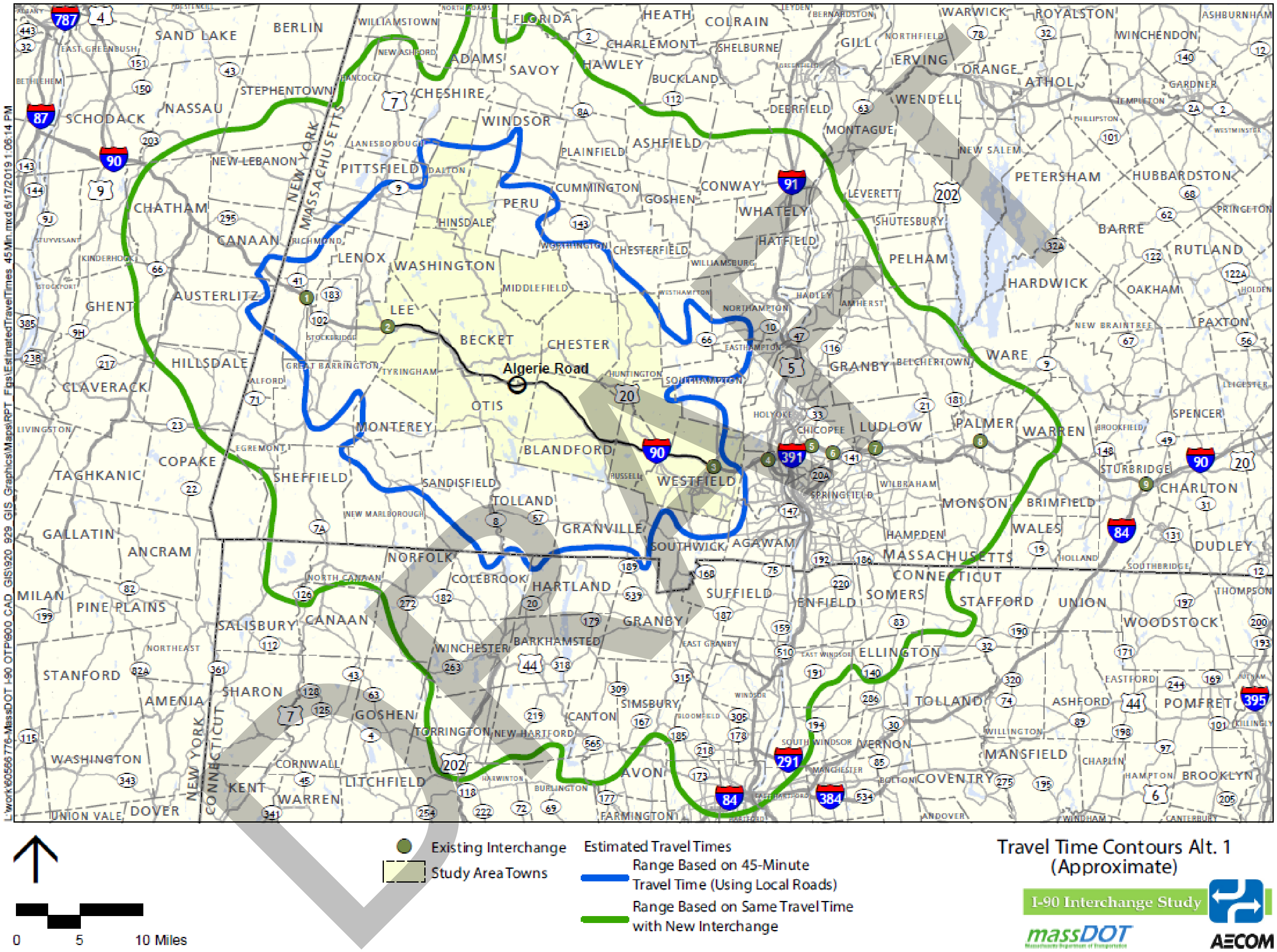


Figure 4-29. Alternative 2, Blandford Maintenance Facility/Change in Geographic Access

