
**Route 114 Long-Term Safety Improvements Planning Study,
From Sylvan Street to Avalon Bay Drive
Danvers and Peabody, Massachusetts**

Final Report

Prepared for:



**Massachusetts Department of Transportation
Office of Transportation Planning**

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Prepared by



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1. Study Process and Framework

1.1 Introduction

This study examines the impacts and benefits of installing either a partial or full median barrier along the Route 114 corridor in the City of Peabody and Town of Danvers to address safety issues related to access management.

Route 114 (Andover Street) is an urban principal arterial under MassDOT jurisdiction that consists of a five-lane cross-section with two travel lanes in each direction divided by a two-way left-turn lane provided along Route 114 from Sylvan Street to Avalon Bay Drive. The posted speed limit is 40 mph in either direction throughout the study area. According to Automatic Traffic Recorder Counts (ATR) from March 2024, the corridor has an Average Daily Traffic (ADT) of 33,768. There are over fifty curb cuts for commercial and residential driveways along the corridor and the corridor serves a high volume of trucks and heavy vehicle traffic. The corridor contains a mix of commercial and residential land uses with nearby schools, parks, and shopping centers. There is a high concentration of vulnerable populations living along the corridor, with approximately half of the population consisting of youth under 18 and older adults over the age of 65.

This study develops and analyzes two long-term corridor reconstruction alternatives – one partial median with left-turn pockets, and one full median with breaks in access for left turns and U-turns. Both alternatives include additional bicycle and pedestrian infrastructure.

1.2 Study Process and Background

In response to a series of two fatal crashes between 2019 and 2021 along the Route 114 corridor, MassDOT, in collaboration with the City of Peabody, Town of Danvers, Representative Tom Walsh's Office, Representative Sally Kerans' Office, and Senator Lovely's Office, conducted a Road Safety Audit (RSA) of Route 114 from Sylvan Street in Peabody to Leblanc Drive in Danvers. The RSA identified several issues, including a need for better access management, concerns with the current two-way center left-turn lane, safety at signalized intersections, and insufficient pedestrian and bicycle infrastructure. The May 2022 RSA, along with a prior RSA completed in 2017, are included in Appendix A.

In October 2022, MassDOT's Highway Division implemented the first tier of improvements using a "quick-build" approach, limited to improvements that do not require any right-of-way impacts, new conduit trenching, or private business access impacts. Major elements included new pavement markings, crosswalks, signage updates, and signal phase timing improvements. The second tier of improvements were installed in 2023 and consisted of flexpost installation to prohibit left turns at select driveways where left turns posed the greatest crash risk. A complete list of Tier 2 improvements is included in Appendix B.

1.3 Study Area

As shown in Figure 1, the study area covers 1.60 miles of the Route 114 corridor, from the Avalon Bay Drive intersection in Danvers to the Sylvan Street/Prospect Street intersection in Peabody. Within this segment, there are seven signalized intersections and numerous local streets and driveways that serve adjacent commercial and residential land uses. Just west of the study area are interchange ramps connecting to Interstate 95 and U.S. Route 1. Approximately 0.5 miles east of the study area, Route 114 intersects with State Route 128 (Yankee Division Highway), which is configured in a cloverleaf style.

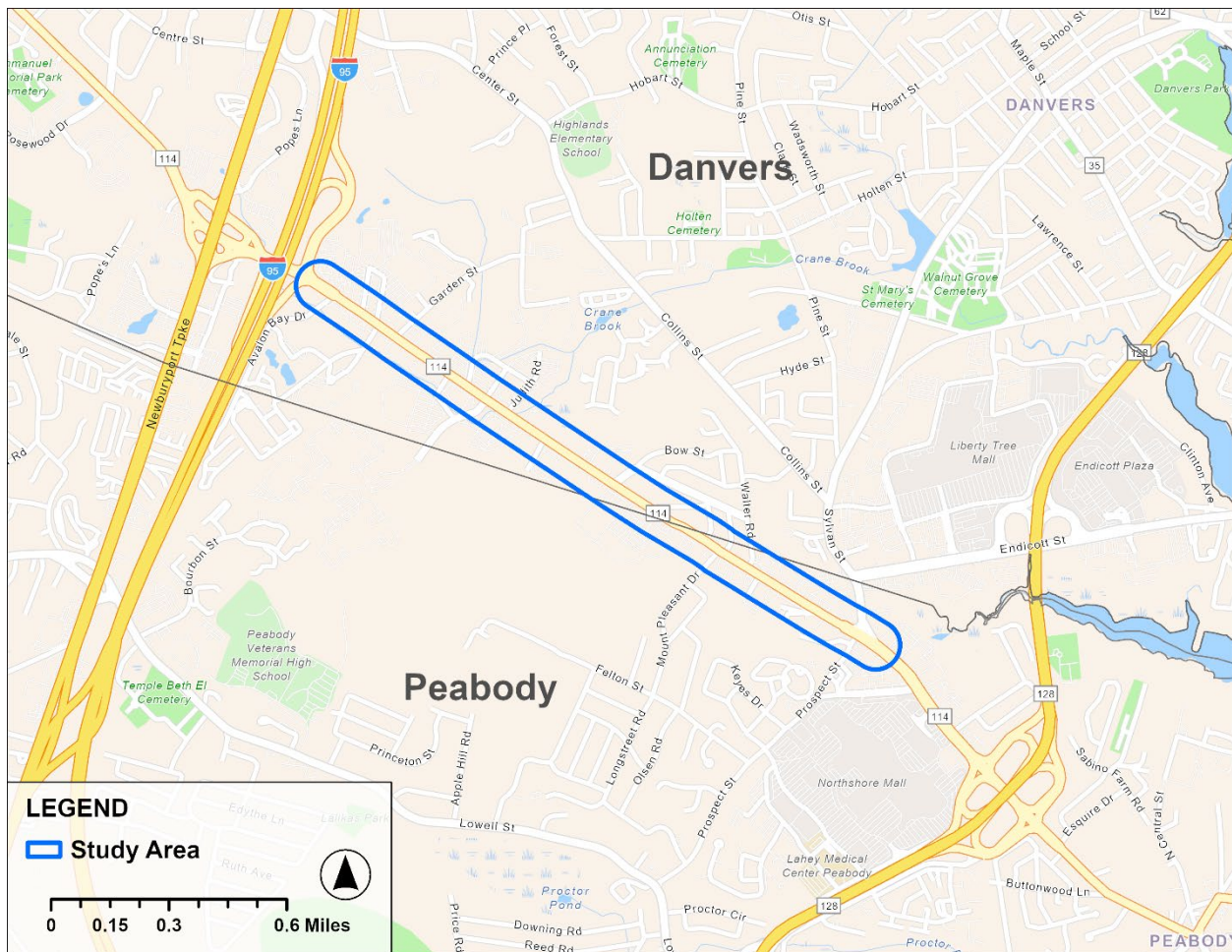


Figure 1. Route 114 Study Area Map

Figure 2 identifies the seven signalized intersections evaluated as part of the operations analysis, including:

- Route 114 at Sylvan Street/Prospect Street
- Route 114 at Palmer Avenue/Peabody Place Driveway
- Route 114 at Brooksby Village Drive

- Andover Street/Route 114 at Walmart Park
- Andover Street/Route 114 at Garden Street
- Andover Street/Route 114 at Lowe's Driveway
- Andover Street/Route 114 at Avalon Bay Drive

While these signalized intersections were the focus of the operational analysis summarized in Figure 2, several unsignalized intersections- including the MacArthur Boulevard intersection- were also reviewed as part of the broader safety and accessibility assessment. These locations are discussed throughout the study in relation to crash history, pedestrian access, and connectivity.

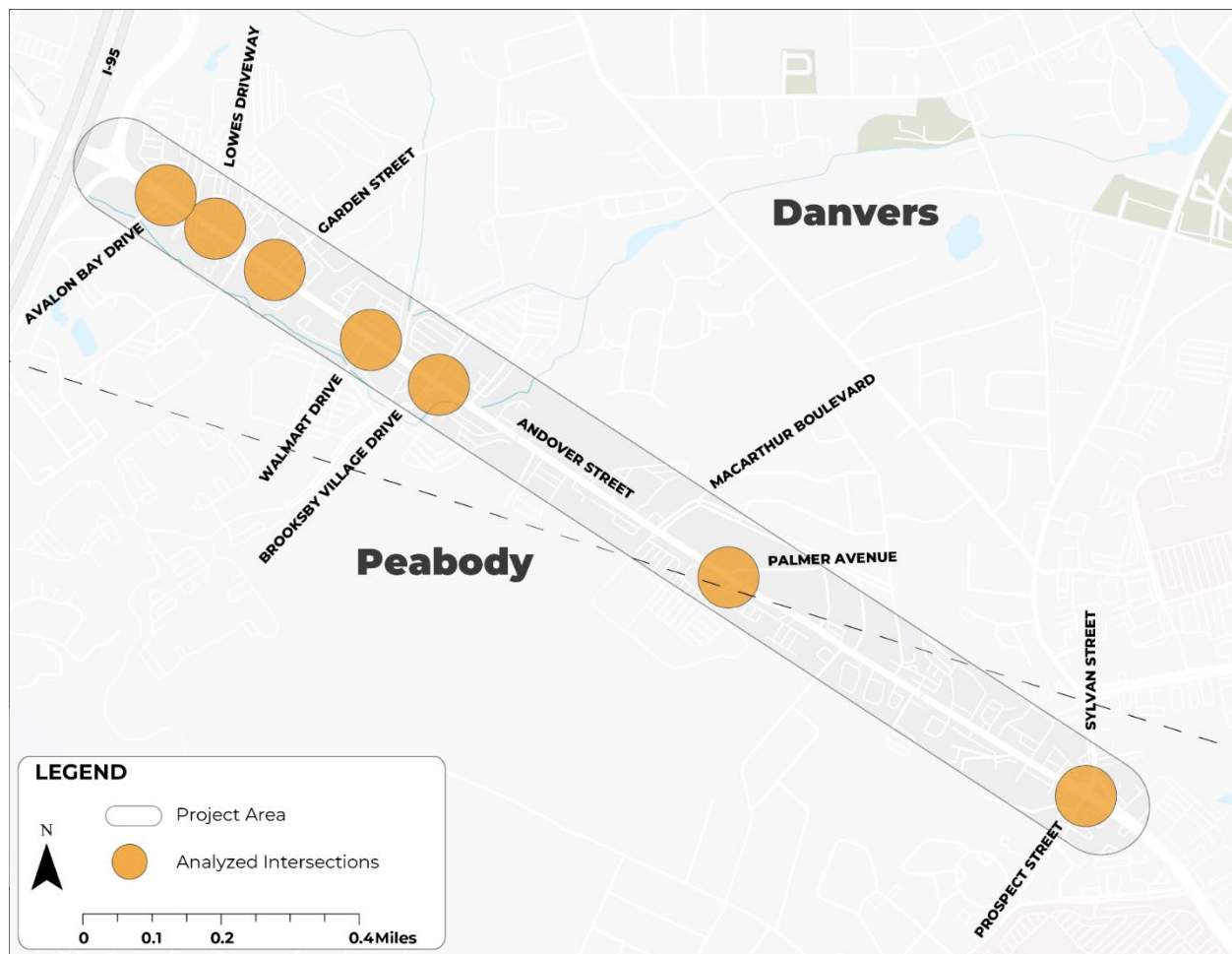


Figure 2. Study Area Intersections

1.4 Study Goals, Objectives, and Evaluation Criteria

Goals and objectives, which define the purpose and guiding principles of the study, were developed in close coordination with a formed group of project stakeholders. Improving

transportation safety conditions in the study area serves as the foundational goal of the study and is supported by several others listed below:

- Improve safety and comfort for all transportation users in the corridor.
- Provide mobility and accessibility for all transportation users.
- Promote economic development and improved quality of life.
- Provide cost effective improvements.
- Avoid or minimize impacts on environmental and other natural resources.
- Support local, regional, and statewide policies.

The evaluation criteria are specific quantitative and qualitative measures used to assess the benefits and impacts of the alternatives developed during the study. The evaluation criteria are directly tied to the study's goals and objectives and are applied in Section 5 – Alternatives. Each criterion is directly derived from either previously developed information or analysis techniques used in the study. By measuring effectiveness against the established goals and objects, the evaluation criteria help identify the best solutions. Table 1 summarizes the objectives and evaluation criteria for each goal.

Table 1: Study-Specific Goals, Objectives, and Evaluation Criteria

Goal	Objectives	Evaluation Criteria
Goal #1: Improve safety and comfort for all transportation users in the corridor.	• Remove or mitigate locations and situations that pose hazards. • Verify that the transportation infrastructure meets current FHWA and MassDOT design standards. • Reduce occurrence of vehicle operations at unsafe speeds.	• High crash corridors/locations (vehicles, bikes, pedestrians). • Severity of crashes. • Types of crashes. • Geometric design review. • High level review of pedestrian and bicyclist level of comfort and stress.
Goal #2: Provide mobility and accessibility for all transportation users.	• Provide and/or improve pedestrian network connectivity. • Provide and/or improve bicycle network connectivity. • Introduce comfortable and safe facilities for vulnerable road users. • Ensure facilities are compliant with ADA design standards. • Minimize vehicle delays and improve regional roadway system reliability.	• Quality, accessibility, and location of pedestrian/bicycle accommodations. • Connectivity between modes. • Connectivity to broader multimodal network. • Geometric design review. • Adherence to accessible design standards. • Average speeds. • Delays/Level of Service.

Goal	Objectives	Evaluation Criteria
Goal #3: Promote economic development and improved quality of life.	- Minimize negative impacts on access to businesses. - Incorporate healthy community design features as defined by the MassDOT Healthy Transportation Policy and the Centers for Disease Control and Prevention (CDC). - Prioritize the needs of environmental justice (EJ) communities.	- Business access route to/from each direction of Route 114. - Business access for trucks and heavy vehicles. - Amount and legibility of wayfinding guidance required. - Potential for everyday biking and walking. - Impacts to residential areas, schools, and community facilities. - Reduce/eliminate barriers to access for identified EJ communities. - Reduce/eliminate harmful transportation impacts.
Goal #4: Provide cost-effective improvements	- Provide supporting evidence for recommended actions. - Minimize project construction costs. - Minimize project operational costs.	- Documentation of analyses and recommendations. - Construction costs per mile. - Operational costs per user.
Goal #5: Avoid or minimize impacts on environmental and other natural resources.	- Avoid impacts on wetlands and other environmentally sensitive areas. - Reduce air emissions and noise. - Reduce Single Occupancy Vehicle (SOV) dependency. - Incorporate design features that reduce urban heat islands and improve flood resilience.	- Impacts to natural environment (Wetlands, habitat, open space, historic areas, conservation areas, others). - Estimated reduction of carbon monoxide (CO) and particulate matter (PM). - Estimated reduction of nitrogen oxides (NOx)/volatile organic compounds (VOC). Transportation mode share. - Extent of landscaped or planted areas. - Tree coverage. - Impermeable surface area.

Goal	Objectives	Evaluation Criteria
Goal #6: Support local, regional, and statewide policies.	- Alignment with the goals, objectives, policies, and strategies outlined in the 2002 Peabody Master Plan. - Support the Danvers 2030 Strategic Plan. - Support regional goals and priorities identified in the MAPC MetroCommon 2050. - Support statewide policies identified in the Massachusetts Strategic Highway Safety Plan, Vulnerable Road User Assessment, and Beyond Mobility related to safety, pedestrian and bicycle network development, public health, freight movement, climate resilience, economic development and other areas.	- Advancement of goals, objectives, policies, and strategies outlined in the 2002 Peabody Master Plan. - Advance the initiatives established in the Danvers 2030 Strategic Plan. - Degree of support for the regional goals and priorities identified in the MAPC MetroCommon 2050. - Degree of support for statewide policies related to safety, pedestrian and bicycle network development, public health, freight movement, climate resilience, economic development and other areas.

1.5 Stakeholder and Public Participation

The study includes a Stakeholder Involvement Plan developed to communicate project information to local and State government officials, project stakeholders, and the general public, while also actively soliciting feedback from these groups. The following meetings were held as part of the public involvement effort:

Table 2: Public Meetings

Meeting	Date	Topics
Legislative Briefing	November 1, 2023	Review scope, study area, goals and objectives, existing conditions, public involvement plan, and next steps.
Outreach to Businesses and Landowners	March 6, 2024	Review implemented short-term improvements, scope, process and milestones, early tasks, and next steps.
Public Involvement Meeting (In-person)	August 1, 2024	Presentation – Project overview, study milestones, existing conditions, preliminary alternatives, next steps, and Q&A
Public Involvement Meeting (Virtual)	November 20, 2024	Presentation – Project overview, study milestones, review alternatives and alternatives analysis, next steps, and Q&A

2. Existing and Future Conditions

2.1 Introduction

This study examines the conditions as they existed in 2024, following the implementation of the low-cost, short-term improvements. The study also contains an analysis of existing traffic operations based on 2024 traffic data, as well as a projection of future traffic data for the year 2034, based on background traffic growth rates and proposed major future developments.

The intersections of Route 114 at Garden Street and Route 114 at Brooksby Village Driveway were each identified as a Highway Safety Improvement Program (HSIP) Cluster within the Metropolitan Area Planning Council (MAPC) and Boston Region Metropolitan Planning Organization (MPO) area from 2018-2020. This indicates that these locations fall within the top 5% of high-crash locations within the region during the given time period. Additionally, from January 2019 to October 2021, a total of two fatal crashes occurred on this segment of Route 114, including one fatal crash that involved a bicyclist.

The purpose of this study is to evaluate the existing roadway and traffic operating conditions along Route 114 within the study area to determine any possible design inadequacies or safety issues for vehicles, pedestrians, and bicyclists. This evaluation of existing conditions will be incorporated into any proposed improvements or concept designs in the future.

2.2 Existing Land Use and Economic Development

This section outlines existing land use and economic development along, and adjacent to, the study corridor. As shown in Figure 3, zoning along Route 114 primarily consists of mixed use, residential, and regional businesses. There are additional residential, commercial, and mixed-use properties located within close proximity to Route 114. Some industrial uses are also scattered near the study area.