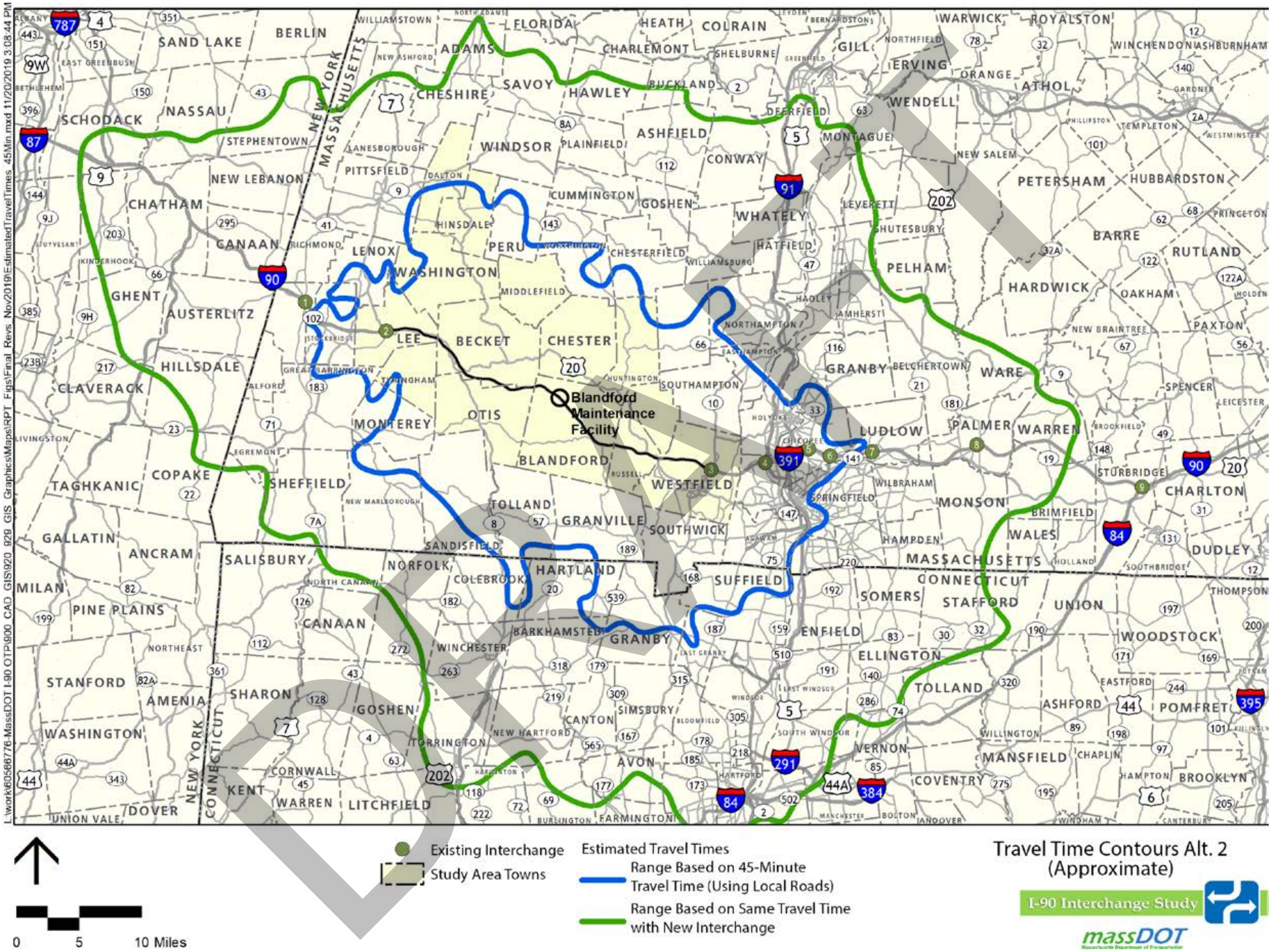
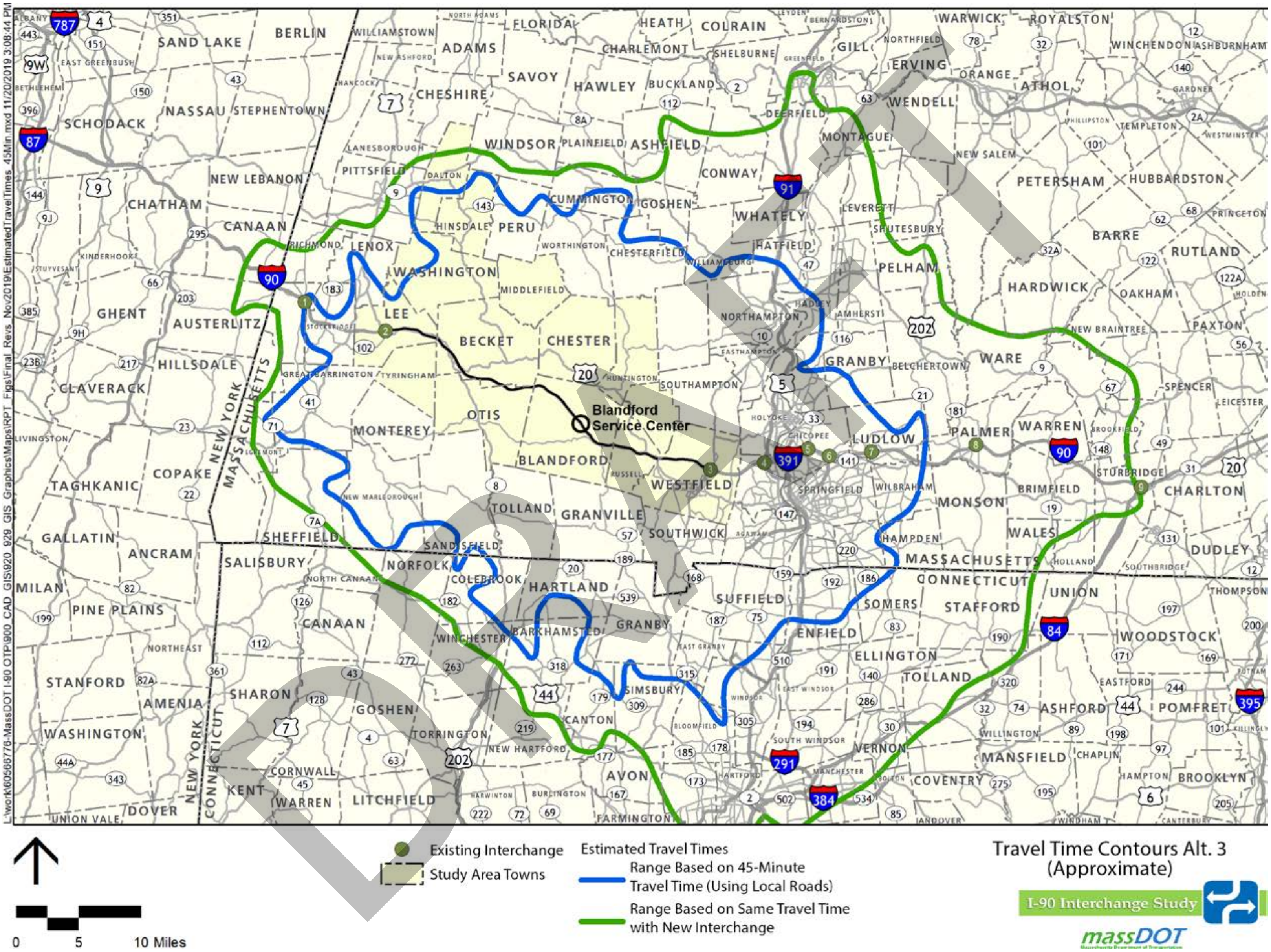


Figure 4-30. Alternative 3, Blandford Service Plaza/Change in Geographic Access



4.3.10 Economic Considerations

With a project such as a new interchange, anticipated economic benefits are generally a result of anticipated changes in connectivity. As discussed in the previous section, changes in connectivity have the potential to improve access to various opportunities. This corresponds directly to economic conditions within the study area. Additionally, travel time savings can benefit local and regional economies in several ways.