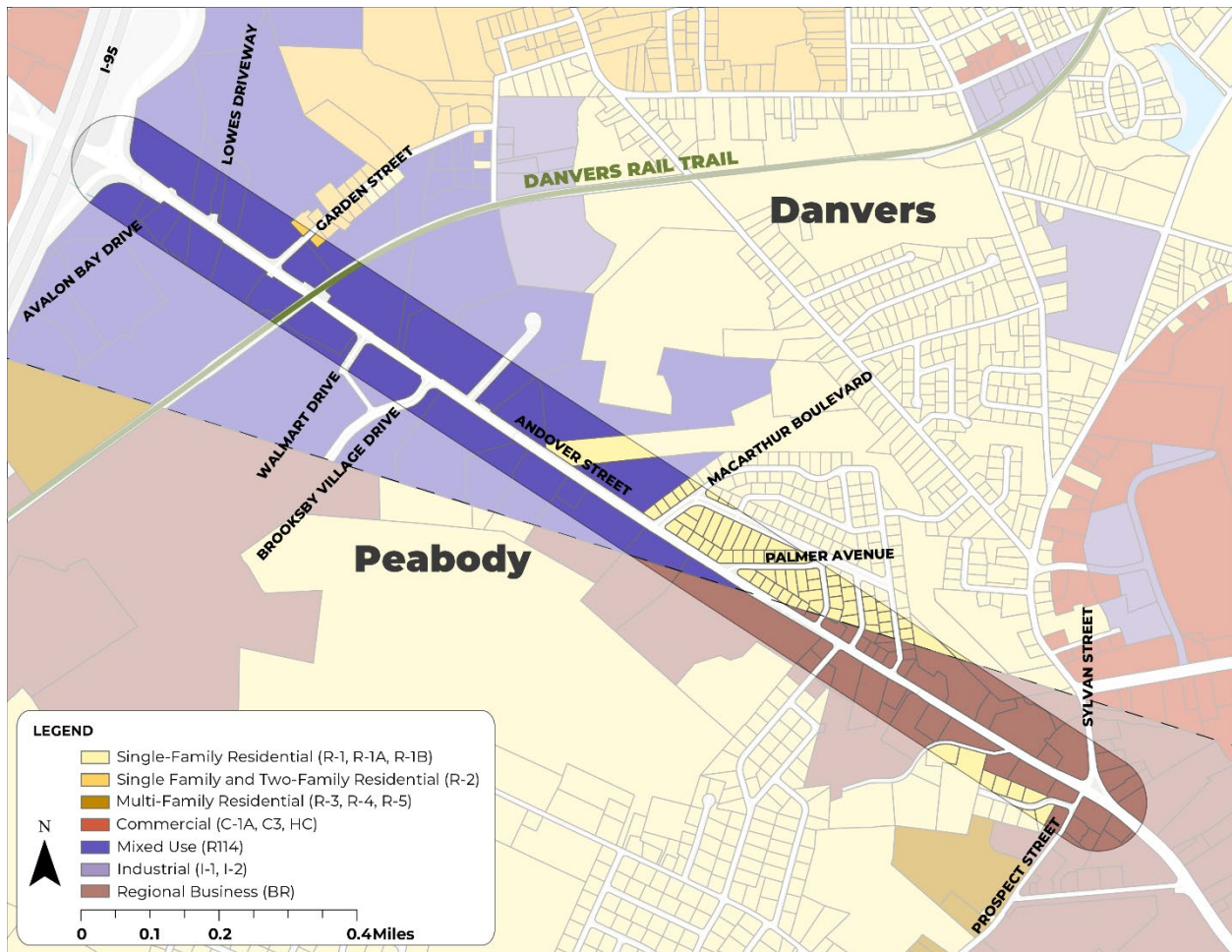


Figure 3. Existing Zoning

There are several proposed developments within the City of Peabody and Town of Danvers, located along or adjacent to Route 114, as summarized below and depicted in Figure 4.

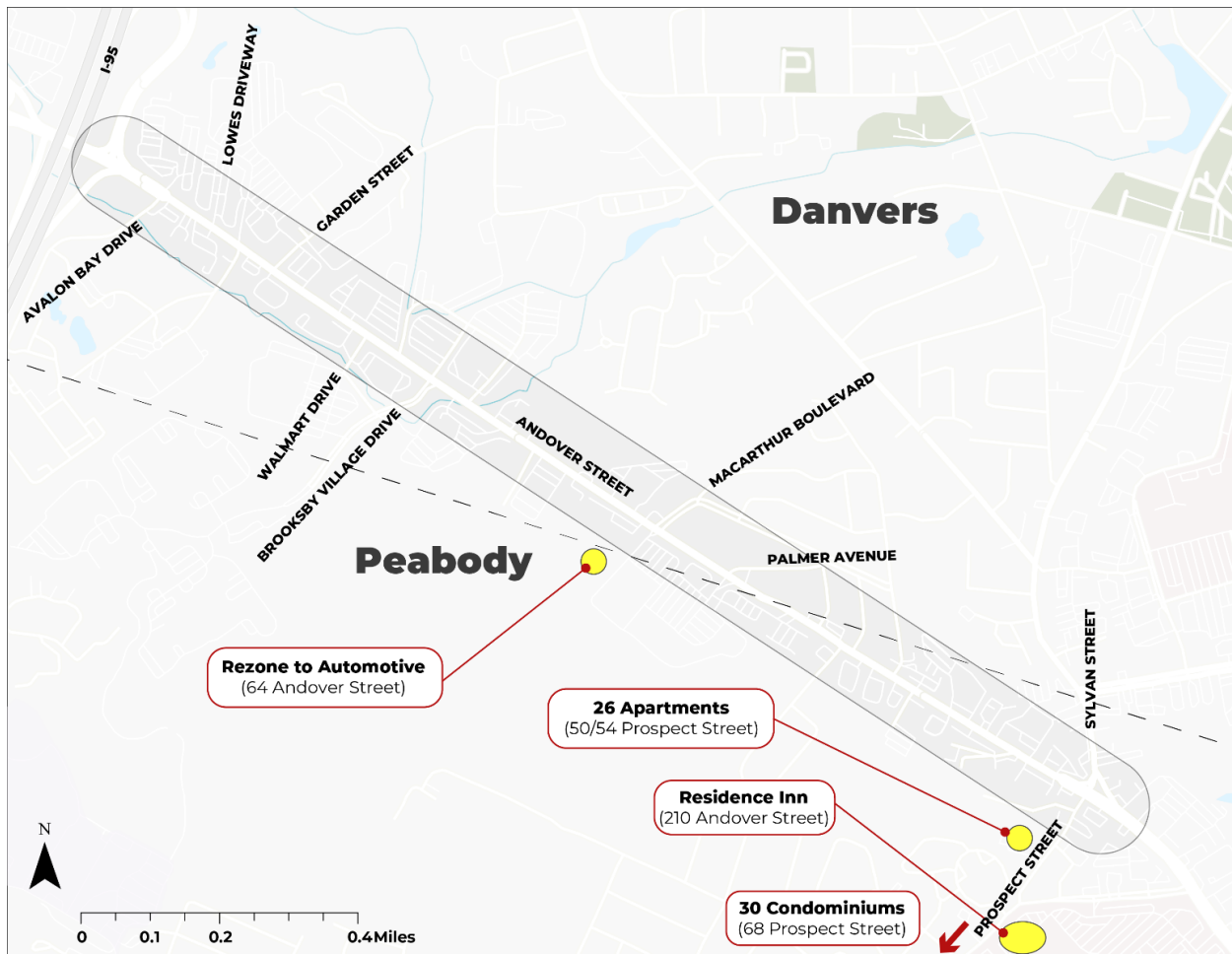


Figure 4. Proposed Developments

Residence Inn at 210 Andover Street: This recently completed development consists of a 142-room hotel with 102 parking spaces on site with additional parking spaces licensed from the North Shore Mall parking lot. The trip generation estimated low activity, with 45 morning peak hour trips, about 50 evening peak hour trips, and approximately 60 Saturday midday peak hour trips. Additionally, there are multiple access points to the site, minimizing overall traffic impacts during critical time periods. Development plans did not indicate a need for capacity improvements at nearby intersections.

Apartment Units at 50 and 54 Prospect Street: This site currently consists of five parcels that are proposed for reconfiguration into two parcels with one occupying the existing residential uses and the second parcel consisting of the proposed apartment units, including 26 two-bedroom apartments occupying up to 56 residents. The proposed apartment will have a mix of garage parking and surface parking spaces totaling 65 parking spaces. The development plans indicate that the project will have minimal impact on the existing adjacent roadway network.

Condominiums at 68 Prospect Street: This site currently consists of the North Shore Magnetic Imaging Center. Development plans propose demolishing the existing building and constructing a 30-unit condominium in five buildings, with each unit having a maximum of two bedrooms. Plans proposed 72 parking spaces. Trip generation estimates that the site will generate 194 vehicle trips per day both entering and exiting the site and is proposed to have minimal impact upon existing traffic conditions.

Automotive Facility at 64 Andover Street: This site currently consists of a flower and garden shop (Kanes' Flower World) and is planned to be used as an automotive site. The City of Peabody and Town of Danvers are reviewing this request.

2.3 Existing Environmental Constraints

In considering environmental constraints, Article 97 and Section 40 protected lands are key considerations for regulated land in the study area. Article 97 of the Amendments to the Massachusetts Constitution protects publicly owned lands used for conservation or recreation purposes. The goal of the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Article 97 Land Disposition Policy (February 19, 1998) is to ensure no net loss of Article 97 lands under the ownership and control of the Commonwealth and its political subdivisions.¹ The Wetlands Protection Act (Massachusetts General Laws Chapter 131, Section 40) protects wetlands and the public interest served by wetlands, requiring a careful review of proposed work that may alter wetlands. The act also applies to areas subject to flooding.²

The study area intersects with Massachusetts Department of Environmental Protection (MassDEP) designated wetlands, rivers, and streams, and Federal Emergency Management Agency (FEMA) floodplains. Several large wetlands, protected open spaces, lakes, rivers and streams are located close to the study area, as depicted in Figure 5. Due to this proximity, these regulations will inform and influence the alternatives development and analysis.

¹ Unless a determination of "exceptional circumstances" is made, including a two-thirds vote of the State Legislature in support of the disposition. [Source: Commonwealth of Massachusetts. Executive Office of Environmental Affairs. Article 97 – Land Disposition Policy. 1998.](#)

² [Mass.gov. Wetlands Protection Program.](#)