By increasing the effective geographic area that can be reached within a given amount of time, Hilltown residents could have enhanced prospects of finding jobs within a reasonable commuting time. This could also allow residents to increase their earnings by entering higher-paying job markets. Meanwhile, for those who could reach their current job faster as a result of a new interchange, the reduction in commuting time could increase the amount of time they can spend in more pleasurable or productive activities.

Additionally, the productivity of current and prospective Hilltowns businesses could be boosted by increasing the reach of a business to its potential labor force and customer base. Moreover, for goods movements where even minor travel time savings have direct consequences to the costs of shipping, businesses can lower shipping costs or increase the effective geographic reach of their markets. As a result, local businesses could be in a better position to improve their employment, sales, market value, and tax contributions.

Reduced travel times for non-work trips could also enhance the quality of life and personal satisfaction of residents, making the Hilltowns a more desirable place to live and work. This could translate to more people choosing to reside in the Hilltowns, spending more on local goods and services, affording higher value homes, and therefore increasing local tax contributions.

4.3.11 Cost Analysis

Conceptual cost estimates were prepared for each of the three alternatives using MassDOT guidelines, including the MassDOT Construction Project Estimator and the latest Weighted Bid Prices available at the time of this study. The cost estimates also consider, to the extent possible at the conceptual level, the cost of local roadway improvements on roadway segments leading to the next main intersection. Necessary local roadway improvements would be investigated in greater detail later in the process if an interchange project advanced. Costs do not include any potential right-of-way acquisitions, environmental permitting, or engineering design.

Alternative 1 at Algerie Road is the most expensive option at $37.8 million in construction costs. This alternative is the most expensive mainly due to the steep slopes and complicated terrain of the land comprising the interchange footprint. Meanwhile, Alternative 2 at the Maintenance Facility in Blandford is estimated to cost $29.5 million, making it the least expensive interchange alternative. Finally, Alternative 3 at the Service Plaza in Blandford falls in the middle of the price range at $34 million.

Table 4-17. Conceptual Cost Estimates for Interchange Alternatives

Cost*	Alternative 1: Algerie Road, Otis	Alternative 2: Blandford Maintenance Facility, Blandford	Alternative 3: Blandford Service Plaza, Blandford
Interchange	$26.3 million	$19.4 million	$20.4 million
Local Road Upgrades	$11.5 million	$10.1 million	$13.6 million
Total	$37.8 million	$29.5 million	$34.0 million

*Do not include ROW acquisition, environmental permitting, or engineering design

4.3.12 Land Use

Within the areas where the three interchange alternatives are being considered, land use is primarily single-family residential, forested undeveloped areas, open space/recreational and agricultural, with limited mixed-use commercial areas. With few exceptions, zoning throughout the study area allows single-family housing on single lots, or single-family housing with agricultural uses. Any development that occurs as a result of a new interchange would be limited to residential use without changes in local zoning regulation or a zoning exception. Therefore, local municipalities maintain the power to control how any future growth occurs.

4.3.13 Right of Way Impacts

The conceptual designs for each alternative were developed based upon avoidance or minimization of impacts to private property. Table 4-18 identifies potential impacts to private property associated with each of the three alternatives.

Table 4-18. Conceptual Parcel Impacts

Alternative	Parcels Impacted	Parcels with Residences	Square Footage Impacted*	Distance from Interchange to Residence (feet)
Alternative 1: Algerie Road, Otis	4 (2 MA owned)	0	17,093	N/A
Alternative 2: Blandford Maintenance Center, Blandford	4	2	91,686	465, 340
Alternative 3: Blandford Service Plaza, Blandford	2	1	20,316	242

*Reflects square footage of potential taking required by interchange footprint
SF = Square Feet

All alternatives would require some amount of right-of-way (ROW) acquisition for construction. Alternative 1 would require the most with 148,856 square feet of necessary land taking. Alternative 2 also requires a significant taking, with 89,936 square feet of ROW impacts. Alternative 3 requires the least ROW taking, with 18,119 square feet impacted.

Of these impacted parcels, there are some that also have a residence on the property. ROW acquisition on land that contains a residence can be more challenging than a parcel that is being used for another purpose or is vacant. Alternative 1 does not require ROW from any parcels with residences, but Alternative 2 requires two parcels with residences and Alterative 3 requires one parcel. For both Alternatives 2 and 3, the interchange footprint is less than 500 feet from a residential building.

4.3.14 Community Impacts

Environmental Justice

As discussed previously, Environmental Justice populations are U.S. Census Blocks that meet certain criteria based on income, minority population, or English language isolation. The criteria is as follows:

- Income: Households in census block earn 65% or less of state median household income.
- Minority population: 25% or more of residents in census block identify as a race other than white.

- English language isolation: 25% or more of households in census block have no one over the age of 14 who speaks English only or very well.

Earlier in this document, Figure 2-10 identified Environmental Justice populations within the study area based on the above information. There are various Environmental Justice populations identified in Lee and Westfield census blocks, but the only Environmental Justice population surrounding any of the interchange alternatives is in Becket. The Becket census block is identified as a qualifying Environmental Justice area based on low-income criteria. The Environmental Justice population is geographically adjacent to Alternative 1 at Algerie Road in Otis, and contains roadways that lead to the interchange alternative.

The proximity of any proposed transportation improvements to an Environmental Justice population must always be considered. Furthermore, additional scrutiny must be given to projects that could negatively impact an Environmental Justice population, which could be the case with a new interchange. Potential impacts include the projected increase in traffic volumes on the routes leading to Alternative 1, public health impacts, and any disruption associated with construction of the potential interchange and associated local roadway improvements.

An alternative that may negatively affect an Environmental Justice population should not be pursued whenever possible. This is particularly true when there are other alternatives available that still fulfil the project purpose and need, and provide similar benefits, without disproportionally impacting the Environmental Justice group.

Title VI

The I-90 Interchange Study includes a Public Participation Plan designed to provide access to information and comment to all interested parties without discrimination. Under Title VI, MassDOT is obliged to assure that its decision-making acknowledges the following:

> *No person in the United States shall, on the grounds of race, color, national origin (including limited English proficiency), age, sex, disability, or low-income status, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity, for which the Recipient receives Federal financial assistance from U. S. DOT, including FHWA.*

Among the instruction relevant to the I-90 Interchange Project are the following requirements:

> *The Recipient shall not locate, design, or construct a highway in such a manner as to deny access to, and use thereof, to any persons on the basis of race, color national origin (including limited English proficiency), age, sex, or disability, including low-income status. Additionally, the Recipient shall develop and implement a Public Participation Plan in a manner that ensures the identification of Title VI/Non-discrimination population(s), affords the population(s) opportunities to comment on transportation planning and highway project development, and provides for consideration of and prompt response to all substantive comments.*

The full copy of the MassDOT Title VI Implementation plan can be viewed at https://www.mass.gov/files/documents/2018/03/15/Title_VI_ImplementationPlan_2017.pdf.

Title VI compliance throughout the project includes a series of Working Group meetings where stakeholders have had opportunities to understand and comment on ongoing design and analysis efforts, and have expressed the viewpoints of their constituents. The general public within the study area have had similar access to the process through Open House workshops. The project website has been continually updated with meeting notices, presentations and other relevant information, all in accessible format to those with disabilities.

4.3.15 Magnitude of Interchange Usage

A comparison of traffic volumes at nearby I-90 interchanges provides useful context for the magnitude of potential usage at the proposed interchange locations. Table 4-19 summarizes average weekday volumes at existing I-90 interchanges and the proposed interchange locations.

Table 4-19. Interchange Volumes at Nearby I-90 Locations

Interchange	Location/Route	2018 Average Daily Interchange Volumes (vehicles/day)*
Exit 1**	West Stockbridge/Routes 41 and 102	765
Exit 2	Lee/Route 20	13,116
Interchange Alternative	Alternative 1/2/3	5,771/6,412/5,922
Exit 3	Westfield/Routes 10-202	20,507
Exit 4	West Springfield/I-91, I-391, Route 5	29,507

*Average Daily Interchange Volumes for Interchange Alternatives are 2040 estimates
** Exit 1 is a partial interchange
Source: MassDOT Transportation Data Management System

With the exception of the partial interchange in West Stockbridge, projected interchange usage for all three alternatives represents less than 50% of the existing daily volumes at Exit 2, less than 25% of the existing daily volumes at Exit 3, and less than 22% of existing volumes at Exit 4. The rural nature and low population density of the study area communities contribute to the proportionally low projected usage. The above existing daily volumes do not account for trips that would be diverted from an existing interchange to a new interchange in build conditions.

Chapter 5: Findings

This chapter summarizes the findings of the study and identifies the alternatives deemed feasible for further study and design. Potential funding sources are described and the program requirements and competition for transportation funds are acknowledged. Finally, a detailed description of the MassDOT Project Development Process is provided, showing the steps necessary to take a project from feasibility study to construction.

5.1 Feasibility

As described in Chapter 1, the purpose of the I-90 Interchange Study is to determine the feasibility of an interchange between Exit 2 in Lee and Exit 3 in Westfield. The locations of a potential new interchange were developed as a result of the study goals developed by the study team and in coordination with the study's Working Group:

- Primary goal: Improve access to and from I-90 for towns in the center of the regional study area
- Secondary goal: Mitigate I-90-bound traffic to and from Lee and Westfield.

Seven potential interchange locations were identified in the study area, based on where I-90 already overlaps with another roadway. After further discussion between the study team and the Working Group, three interchange alternatives were selected for detailed analysis, due to their alignment with the primary goals and objectives of the study:

- Alternative 1: Algerie Road in Otis
- Alternative 2: Blandford Maintenance Facility in Blandford
- Alternative 3: Blandford Service Plaza in Blandford

The analysis summarized in Chapter 4 determined that all three selected alternatives are conceptually feasible from an engineering perspective. They also fulfill the study's primary goal to provide access to the midpoint of the existing interchanges, while also reducing vehicle trips at Exits 2 and 3.

5.2 Recommendations

After comparing the potential benefits, impacts, costs, and public support associated with each alternative, MassDOT determined that Alternatives 2 and 3 are more favorable options for a new interchange, while Alternative 1 should be dismissed from future consideration. As shown in Table 5-1 below, Alternative 1 in Otis would provide the least benefit in terms of travel time savings and vehicle usage. The footprint of the interchange overlaps with environmentally sensitive areas, including open space/Article 97 land, and is adjacent to an Environmental Justice group. Due to the steep physical terrain surrounding the proposed interchange, it would be the most difficult alternative to construct and would have the highest construction cost. Moreover, Alternative 1 generated strong public opposition during the study process. Public comment is documented in Appendix B. As a result of these factors, this study has concluded that Alternative 1 be dismissed from future consideration if an interchange project is advanced.