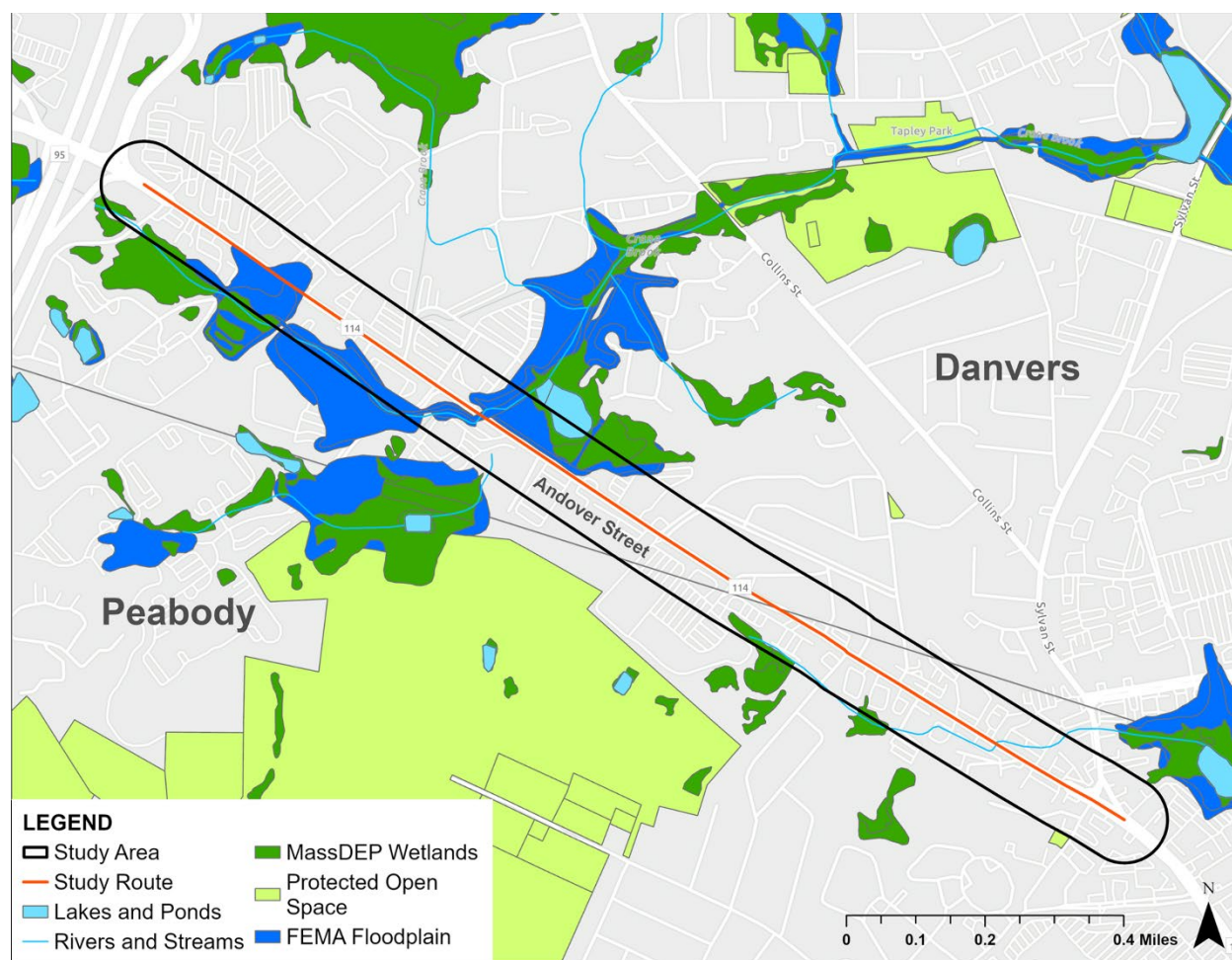


Figure 5. Environmental Constraints in the Study Area

2.4 Existing Roadway and Traffic Conditions

2.4.1 Roadway Characteristics

Detailed descriptions of each of the intersections and roadways contained within the study area are provided in Table 3 and the text below:

Table 3: Existing Roadway Characteristics

Roadway	Jurisdiction	Functional Classification	Speed Limit	Bicycle Facility	Parking
Route 114 (Andover Street)	MassDOT	Urban Principal Arterial	40 MPH	No	No
Sylvan Street	MassDOT	Urban Minor Arterial	35 MPH	No	No
Prospect St	Peabody	Urban Collector	25 MPH	No	No
Palmer Avenue	Danvers	Local Road	N.P.	No	No
Brooksby Village Drive	Danvers	Local Road	N.P.	No	No
Walmart Park	Private	Local	N.P.	No	No
Garden Street	Danvers	Urban Minor Arterial	30 MPH	No	No
Avalon Bay Drive	Private	Local	N.P.	No	No

N.P. = No Posted Limit

Route 114 (Andover Street): Travels east-west across Essex County from Lawrence to Marblehead. Within the study area, Route 114 consists of two travel lanes in each direction. A two-way left-turn lane is provided along Route 114 from Sylvan Street to Avalon Bay Drive. There is a continuous approximately 4-foot-wide sidewalk along the north side of Route 114 within the study area.

Sylvan Street: Runs north-south between Route 114 and Park Street. Within the study area, Sylvan Street has one travel lane in each direction with turning lanes at intersections and driveways. It also has a 2-foot shoulder on both sides of the road. There is a continuous 5-foot-wide sidewalk along both sides of the road within the study area.

Prospect Street: Runs north-south between Lowell Street and Route 114. Within the study area, Prospect Street has one travel lane in each direction. There are no sidewalks along Prospect Street within the study area.

Palmer Avenue: Runs north-south between MacArthur Boulevard and Route 114. Within the study area, Palmer Avenue has one travel lane in each direction. There are no pavement markings to demarcate lanes and there is no posted speed limit. There is a continuous 5-foot-wide sidewalk along both sides of the road within the study area.

Brooksby Village Drive: Runs north-south from Route 114 approximately 0.5 miles south to its terminus at the Brooksby Village Senior Living Facility. Within the study area, Brooksby Village Drive has two travel lanes in each direction. There is a continuous 5-foot-wide sidewalk along both sides of the road within the study area.

Walmart Park: Runs north-south connecting Route 114 to Walmart and other commercial destinations. Walmart Park has one travel lane in each direction with a median separating the travel lanes. There is one sidewalk on the west side of Walmart Park and no marked crosswalk across Walmart Park.

Lowe's Driveway: Runs north-south connecting Route 114 to Lowe's and other commercial destinations. Lowe's Driveway has two travel lanes in each direction. There are no sidewalks on Lowe's Driveway.

Garden Street: Runs north-south from Prince Street to Route 114. Within the study area, Garden Street has one travel lane in each direction and turning lanes at intersections. There are continuous 5-foot-wide sidewalks along both sides of the road as well as a crosswalk at its intersection with Route 114 within the study area.

Avalon Bay Drive: Runs north-south from Popular Place to Route 114. Within the study area, Avalon Bay Drive has one travel lane in each direction; there are no pavement markings to

demarcate lanes or shoulders and there is no posted speed limit. There are no sidewalks alongside Avalon Bay Drive within the study area.

2.4.2 Intersection Characteristics

This section summarizes the seven signalized intersections along the Route 114 study area. Details are summarized in Table 4 and in the text below.

Table 4: Existing Intersection Characteristics

Intersecting Roads with Route 114	Number of Legs	Signalized	Bicycle Facility	Parking
Sylvan Street/Prospect Street	4-way	Yes	No	No
Palmer Avenue/Peabody Place Driveway	4-way	Yes	No	No
Brooksby Village Drive	4-way	Yes	No	No
Walmart Park	3-way	Yes	No	No
Garden Street	4-way	Yes	No	No
Lowe's Driveway	4-way	Yes	No	No
Avalon Bay Drive	4-way	Yes	No	No

Route 114 at Sylvan Street/Prospect Street: There are crosswalks across all approaches except for the Route 114 westbound approach.

- The northbound approach consists of one 12-foot general-purpose lane.
- The southbound approach consists of two 11-foot left-turn lanes, an 11-foot through lane, and one 14-foot right-turn channelized lane.
- The eastbound approach consists of an 11-foot left-turn lane, an 11-foot through lane, and an 11-foot shared right-turn/through lane.
- The westbound approach consists of an 11-foot left-turn lane and two 11-foot through lanes. Right turns are separated from the intersection with a large radius channelized right-turn lane under free control.

Route 114 at Palmer Avenue/Peabody Place Drive: There are crosswalks across the westbound approach on Route 114 and across the southbound approach on Palmer Avenue.

- The northbound approach consists of one 10-foot left-turn lane, one 10-foot left/through shared lane, and one 12-foot channelized right-turn lane.
- The southbound approach (Palmer Avenue) consists of a single, 12-foot, general-purpose lane.
- The eastbound approach consists of an 11-foot left-turn lane, two 11-foot through lanes, and a 12-foot channelized right-turn lane striped with flexposts.
- The westbound approach consists of an 11-foot left-turn lane, an 11-foot through lane, and an 11-foot shared through/right turn lane.

Route 114 at Brooksby Village Drive: There are crosswalks across both eastbound and westbound legs of Route 114 and across the southbound leg of the Private Driveway.

- The northbound approach consists of an 18-foot right-turn-only lane.
- The southbound approach consists of a 12-foot right-turn lane and a shared 12-foot left/through lane.
- The eastbound approach consists of an 11-foot left-turn lane, an 11-foot through lane, and an 11-foot shared through/right turn lane.
- The westbound approach consists of an 11-foot left-turn lane, an 11-foot through lane, and an 11-foot right/through lane.

Route 114 at Walmart Park: Signalized, three-way intersection. There is a marked crosswalk across the eastbound leg of Route 114.

- The northbound approach (Walmart Park) consists of an 11-foot shared right-turn/left-turn lane and an 11-foot left-turn only lane.
- The eastbound approach consists of an 11-foot through lane, and an 11-foot shared through/right-turn lane.
- The westbound approach consists of an 11-foot left-turn lane and two 11-foot through lanes.

Route 114 at Garden Street: There are crosswalks across the southbound leg of Garden Street and the eastbound leg of Route 114.

- The northbound approach consists of a 30-foot general purpose lane. During the field visit it was noted this approach acts as a through/left-turn lane and a right-turn lane.
- The southbound approach consists of a 12-foot right-turn lane and a shared 12-foot left-turn/through lane.
- The eastbound approach consists of an 11-foot left-turn lane, an 11-foot through lane, and an 11-foot shared through/right-turn lane.
- The westbound approach consists of an 11-foot left-turn lane, one 11-foot through lane, and an 11-foot right/through lane.

Route 114 at Lowe's Driveway: There is a marked crosswalk across the southbound approach on Lowe's Driveway.

- The northbound approach consists of a 12-foot right-turn lane and a shared 12-foot left-turn/through lane.
- The southbound approach consists of a 12-foot right-turn lane and a shared 12-foot left-turn/through lane.

- The eastbound approach consists of an 11-foot left-turn lane, an 11-foot through lane and a shared 11-foot right-turn/through lane.
- The westbound approach consists of one 11-foot left-turn lane, one 11-foot through lane and one shared 11-foot right-turn/through lane.

Route 114 at Avalon Bay Drive: There is a marked crosswalk across the southbound approach on Avalon Bay Drive.