Table 5-1. Summary of Analysis of Proposed Interchange Alternatives

	Alternative 1 Algerie Road, Otis	**Alternative 2 Blandford Maintenance Facility**	**Alternative 3 Blandford Service Plaza**
Proximity to Adjacent Interchanges	Exit 2: 11.8 Miles Exit 3: 17.9 Miles	Exit 2: 15.7 Miles Exit 3: 14 Miles	Exit 2: 18.4 Miles Exit 3: 11.3 Miles
Local Road Connections	Minor Collector	Local	Major Collector
Jurisdiction	Town	Town	State
National Highway System	No	No	No
Condition	Fair	Fair	Fair
Wetland Impact	Less than 500 SF	None	Less than 500 SF
Water Resource Impact	None	180,000 SF	105,500 SF
Open Space/Article 97 Impact	2,900 SF	Less than 300 SF	None
ROW Impact	17,000 SF	92,000 SF	21,000 SF
Potential Property Taking	4 parcels (2 MA owned)	4 parcels	2 parcels
Parcels with Residences	0	2	1
Environmental Justice Population	Yes	No	No
Residences within ¼ Mile	7	18	15
Daily CO^2 Emissions Reduction	6.2 metric tons	5.2 metric tons	7.0 metric tons
Average Travel Time Savings/Trip	9.36 minutes	10.72 minutes	13.12 minutes
Average Mileage Savings/Trip	2.58 miles	2.01 miles	2.93 miles
Projected Daily Use	5,771 trips	6,412 trips	5,922 trips
Estimated Conceptual Cost	$37.8 million	$29.5 million	$34 million

SF = Square Feet

Alternatives 2 and 3 each provide similar benefits while generally having less impacts and costs compared to Alternative 1. Alternative 2 would have the highest ROW and water resource impacts, but would by far generate the most daily use. Alternative 3 has fewer land impacts while providing the highest average travel time savings and mileage savings. Both alternatives also have less capital costs than Alternative 1. Because of these considerations, this study recommends that only Alternatives 2 and 3 be considered should the project move past the conceptual study phase. Both are able to provide relatively more benefits than Alternative 1 with comparatively less negative impacts and lower capital costs.

As mentioned previously, a new interchange could attract regional transit providers to consider service to the central study area. If an interchange project advanced, provision of new transit services should be explored. Furthermore, if more efficient highway access is available, new Park and Ride services should be investigated as a part of an interchange project.

5.3 Potential Funding Paths

Should the study area communities and regional stakeholders seek to advance the either of the interchange alternatives, an integral next step would be identifying funding opportunities for the capital costs of construction. This study explored several funding paths at a conceptual level:

- Toll Revenue
  - Western Turnpike Toll Revenue
  - New Interchange Toll Revenue
- State Funding
  - Commonwealth Bond Cap
- Federal Funding
  - Metropolitan Planning Organization (MPO) Programming
  - Federal Discretionary Programs

5.3.1 Toll Revenue

Western Turnpike Toll Revenue

The Western Turnpike has toll revenue available that can be used to fund projects along the interstate between Route 128 and the New York State Border. Funding amounts that may be available are based on what is left after deducting operations and maintenance costs from total revenue. The remaining funds can be allocated towards new projects. New projects are presented to the Highway Division's Project Review Committee (PRC), where they are scored and ranked along with other projects. This means that a new interchange would need to be competitive against any other project vying to use Western Turnpike funds.

There is approximately $90 million available annually for new and existing Western Turnpike projects for the next five years. Western Turnpike funds are fully programmed in the current 2020-2024 Capital Investment Plan (CIP) for new and existing projects. The MassDOT Highway Division prioritizes the programming of these funds. Ongoing projects are the first priority for funding.

Anticipated use of a transportation improvement is important to consider when programming Western Turnpike funds. A proposed project should ideally show that it would get a lot of use or readily alleviate a large traffic problem. For comparison of use, the interchange alternatives presented in this study are expected to generate between 5,771 and 6,421 average daily trips. Meanwhile, in 2018 Exit 2 observed 13,116 average daily trips and Exit 3 saw 20,507 average daily trips. This difference does not preclude an interchange project from receiving funding, but it is important to consider when contemplating funding sources.

New Interchange Toll Revenue

In addition to Western Turnpike Toll Revenue funding, the study investigated the potential to leverage toll revenue to take out a loan for the cost of an interchange project. This involved understanding whether toll revenue generated by the project would be sufficient to pay debt service over a given amount of time. A separate analysis was conducted for MassDOT (see Appendix E) to determine the potential toll revenue generated by each interchange alternative. The analysis assumed a 10-year payback term for the loan, a 6% loan interest rate, and did not account for any inflation. A 10-year payback reflects a standard debt service scenario for this type of project as interest rates fluctuate over time.

There is currently one All Electronic Toll (AET) gantry in the middle of the study area along I-90 which collects a toll from anyone traveling between Exits 2 and 3. The toll is currently $1. In order to capture a toll for users of a new interchange, a new toll gantry would be necessary. The cost of a new gantry is approximately $1.5 million. The current $1 toll would be split with the new gantry proportional to its location on the road. Table 5-2 shows the total revenue scenarios that a new interchange could generate over a total of ten years.

Table 5-2. 10-Year Total Revenue & Expense Summary for New Interchange in 2019 Dollars

	Alternative 1	Alternative 2	Alternative 3
Toll Revenue	$5,963,000	$6,327,000	$5,902,000
Fee and Fine Revenue*	$429,000	$440,000	$392,000
Toll Collection O & M	- $4,424,000	- $4,463,000	- $4,394,000
Interchange O & M	- $99,600	- $99,600	- $133,500
Revenue available for Debt Service	$1,868,400	$2,204,400	$1,766,500
Total Debt Service after 10 Years**	- $53,400,000	- $42,100,000	- $48,200,000
Net Revenue after 10 Years	- $51,531,600	- $39,895,600	- $46,433,500

*Comprised of fees and late payment fines for pay-by-plate toll payers

**Debt Service includes 6% interest rate. Total includes the additional cost of new gantry.

O & M = Operations and Maintenance

For all alternatives, the toll revenue generated from a new interchange is about $6 million over 10 years. Fees and fines from pay-by-plate drivers increase the revenue a small amount. Meanwhile, the cost of operations and maintenance (O & M) of toll collection and the interchange itself is about $4.5 million over ten years for any of the alternatives. This leaves only a small amount of revenue to be applied to the debt service. Therefore, while toll and fee revenue would cover operations and maintenance of each interchange, toll revenue would not be able to recover the capital costs of a new interchange for any alternative. A detailed memorandum regarding this toll analysis can be found in Appendix E.

5.3.2 State Funding

Commonwealth Bond Cap

The Commonwealth Bond Cap funds many projects and programs statewide, and is a primary source of state transportation capital funding. Through this funding method, debt is issued to investors and paid back with interest over the course of the bond's life, similar to a mortgage for the purchase of a house. A certain amount of Commonwealth general obligation bond proceeds are allocated to transportation and are divided among the MassDOT Aeronautics, Highway and Rail and Transit Divisions, as well as the Massachusetts Bay Transportation Authority (MBTA). An interchange project would use funds allocated to the MassDOT Highway Division. These funds are first directed to existing projects, then funds are programmed for new projects. New projects are initiated according to MassDOT policy directives and are considered by the MassDOT Project Review Committee, which scores and ranks submitted projects.

5.3.3 Federal Funding

Metropolitan Planning Organization Programming

Funding through a Metropolitan Planning Organization (MPO) is another potential funding source to consider. Programming a project into an MPO's Transportation Improvement Program (TIP) is a traditional path for a project to receive funding for construction. Each year, MassDOT allocates a certain amount of federal funding to each MPO based on a formula determined by the

Massachusetts Association of Regional Planning Agencies (MARPA). MPOs then use their TIPs to allocate that money towards various projects and programs. The study area for this report is encompassed by both the Berkshire Regional MPO and the Pioneer Valley MPO. Programming the project to receive funding from either or both MPOs (depending upon interchange location and MPO support) would be imperative to moving the project forward.

A new interchange along I-90 in the study area was identified by the Pioneer Valley MPO in its latest (2019) Regional Transportation Plan (RTP) Update as a visionary project. Visionary projects are defined as projects that would likely result in an improvement to the regional transportation system but do not have an identified source of funding. As funding is available, the RTP is amended in order to demonstrate financial constraint and conformance with air quality requirements. Similarly, the Berkshire Regional MPO listed a new interchange along I-90 in the study area as a project recommended for funding in their latest (2019) RTP Update. Once included in the RTP, the project would be eligible to move through the TIP process and have funding programmed by the MPO, assuming the necessary funding is available.

It is important to note that a new interchange would need to compete with other projects for funding. As mentioned above, a certain amount of funds are allocated to each MPO by formula, resulting in a fixed amount of funding available for projects. Each MPO follows a process to prioritize projects to include and fund in its TIP. Pre-determined scoring criteria are used to weigh the anticipated benefits and costs of a proposed project in order to assist in the prioritization. Thus, a new interchange project would need to rank competitively among other regional projects.

Cost is also a particularly important characteristic to note, as this is a relatively expensive project compared to the amount of money available to the study area MPOs to program. For example, the latest Pioneer Valley MPO TIP (2020-2024) includes 18 regionally-prioritized highway projects with total funding of approximately $133 million. The latest Berkshire Region MPO TIP (2020-2024) includes seven regionally-prioritized highway projects with total funding of approximately $44 million. While the construction of any of the interchange alternatives would not begin during this current TIP period, this demonstrates the proportion of funding that the MPOs generally receive versus what would need to be oriented towards a single interchange project. The inclusion of a new interchange in the TIP of either MPO would comprise a significant percentage of total available funding and could displace other projects depending on the funding category and average cost of projects listed in these TIPs.

Finally, since these are federal funds, there are certain specifications and requirements that a project on the Western Turnpike would need to meet in order to be eligible. This is detailed in the *Constraints of Federal* Funding section below.

Federal Discretionary Programs

While individual states own and operate nearly all of the nation's interstates, the U.S. Department of Transportation provides funding opportunities for the construction, maintenance, and operation of the Interstate Highway System, primary highways, and secondary local roads through discretionary grant programs. There are several types of grant programs available under which an interchange project may apply to receive funding. One of the most notable grant programs is the Better Utilizing Investments to Leverage Development (BUILD) transportation discretionary grant. BUILD seeks to provide infrastructure investments that will better connect rural and urban communities. Selection criteria for BUILD includes safety, economic competitiveness, quality of life aspects, and innovation. The U.S. Department of Transportation announced $900 million in discretionary grant funding through BUILD in 2019.

Another potential grant opportunity is Infrastructure for Rebuilding America (INFRA). This grant program provides dedicated funding for projects that address critical issues facing the nation's highways and bridges. The main focus of this grant is to rebuild deteriorating infrastructure, though the grant also evaluates projects for their alignment with national and regional economic vitality goals, as well as their incorporation of innovative technologies. The U.S. Department of Transportation awarded $856 million in INFRA grants in 2019.