- The northbound approach consists of a wide unmarked left/through/right lane. During the field observations it was noted that about half the time the large lane functioned as one left-turn lane and one right-turn lane.
- The southbound approach consists of a 12-foot left-turn lane and a 12-foot right-turn lane.
- The eastbound approach consists of a 12-foot left-turn lane, two 12-foot through lanes and one 12-foot through/right-turn lane.
- The westbound approach consists of an 11-foot left-turn lane, one 11-foot through lane, and an 11-foot shared right-turn lane.

2.4.3 Pedestrian and Bicycle Accommodations

The following section outlines existing bicycle and pedestrian facilities and conditions along Route 114. The findings from this evaluation were then used to determine appropriate future pedestrian and bicycle facilities to improve the safety and comfort for non-automobile transportation users. In summary:

- There are no bicycle accommodations throughout the study corridor.
- A sidewalk is provided on the north side of Route 114, as shown in Figure 6, and no sidewalk is provided on the south side of the corridor.
- The Danvers Rail Trail intersects with Route 114; however, connections to the trail are limited, as shown in Figure 7.
- Sidewalk gaps and insufficient landing pads at pedestrian ramps limit pedestrian accessibility along the corridor, as shown in Figure 8 and Figure 9.
- Crossing opportunities across Route 114 are limited and require crossing many travel lanes, as shown in Figure 10.
- Physical obstructions and barriers, as shown in Figure 11, further narrow the existing sidewalk.
- Traffic counts show pedestrian activity throughout the corridor and at every intersection crossing, which demonstrates a potential for improved pedestrian conditions to invite more pedestrian activity and use along the corridor.

- It is important to note that a bicycle fatality occurred on Route 114 near Willowdale Avenue in 2019.

Providing roadways that are safe, accessible, comfortable, convenient, and well-connected enables communities to experience social, economic, health, and environmental benefits. Walkable and bikeable communities increase mobility options for all and are essential to the mobility of people with physical disabilities, limited mobility, or without access to a vehicle. The lack of safe and comfortable pedestrian and bicycle infrastructure in this area severely limits access within and around the study area. It is particularly restricting for people with limited transportation options who rely on walking or bicycling, such as youth, older adults, or low-income individuals, from accessing essential destinations. Although many large box store and automotive businesses front Route 114 along the study area, the corridor also includes many single-family homes and is surrounded by a variety of other land uses, such as schools, senior living centers, community and sports centers, malls and shopping centers, and parks. These trip generating destinations serve a diverse community of families with young children and older adult populations. The destinations on both sides of Route 114 create demand for crossing opportunities for people walking and biking.

The EEA publishes an EEA Environmental Justice (EJ) Maps Viewer that provides interactive information for areas in the Commonwealth that are identified as EJ Populations based on certain demographic criteria set forth in *An Act Creating a Next Generation Roadmap for MA Climate Policy*. According to the 2020 EJ Maps Viewer, the study area includes two block groups identified as EJ populations (see Table 5). EJ communities have historically faced underinvestment, which emphasizes the need to understand the unique challenges their residents face to provide targeted and effective services. Typically, a low median household income indicates a disproportionate spending on essentials such as transportation and housing, which can strain family budgets and limit access to other important resources and opportunities.

Table 5: Environmental Justice Population Block Group Criteria and Characteristics³

Census Tract	Block Group	EJ Criteria Classification	Minority Population	Median Household Income	Language Isolation
2103.01	2	Income ⁴	9%	\$53,450	2%
2103.02	4	Minority ⁵	33%	\$84,100	0%

According to Table 6, half of the population along the study corridor is over the age of 65 or below the age of 18, a demographic that underscores the importance of safe and accessible infrastructure. The Brooksby Village Senior Living Community located on Brooksby Village Drive has contributed to a significant spike in the older adult population within the study area. In addition, the study area is also characterized by a substantial presence of households without vehicles and individuals with disabilities. The pedestrian amenities on Route 114, as depicted in the images below Table 6, illustrate the current challenges these groups face in navigating the area safely and comfortably.

Table 6: Census Tract Age and Population from 2020 U.S. Census⁶

Census Tract	% Pop. < 18	% Pop. > 65	% Pop. with a Disability	Total Population	% Households with Zero Vehicles	Total Households
2114.02	20.4%	22.0%	9.13%	6,442	3.54%	2,629
2103.02	17.9%	23.7%	9.45%	5,176	4.80%	1,751
2103.01	8.4%	58.1%	41.35%	4,918	35.08%	2,953
Avg. Total %	15.6%	34.6%	18.81%	16,536	16.54%	7,333

³ [2020 Massachusetts Environmental Justice Map Viewer.](#)

⁴ EJ Income classification is defined as the annual median household income is 65 percent or less of the statewide annual median household income.

⁵ EJ Minority classification is defined as minorities make up 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

⁶ [U.S. Census Bureau 2020](#)



Figure 6. Narrow sidewalks without buffer from travel lanes on the north side of Route 114



Figure 7. Demand for access to the Danvers Rail Trail and no connections



Figure 8. Insufficient pedestrian ramp landing pad area



Figure 9. Pedestrian ramp and push button lack connectivity



Figure 10. Long crossing distances across Route 114



Figure 11. Sidewalk obstruction

2.4.3.1. Pedestrian Infrastructure

MassDOT analyzes and maps pedestrian demand using its Potential for Walkable Trips tool, which evaluates the potential demand for pedestrian activity based on access to destinations and proximity to reported pedestrian crashes. The analysis also incorporates social factors such as income, car ownership, minority status, disability, and age to help identify areas where residents may have limited transportation options and could benefit from enhanced pedestrian infrastructure. The 2022 MassDOT analysis for Potential for Walkable Trips indicates that Route 114 within the study area has a medium potential demand for pedestrian activity. This places the corridor within the top 60% of segments in the state with unmet or latent demand for pedestrian activity.⁷

Pedestrian conditions were evaluated using MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan⁸ to document and assess the corridor's existing conditions and determine the level of comfort experienced by people walking. This evaluation considers factors, such as:

- Land use
- Presence, width, and condition of sidewalk
- Sidewalk obstructions
- Sidewalk buffers
- Landscaping, tree canopy, shade
- Connections to destinations and other transportation facilities
- Crosswalks
- Pedestrian crossing delay (Highway Capacity Manual 6th Edition, assuming additional four seconds for effective walk time)
- Pedestrian clearance time (assuming 3.0 feet per second average walking speed for seniors and children)

The following section outlines the existing pedestrian accommodations and resulting qualitative pedestrian level of comfort along Route 114, Sylvan Street, Prospect Street, Palmer Avenue, Brooksby Village Drive, Walmart Park, Garden Street, and Avalon Bay Drive. Additionally, multimodal turning movement counts (TMC) were collected for the weekday evening peak hour on Thursday, March 14, 2024, from 4:15 p.m. to 5:15 p.m. and for the weekend midday peak hour on Saturday, March 16, 2024, from 12:00 p.m. to 1:00 p.m. These multimodal traffic counts

⁷ [Massachusetts geoDOT. Potential for Walkable Trips \(2022 Update\).](#)

⁸ [Massachusetts DOT. Pedestrian Plan: Municipal Resources Guide for Walkability, Massachusetts Pedestrian Transportation Plan.](#)

(pedestrian, bicycle, vehicle, heavy vehicle) are discussed in the following sections to describe pedestrian activity and are further analyzed in section *3.5 Traffic Volumes*.



Figure 12. Sidewalk underneath the Danvers Rail Trail Bridge

Route 114 (Andover Street): Mostly zoned for commercial and industrial development with residential areas north of Route 114 between MacArthur Boulevard and Walter Road. Surrounding land uses include civic spaces, commercial uses, and residential uses of varying density. The sidewalk along the north side of Route 114 is continuous but is punctuated by over 50 curb cuts for residential and commercial driveways along the entire 2-mile corridor. These curb cuts are wide and frequent. The sidewalk is in generally acceptable pavement condition throughout but has an insufficient width of four feet that is often narrowed even further to approximately two to three feet due to utilities poles and overgrown vegetation obstructing the sidewalk. There are no buffers present between the sidewalk and the roadway. There is street lighting provided approximately every 250 feet along the sidewalk. There is limited tree cover

and shade along the study corridor. These conditions are depicted in Figure 12. Pedestrian activity has been observed throughout the corridor, despite the limited accommodations.

There are limited pedestrian connections to access Route 114. Of the intersecting streets within the study area, Sylvan Street, Palmer Avenue, Brooksby Village Drive, and Garden Street have four-foot-wide sidewalks on both sides of the streets connecting to the Route 114 pedestrian network. Prospect Street, Avalon Bay Drive, and Lowe's Driveway have no pedestrian facilities.

The Danvers Rail Trail crosses over Route 114 on a bridge between Garden Street and Brooksby Village Drive, with three limited, informal connections to the corridor, none of which comply with the Americans with Disabilities Act (1990). On the north side of Route 114, there is a set of stairs connecting west of the trail to a paved sidewalk leading to the McDonald's parking lot. On



Figure 13. Connection to Danvers Rail Trail from south side of Route 114

the south side of Route 114, there are two sets of unpaved stairs with no railings on either side of the bridge connecting to dirt paths, as shown in Figure 13. All stair connections are unpaved, informally created, and present desire for a greater connection between the Rail Trail and Route 114.

There are six highly visible crosswalks marked across Route 114, located at:

- Garden Street (west leg)
- Walmart Park (west leg)
- Brooksby Village Drive (east and west legs)
- Parmer Avenue (east leg)
- Sylvan Street/Prospect Street (west leg)

These six marked crosswalks across Route 114 are located at signalized intersections with Accessible Pedestrian Signals (APS). Average pedestrian delay for signalized crossings across Route 114 range from 15.0 seconds to 49.5 seconds, with the longest delays being at Palmer Avenue, Brooksby Village Drive, Walmart Park, and Garden Street intersections, as shown in Table 7. Based on the crossing distance, pedestrian clearance times are insufficient at Palmer Avenue and Garden Street intersections. Pedestrian crossing times are estimated based on a walking speed of 3.0 feet per second.