The major challenge with these grants is that they are highly competitive. All proposed projects must align with the grants' mission and score well based the various selection criteria set forth. These grants are also generally awarded to projects that have a high level of readiness. Grant recipients are expected to begin project construction within a short timeframe. This conceptual planning study does not bring a new interchange to this level of readiness.

Constraints of Federal Funding

There is a unique challenge for using federal funding that applies to both MPO Programming and Federal Discretionary Programs. The Western Turnpike's construction predates the majority of I-90 in the Commonwealth and surrounding states, which was built in the 1960s as a part of the Federal Aid Highway Act of 1956, and followed by the Boston extension in 2003 under the Central Artery/Tunnel Project. Despite its eventual incorporation into the Interstate Highway System, this portion of the highway was not designed precisely to Interstate Highway System standards. This relates to things such as uniform geometric and construction standards, including access geometry, design speeds (depending on the type of terrain), number of travel lanes, lane widths, and left and right paved shoulder widths. In order to use federal funding to build an interchange, it would be necessary to bring the entire Western Turnpike up to federal standards. This alone poses a financial obligation and a potential engineering challenge.

The secondary highways and local roads that would connect to any of the interchange alternatives may be able to use federal funds for construction, operation, and maintenance without the above limitations. The project elements that are not of the interchange itself, such as the roads that the interchange on- and off-ramps would connect to, and any necessary upgrades to those roads, could be eligible for federal funding. In other words, while it may be feasible to pursue federal grant funding opportunities or funding from the MPOs for a new interchange, only those elements off of the turnpike could be funded without triggering the need for significant upgrades along the entire Western Turnpike.

5.4 MassDOT Project Development Process

Beyond funding, there are many steps to be taken to get a project from the conceptual level (like this feasibility study) to design and then to construction. All projects developed through the MassDOT Highway Division are guided by a process outlined in the MassDOT Highway Division's Project Development and Design Guide. This project development process is a requirement for all projects involving the MassDOT Highway Division, including projects in which the Highway Division is the project proponent, is responsible for funding, or controls the infrastructure in question. Outlined below are the eight major steps that comprise the MassDOT Project Development and Design Process.

Step 1: Identification of Needs

For any proposed transportation improvement, MassDOT leads an effort to define the problem, establish project goals and objectives, and define the scope of the planning needed for implementation. This is accomplished by completing a MassDOT Project Need Form (PNF). The

PNF documents the existing problems and explains why corrective action is needed. Much of this information can be derived from this study.

The PNF is reviewed by the Highway Division and the District Offices whose jurisdiction includes the location of the proposed project. For this study, this is District 1 and District 2. The outcome of this effort is to determine whether the project requires further planning or is already well supported by prior planning studies. This allows MassDOT to decide whether it the project ready to advance or whether it should be dismissed from consideration.

Step 2: Planning

The purpose of this step is for the project proponent to identify issues, impacts, and approvals that may need to be obtained so that the subsequent design and permitting processes are understood. The level of planning needed for a project varies widely depending on complexity. This study should suffice in identifying preliminary issues, impacts and necessary approvals, though MassDOT could decide that more study is needed in order to proceed.

Step 3: Project Initiation

Next, the proponent completes a Project Initiation Form (PIF) for each proposed improvement, which is reviewed by the MassDOT Project Review Committee (PRC). The PRC is composed of the Chief Engineer, each District Highway Director, and representatives of the Project Management, Environmental, Planning, Right-of-Way, Traffic, and Bridge departments, and the Federal Aid Program Office (FAPO). The PIF documents the project type and description, summarizes the project planning process, identifies likely funding and project management responsibility, and defines a plan for interagency and public participation.

First, the PRC evaluates the proposed project based on the MassDOT's statewide priorities and criteria. If it is reviewed favorably, MassDOT Highway Division moves the project forward to the design phase. The PRC may provide a Project Management Plan to define roles and responsibilities for subsequent steps. If the project is being programmed for funding through an MPO, the MPO will also conduct a review that includes a project evaluation based on the MPO's regional priorities and criteria. The MPO may then assign its own project evaluation criteria score, a TIP program year, a tentative project category, and a tentative funding category.

Step 4: Outreach, Permitting, FHWA Approval, Design, and Right-of-Way

This step has several distinct but closely integrated elements: outreach, permitting, FHWA approval, and right-of-way acquisition. The outcome of this step is to have a fully designed and permitted project ready for construction. The sections below provide more detailed information on the four elements of this step of the project development process.

- Public Outreach: Continued public outreach in the design and environmental process is essential to maintain public support for the project and to seek meaningful input on the design elements. The public outreach is often in the form of required public hearings (conducted at the 25 percent and 100 percent design milestones) but can also include less formal dialogue with those interested in and affected by a proposed project.
- Interchange Justification Report: While Massachusetts owns and operates the interstate, the Federal Highway Administration (FHWA) retains full control over changes in access to it. An Interchange Justification Report (IJR) would need to be submitted to FHWA for approval. An IJR details why a new interchange is needed, what solution is proposed, and why that is the best solution.

- Environmental Documentation and Permitting: The project proponent, in coordination with the Environmental Services section of the MassDOT Highway Division, will be responsible for identifying and complying with all applicable federal, state, and local environmental laws and requirements. Environmental documentation and permitting are often completed in conjunction with the Preliminary Design. Potential applicable environmental policy acts and permitting reviews are detailed below.

  The appropriate project category for both the Massachusetts Environmental Protection Act (MEPA) and the National Environmental Protection Act (NEPA) would need to be determined at the onset. Both MEPA and NEPA typically require an evaluation of a project to determine the environmental consequences and mitigation measures required for the proposed improvements. With a new interchange, it is anticipated that MEPA review will at least consist of an Environmental Notification Form (ENF) and a Draft and Final Environmental Impact Report (EIR). Similar thresholds apply to NEPA where a full Environmental Assessment (EA) could be warranted for this project.