Table 7: Pedestrian Accommodations at Signalized Intersections along Route 114

Crossing Route 114	Exclusive Ped Phase	Pedestrian Delay	Pedestrian Clearance Times ⁹	Crossing Distance Across Route 114
Garden Street	Yes	34.6-49.5 sec	26	90 feet
Walmart Park	Yes	34.6-49.5 sec	27	65 feet
Brooksby Village Drive (east and west legs)	Yes	34.6-49.5 sec	24	70 feet
Palmer Avenue (east leg)	Yes	32.2-49.5 sec	23	80 feet
Sylvan Street/Prospect Street (west leg) ¹⁰	No ¹¹	15.0-18.2 sec	25	75 feet

Pedestrian conditions on Route 114 are highly uncomfortable based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan. Contributing factors include the insufficient sidewalk width, lack of buffer, lack of shade, and multiple driveway curb cuts on the north side; lack of sidewalk presence on the south side; infrequent crossing opportunities across Route 114; insufficient crossing times and long delays at signalized crossings across Route 114; and limited access to the Danvers Rail Trail from Route 114.¹²

Avalon Bay Drive: Zoned for commercial and industrial land uses and connects to residential apartment complexes and a mobile home park. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹³ pedestrian conditions along Avalon Bay Drive within the study area are highly uncomfortable and inaccessible, due to the lack of pedestrian facilities, the insufficient crossing time at the Route 114 / Avalon Bay Drive intersection, the long pedestrian delay, and the lack of marked crossing where pedestrians are crossing.

There are no sidewalks provided along Avalon Bay Drive near Route 114, and no marked crossings across Route 114 at the intersection. There is one marked crossing across Avalon Bay Drive, approximately 60 feet long with detectable warning surfaces, APS, concurrent pedestrian phasing, and pedestrian signal heads. However, pedestrian clearance time is 19 seconds, which is insufficient for all potential users who need 20 seconds to cross safely. Average pedestrian delay at this intersection is 34.6 seconds during 6:00 a.m. – 10:00 a.m. Monday through Friday,

⁹ Based on an estimated walking speed of 3.0 feet per second.

¹⁰ Lowe's Driveway intersection and Avalon Bay Drive intersection are signalized but do not include pedestrian accommodations.

¹¹ Protected crossing.

¹² [Massachusetts DOT. Pedestrian Plan: Municipal Resources Guide for Walkability, Massachusetts Pedestrian Transportation Plan.](#)

¹³ Ibid.

49.5 seconds during 3:00 p.m. – 7:00 p.m. Monday through Friday, 34.6 seconds during 12:00 p.m. – 4:00 p.m. on Saturday, and 49.5 seconds at all other times.

Observed pedestrian activity highlights the need for better accommodations. During the weekday evening peak hour, three pedestrians were counted crossing the crosswalk on the southbound leg of Avalon Bay Drive. During the Saturday midday peak hour, one pedestrian was counted crossing the northbound leg of Avalon Bay Drive where there is currently no marked crosswalk.

Lowe's Driveway: Zoned for a mix of commercial and industrial land uses and connects with businesses. Lowe's Driveway within the study area are highly uncomfortable and inaccessible as there are no sidewalks along Lowe's Driveway, no detectable warning surfaces at the crosswalk across Lowe's Driveway, and the pedestrian clearance time is insufficient for all potential users to cross safely.

There are no sidewalks provided along the Lowe's Driveway near Route 114. There is one marked crosswalk across from the Lowe's Driveway that is about seventy-five feet long with no detectable warning surfaces. However, APS and pedestrian signal heads are provided, with concurrent pedestrian phasing. Average pedestrian delay is 34.6 seconds during 6:00 a.m. – 10:00 a.m. Monday through Friday, 49.5 seconds during 3:00 p.m. – 7:00 p.m. Monday through Friday, 34.6 seconds during 12:00 p.m. – 4:00 p.m. on Saturday, and 49.5 seconds at all other times. Pedestrian clearance time is 23 seconds, which is insufficient for all potential users who need up to 25 seconds to cross. There are no marked crossings across Route 114 at the Lowe's Driveway intersection.

Observed pedestrian activity highlights the need for better accommodations. According to the multimodal traffic data collected for this effort, during the weekday evening peak hour, four pedestrians were counted crossing the crosswalk on the southbound leg of Lowe's Driveway. During the Saturday midday peak hour, there were no pedestrian counts. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁴ pedestrian conditions along Lowe's Driveway within the study area are highly uncomfortable and inaccessible as there are no sidewalks along Lowe's Driveway, no detectable warning surfaces at the crosswalk across Lowe's Driveway, and the pedestrian clearance time is insufficient for all potential users to cross safely.

Garden Street: Zoned for a mix of commercial and residential land uses with both businesses and single-family homes fronting the street. Based on the criteria outlined in MassDOT's

¹⁴ Massachusetts DOT. Pedestrian Plan: Municipal Resources Guide for Walkability, Massachusetts Pedestrian Transportation Plan. <https://www.mass.gov/info-details/pedestrian-plan>

Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁵ pedestrian conditions along Garden Street within the study area are generally uncomfortable, inaccessible, and insufficient, due to long crossing distances, insufficient crossing times, and lack of pedestrian facility connectivity.

There are 5-foot sidewalks along both sides of the road that are in good condition. The west sidewalk ends after the driveway entrance to Olive Garden, but the east sidewalk continues. General overgrowth and utility poles obstruct the sidewalk, narrowing usable width to about two feet in areas. Street lighting is provided approximately every 100 feet and there are no landscape buffers along Garden Street from Route 114 to Emanon Street. There is some tree canopy and shade along the east sidewalk. There is a 3-foot-wide landscape buffer between the sidewalk and the roadway starting north of Emanon Street.

There is one marked crosswalk across Garden Street that is about seventy-five feet long with detectable warning surfaces, APS, exclusive pedestrian phasing, and pedestrian signal heads. Average pedestrian delay is 34.6 seconds during 6:00 a.m. – 10:00 a.m. Monday through Friday, 49.5 seconds during 3:00 p.m. – 7:00 p.m. Monday through Friday, 34.6 seconds during 12:00 p.m. – 4:00 p.m. on Saturday, and 49.5 seconds at all other times. Pedestrian clearance time is 26 seconds which is sufficient for users with an assumed walking speed of 3.0 feet per second who need 25 seconds to cross.

There is one marked crosswalk across Route 114 about ninety feet long that has detectable warning surfaces, APS, and pedestrian signal heads but does not connect to any pedestrian facilities on the south side of Route 114. Average pedestrian delay is 34.6 seconds during 6:00 a.m. - 10:00 a.m. Monday through Friday, 49.5 seconds during 3:00 p.m. - 7:00 p.m. Monday through Friday, 34.6 seconds during 12:00 p.m. - 4:00 p.m. on Saturday, and 49.5 seconds at all other times. Pedestrian clearance time is 26 seconds which is insufficient for users with an assumed walking speed of 3.0 feet per second who need 30 seconds to cross.

During the weekday evening peak hour, five pedestrians were counted crossing the southbound leg of Garden Street and one pedestrian counted crossing the westbound leg of Route 114. During the Saturday midday peak hour, there were two pedestrians counted crossing the southbound leg of Garden Street and two pedestrians counted crossing the northbound leg of the parking lot driveway entrance.

Walmart Park: Zoned for commercial and industrial development and currently serves large, auto-oriented businesses fronting Route 114. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁶

¹⁵ Ibid

¹⁶ Ibid

pedestrian conditions along Walmart Park are acceptable, but do not meet accessibility standards. Connections to the broader pedestrian network could also be improved.

There is a 5-foot-wide sidewalk along the west of the road connecting to a crosswalk across Route 114. The sidewalk is in good condition with no obstructions, ample street lighting provided approximately every 100 feet, and no landscape buffer. There is no sidewalk on the east side of the street. There is one marked crosswalk across Route 114 on the west side of Walmart Park that is approximately 65 feet long with detectable warning surfaces, APS, exclusive pedestrian phasing, and pedestrian signal heads. Average pedestrian delay is 34.6 seconds during 6:00 a.m. - 10:00 a.m. Monday through Friday, 49.5 seconds during 3:00 p.m. - 7:00 p.m. Monday through Friday, 34.6 seconds during 12:00 p.m. - 4:00 p.m. on Saturday, and 49.5 seconds at all other times. Pedestrian clearance time is 27 seconds which is sufficient for users with an assumed walking speed of 3.0 feet per second who need 21.7 seconds to cross. During the weekday evening peak hour, one pedestrian crossed the eastbound leg crosswalk across Route 114. During the Saturday midday peak hour, there were no pedestrians counted.

Palmer Avenue: Zoned for low-density residential land uses and connects to a neighborhood of single-family homes. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁷ pedestrian conditions along Palmer Avenue within the study area are acceptable, but do not meet accessibility standards. Crossings are long and pedestrian phases are insufficiently timed. Connections to the broader pedestrian network could also be improved.



Figure 14. Long crosswalk facing westbound across Palmer Avenue

There are 4-foot-wide sidewalks along both sides of the road connecting to Route 114. The sidewalk is generally in fair to poor condition with many driveway curb cuts and obstructions from tree roots and overgrowth. There is street lighting provided approximately every 150 feet. There is a 4-foot-wide landscape buffer between the sidewalk and the roadway and moderate tree canopy, or shade provided. There is a marked crosswalk across Palmer Avenue detectable warning surfaces, APS, pedestrian signal heads, and an exclusive pedestrian phase. The distance across Palmer Avenue is approximately 135 feet, as shown in Figure 14. Average

¹⁷ Ibid



Figure 15. Pedestrian connection gap on south side of Route 114 at Palmer Avenue crosswalk

pedestrian delay is 34.6 seconds during 6:00 a.m. - 10:00 a.m. Monday through Friday, 44.6 seconds during 3:00 p.m. - 7:00 p.m. Monday through Friday, 49.5 seconds during 12:00 p.m. - 4:00 p.m. on Saturday, and 32.2 seconds at all other times. Pedestrian clearance time is 23 seconds which is insufficient for users with an assumed walking speed of 3.0 feet per second who need 26.7 seconds to cross Route 114 and need 45 seconds to cross Palmer Avenue. The high visibility crosswalk across Route 114 at Palmer Avenue is approximately 80 feet long and has detectable warning surfaces, APS, and pedestrian signal heads, but does not connect to any facilities on the south side of Route 114, as shown in Figure 15.