  Local, state, and federal regulatory agencies will review proposed activities with respect to applicable environmental laws and regulations. Depending on the interchange alternative, necessary regulatory agency reviews and applicable permits could consist of the following:

  - Massachusetts Wetlands Protection Act (WPA) – Wetlands Notice of Intent (NOI)
  - Section 401 of the Federal Clean Water Act – 401 Water Quality Certification
  - National Pollutant Discharge Elimination System (NPDES) Remediation General Permit
  - EPA Construction Stormwater General Permit
  - Massachusetts Natural Heritage Priority and Estimated Habitats
  - Massachusetts Historical Commission (MHC)
  - Massachusetts General Law Chapter 21E and the Massachusetts Contingency Plan (MCP)

- Design: There are three major phases of design. The first is Preliminary Design, also referred to as the 25 percent submission. The major components of this phase include a full survey of the project area, preparation of base plans, development of basic geometric layout, development of preliminary cost estimates, and submission of a functional design report. Preliminary Design, although not required to, is often completed in conjunction with Environmental Documentation and Permitting. This study does not fulfil Preliminary Design requirements.

  The next phase is Final Design, which is also referred to as the 75% and 100% submission. The major components of this phase include preparation of a subsurface exploratory plan (if required), coordination of utility relocations, development of temporary traffic control plans through construction zones, development of final cost estimates, and refinement and finalization of the construction plans. Once Final Design is complete, a full set of Plans, Specifications, and Estimates (PS&E) is developed.

- Right-of-Way Acquisition: A separate set of Right-of-Way plans is required for any project that requires land acquisition or easements. The plans must identify the existing and proposed layout lines, easements, property lines, names of property owners, and the dimensions and areas of estimated takings and easements.

Step 5: Programming (Identification of Funding)

Programming of funding, which typically begins during the design phase, can actually occur at any time during the process, from planning to design. The many ways that an interchange project can be funded is detailed in the previous section of this chapter.

Step 6: Procurement

Following project design and programming of a highway project, the MassDOT Highway Division releases a Request for Responses (RFR) for the construction of a project, which is also often referred to as being "advertised‟ for construction. MassDOT then reviews the bids and awards the contract to the qualified bidder with the lowest bid.

Step 7: Construction

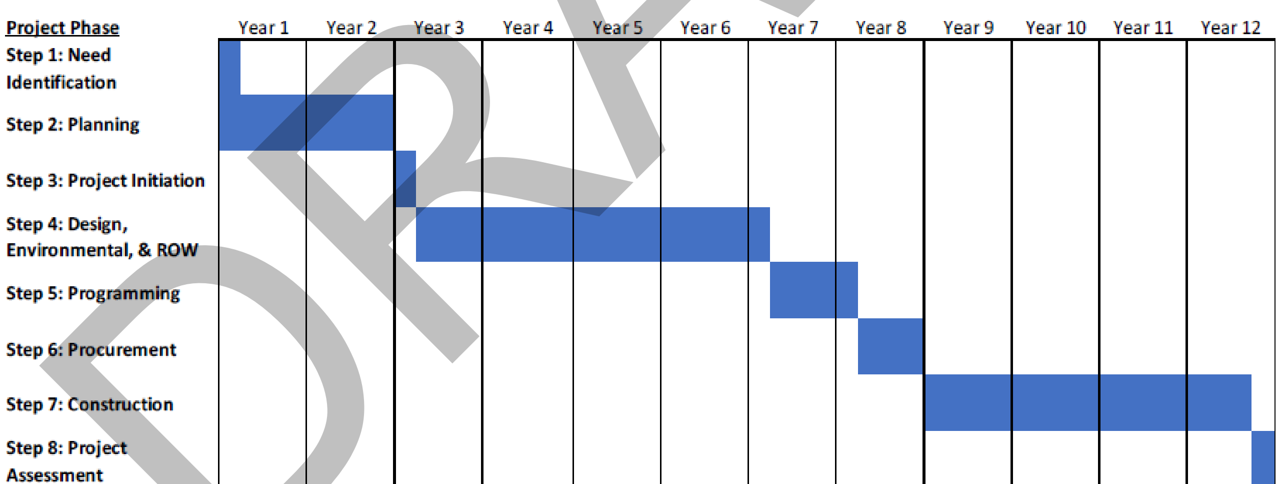
After a construction contract is awarded, MassDOT Highway Division and the contractor develop a public participation plan and a temporary traffic control plan for the construction process. Then construction begins.

Step 8: Project Assessment

The purpose of this step is to receive constituents' comments on the project development process and the project's design elements. MassDOT Highway Division can apply what is learned in this process to future projects.

A project like a new interchange could take over ten years to compete. Each of the above steps require varying amounts of time to complete, which is detailed in Figure 5-1.

Figure 5-1. Example of the Current MassDOT Project Development Process Timeline



5.5 Conclusion

This conceptual planning study has determined that the three interchange alternatives in Otis and Blandford are feasible from a conceptual engineering perspective. However, each alternative is subject to meeting permitting requirements and overcoming financial hurdles. Furthermore, the study's analysis of the three alternatives has resulted in the conclusion that Alternatives 2 and 3 are more viable options, and that Alternative 1 should be dismissed from further consideration.

Potential next steps for the project have been identified in the description of the MassDOT Project Development Process. In order for an interchange project to advance into more detailed design and permitting, the involvement of local and regional stakeholders is essential. The advocacy of residents, state legislators, local officials and planning departments, as well as the two Metropolitan Planning Organizations serving the study area, will be critical to gathering support and securing funding for the project's advancement.