During the weekday evening peak hour, two pedestrians counted crossing the westbound leg of Route 114. During the Saturday midday peak hour, there was one pedestrian counted crossing the southbound leg of Palmer Avenue.

Brooksby Village Drive: Zoned for commercial and industrial development and currently serves large, auto-oriented businesses fronting Route 114. Brooksby Village Drive connects to the Brooksby Village Senior Living Community, south of Route 114. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁸ pedestrian conditions along Brooksby Village Drive within the study area are generally comfortable, accessible, and well-maintained, but crossings and connections to the broader pedestrian network could be improved, especially to serve the large older population.

There are 5-foot-wide sidewalks along both sides of the road connecting to Route 114. The sidewalks are in good condition with no obstructions, ample street lighting provided ever approximately every 100 feet, and 8- to 10-foot-wide landscape buffers between the sidewalk and the roadway. There is a consistent tree canopy and shade provided along Brooksby Village Drive. The sidewalks end at the corners of the intersection with Route 114 but connect across Route 114 to access the north sidewalk.

¹⁸ Ibid

There are two marked crosswalks across Route 114 on the east and west legs of the intersection that are both approximately seventy feet long. There is one marked crosswalk marked across the IRA Dealership Driveway (north leg) at the signalized intersection that is approximately sixty feet long. These crossings all have detectable warning surfaces, APS, pedestrian signal heads, and exclusive pedestrian phases. There is no marked crossing across Brooksby Village Drive (south leg), as shown in Figure 16. Average pedestrian delay is 34.6 seconds during 6:00 a.m. - 10:00 a.m. Monday through Friday, 49.5 seconds during 3:00 p.m. - 7:00 p.m. Monday through Friday 34.6 seconds during 12:00 p.m. - 4:00 p.m. on Saturday, and 49.5 seconds at all other times. Pedestrian clearance time is 24 seconds which is sufficient for users with an assumed walking speed of 3.0 feet per second who need 23.3 seconds to cross.



Figure 16. Lack of marking crossing across Brooksby Village Drive

During the weekday evening peak hour, two pedestrians crossed the southbound leg of Brooksby Village Drive. During the Saturday midday peak hour, there was one pedestrian counted crossing the eastbound leg of Route 114.

Sylvan Street: Zoned for commercial development and gives access to a mix of restaurants, clinics, and small stores. Sylvan Street connects further out into single-family home residential neighborhoods and mixed commercial land uses with connections to destinations such as the Liberty Tree Mall and Endicott Square Shopping Center. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,¹⁹ pedestrian conditions along Sylvan Street within the study area are generally uncomfortable, inaccessible, and insufficient by MassDOT engineering standards. Connections to the broader pedestrian network could also be improved.



Figure 17. Raised crosswalk across Sylvan Street

There are 4-foot-wide sidewalks along both sides of Sylvan Street connecting to Route 114. The sidewalk is interrupted by wide curb cuts and is in generally poor pavement condition. There

¹⁹ Ibid

are no buffers present between the sidewalk and the roadway and there is limited tree canopy and shade. There is street lighting provided approximately every 100 feet on the east sidewalk. The street light poles obstruct the sidewalk and narrow the usable width to approximately two feet wide. The sidewalks on Sylvan Street connect to the sidewalk along Route 114 and connect users to two MBTA bus stops at 10 Sylvan Street.

Crosswalks are provided at each leg across Sylvan Street. A recent raised crosswalk and pedestrian crossing signage was installed across the northbound right channelized lane on Sylvan Street (traveling westbound on Andover Street), as shown in Figure 17.

The total crossing distance across Sylvan Street is approximately 250 feet, including medians, with about one hundred feet of exposed crossing. The intersection includes APS and pedestrian signal heads. Pedestrian clearance time across Sylvan Street is 27 seconds, which is sufficient for users with an assumed pedestrian walking speed of 3.0 feet per second, requiring twenty-four seconds to cross. Pedestrian clearance time crossing north or south across Route 114 is 25 seconds, which is sufficient for users of all ages and abilities at an assumed speed of 3.0 feet per second who need 25 seconds to cross.

During the weekday evening peak hour, one pedestrian crossed the southbound leg of Sylvan Street, and two pedestrians crossed the eastbound leg of Route 114. During the Saturday midday peak hour, seven pedestrians were counted crossing the southbound leg of Sylvan Street.

Prospect Street: Zoned for commercial development and connects further out to residential neighborhoods and destinations like the Northshore Mall. Based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan,²⁰ pedestrian conditions along Prospect Street within the study area are highly uncomfortable, inaccessible, and insufficient.

There is a 4-foot-wide sidewalk on the east side that ends at Emery Street and is in poor condition with severe overgrowth obstructing the sidewalk. A pole-mounted signal at the intersection of Route 114 also obstructs the sidewalk and narrows the usable width to two feet. There is street lighting along Prospect Street. There are no buffers present between the sidewalk and the roadway and limited tree canopy or shade. The sidewalk ends at the corner of the intersection and connects to the north sidewalk on Route 114 with a high visibility crosswalk across Route 114.

The marked crossing across Prospect Street includes detectable warning surfaces, APS, and pedestrian signal heads. The pedestrian crossing distance is approximately thirty feet long. Average pedestrian delay is 15.6 seconds during 6:00 a.m. - 10:00 a.m. Monday through Friday,

²⁰ Ibid

15.0 seconds during 3:00 p.m. - 7:00 p.m. Monday through Friday, and 11.7 seconds at all other times. Pedestrian clearance time is 16 seconds, which is sufficient for users who need 10 seconds to cross, based on the 3.0 feet per second assumed speed.

During the weekday evening peak hour, one pedestrian crossed the northbound leg of Prospect Street.

Summary: The current pedestrian conditions along Route 114 from Avalon Bay Drive to Sylvan Street are highly uncomfortable and inaccessible based on the criteria outlined in MassDOT's Municipal Resource Guide for Walkability and MassDOT's Pedestrian Transportation Plan.²¹ Additionally, pedestrian conditions do not meet the standards specified in MassDOT Engineering Directive E-20-001. According to the directive, pedestrian facilities should be provided on both sides of the roadway and sidewalk widths should be at least five feet. Marked crosswalks should be provided across every signalized intersection where sidewalks are present or proposed. Marked crosswalks should also be maintained anywhere an existing crosswalk is located regardless of sidewalk presence.

2.4.3.2. Bicycle Infrastructure

MassDOT analyzes the 2022 Potential for Everyday Biking to predict where people are reasonably expected to bike for everyday travel and if safe, comfortable, and convenient bikeways are available. The analysis considers both trip distance and social conditions when determining the potential for everyday biking. The methodology also considers social factors related to income, vehicle ownership, English proficiency, minority status, disability status, and age to indicate where there may be concentrations of people with limited transportation options. The analysis indicates that Route 114 within the study area has a medium potential demand for biking activity. This indicates that Route 114 segments within the study area are in the top 60% of segments in the state with latent demand for biking activity.²²

Bicycle conditions were evaluated using MassDOT's Separated Bike Lane Planning and Design Guide²³ to document and review the corridor's existing conditions and determine the level of comfort and level of stress experienced by people biking, including factors such as:

- Presence and type of bicycle facilities
- Posted speed limit
- Number of travel lanes
- Existing traffic volumes

²¹ Ibid

²² Ibid

²³ [MassDOT Separated Bike Lane Planning & Design Guide: Chapter 2, Planning](#)

- Curbside conflicts
- Percentage of trucks and buses
- Vulnerable populations (children and seniors)
- Low-stress network connectivity gaps (connection to Danvers Rail Trail)
- Land uses

The corridor contains a mix of commercial and residential land uses with nearby schools, parks, and shopping centers. As noted in Table 7 (Section **2.5.3.1 Pedestrian Accommodations**), there is a high concentration of vulnerable populations living along the corridor, with approximately half of the population consisting of youth under 18 and seniors over the age of 65.

Based on the criteria outlined in MassDOT's Separated Bike Lane Planning and Design Guide,²⁴ bicycle conditions along Route 114 within the study area are highly uncomfortable for most users. This is primarily due to roadway characteristics, surrounding land uses, and lack of bicycle infrastructure along Route 114. Currently, Route 114 has no bicycle facilities, requiring people who are biking to either ride on the road with mixed traffic or along the narrow sidewalk on the north side of Route 114. There are also no bicycle facilities on roads intersecting with Route 114 along the study corridor, aside from the Danvers Rail Trail. However, connections to the trail are informal and disconnected, as shown in Figure 18.

Despite the lack of bicycle facilities, multimodal traffic data collected for the study area during May of 2024 demonstrate clear demand, as seven bicyclists were counted riding in the roadway and two bicyclists were counted riding in crosswalks and on pedestrian facilities.

The current conditions along Route 114 from Avalon Bay Drive to Sylvan Street do not meet the standards specified in MassDOT's Engineering Directive E-20-001. According to the directive, as Route 114 is in an urbanized area and has a posted speed limit greater than 40 miles per hour, volumes greater than 10,000 vehicles per day, and more than one travel lane in a single direction, the requirements for bicycle facilities of this engineering directive apply. Bicycle facilities should provide service for each direction of travel along the roadway and should maintain minimum widths of ten



Figure 18. Connection to Danvers Rail Trail from McDonald's parking lot on north side of Route 114

²⁴ [MassDOT Separated Bike Lane Planning & Design Guide: Chapter 2, Planning](#)

feet for a shared-use path or side path, eight to ten feet for a two-way separated bike lane, and five feet for a one-way separated bike lane, buffered bike lane, bike lane, or shoulder.

2.4.3.3. Pedestrian and Bicycle Issues and Opportunities

Based on the existing conditions review, the team identified key issues and opportunities for people biking and walking along and adjacent to Route 114. The issues and opportunities are depicted in Figure 19. Key opportunities include improving connectivity and access at key locations to improve the pedestrian and biking experience for vulnerable populations. Additionally, there are opportunities to connect to multimodal facilities, including the Danvers Rail Trail and MBTA bus service along Sylvan Street.

Key issues include missing connections, lack of bicycle infrastructure, minimal pedestrian infrastructure, and limited connectivity across Route 114. These issues and opportunities will be further explored and addressed in the development of recommendations.

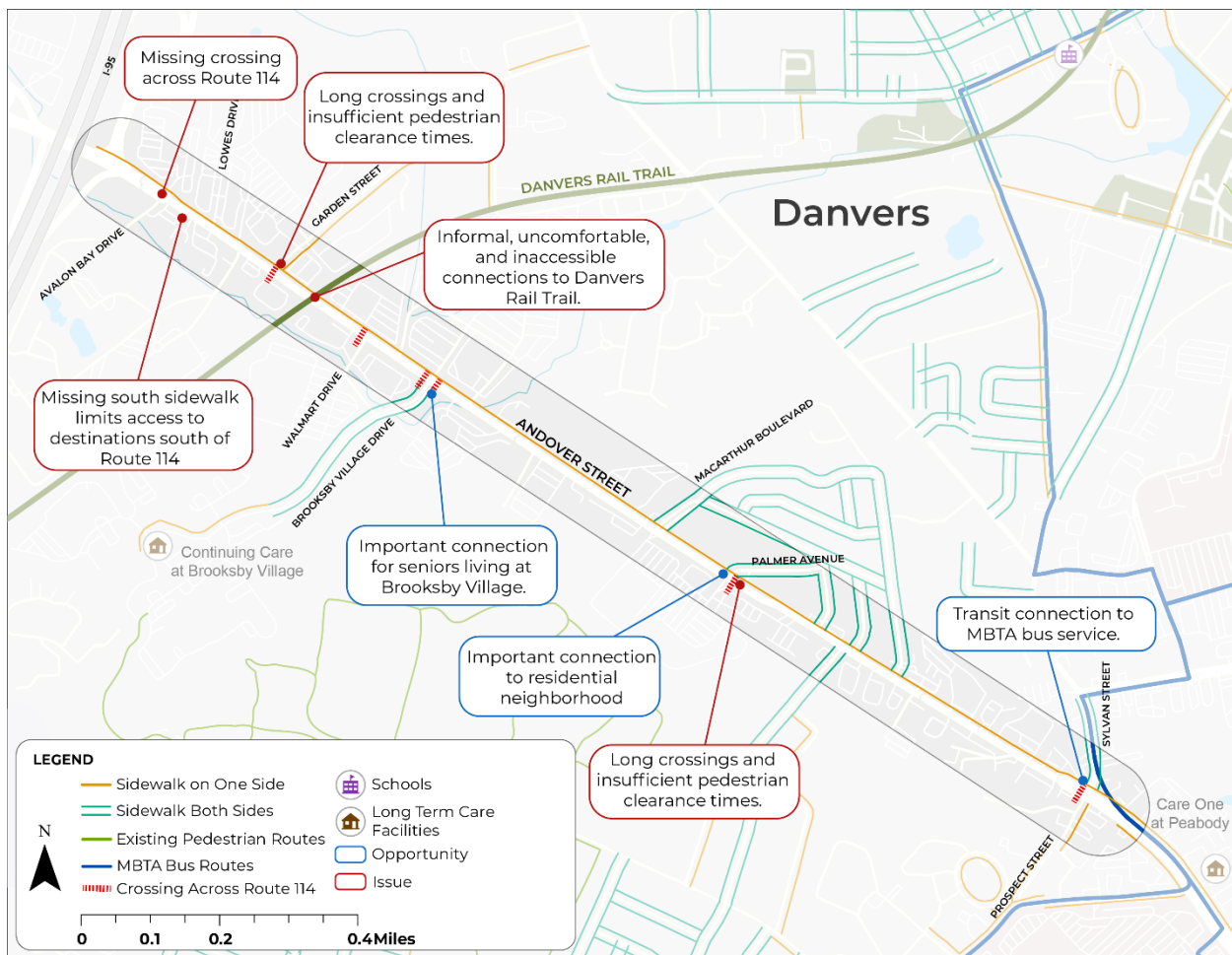


Figure 19. Bicycle and Pedestrian Issues and Opportunities

2.4.4 Transit

The Massachusetts Bay Transit Authority (MBTA) bus routes 435 and 436 travel through the eastern edge of the study area. The MBTA bus 435 travels from Central Square in Lynn to the Salem Depot MBTA Commuter Rail Station. The MBTA 436 bus travels from Central Square in Lynn to the Liberty Tree Mall in Danvers. In the vicinity of the study area, both bus routes stop at the North Shore Mall, then travel west on Route 114 to Sylvan Street where they continue north out of the study area. Both bus routes stop on Sylvan Street just north of Route 114, at 10 Sylvan Street, in both the northbound and southbound directions. Both bus routes have a maximum frequency of six minutes.

The Massachusetts Port Authority (MassPort) also operates a Logan Express shuttle from the North Shore Mall on Prospect Street, at the eastern edge of the study area, to Logan International Airport in Boston. Shuttle buses run once an hour from 3:15 a.m. – 10:15 p.m. seven days a week.

2.4.5 Traffic Volumes

Automatic Traffic Recorder Counts (ATR) were conducted from Monday, March 11, 2024, at 12:00 p.m. to Friday, March 15, 2024, at 12:00 p.m. ATR counts were collected for volume, speed, and vehicle classification data on Route 114 in both the eastbound and westbound directions. It should be noted that the speed and vehicle classification data was only able to capture data for the right-hand, outermost lanes in either direction. ATRs were collected at the following four locations:

- Route 114, west of Mt. Pleasant Street
- Route 114, west of 79 Andover Street
- Route 114, west of 120 Andover Street
- Route 114, west of 158 Andover Street

The traffic data collected by the ATRs are summarized in Table 8. The hourly volume trends for the ATR traffic data are shown in Figure 20 through Figure 23.

Table 8: ATR Data Summary (2024)

Location	ADT	A.M. Peak	P.M. Peak
Route 114, west of Mt. Pleasant Street	31,567	1,781	2,467
<i>Eastbound</i>	15,142	805	1,165
<i>Westbound</i>	16,432	976	1,294
Route 114, west of 79 Andover Street	31,828	1,890	2,531
<i>Eastbound</i>	14,982	852	1,194
<i>Westbound</i>	17,139	1,039	1,337
Route 114, west of 120 Andover Street	34,438	2,078	2,805
<i>Eastbound</i>	16,375	1,163	1,270
<i>Westbound</i>	18,070	916	1,535
Route 114, west of 158 Andover Street	37,240	2,261	3,100
<i>Eastbound</i>	17,786	1,283	1,385
<i>Westbound</i>	19,782	978	1,715

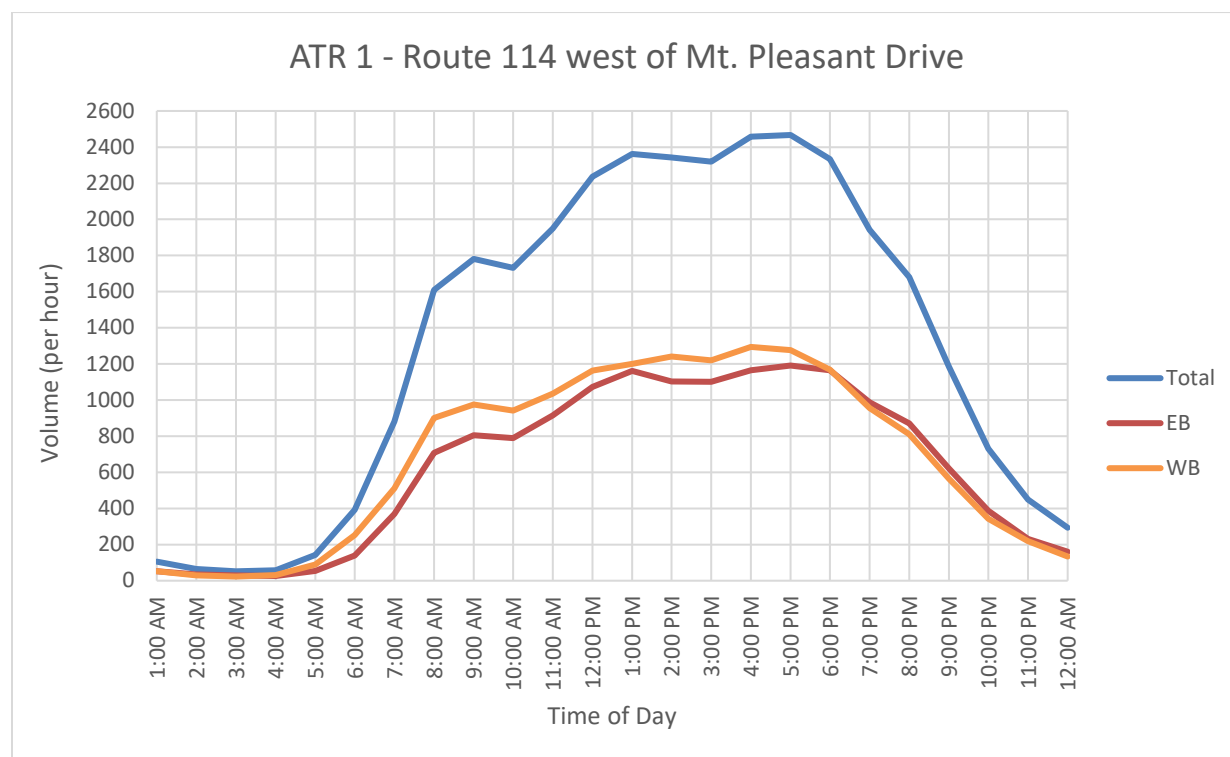


Figure 20. Daily Traffic Volumes (Route 114, west of Mt. Pleasant Drive)

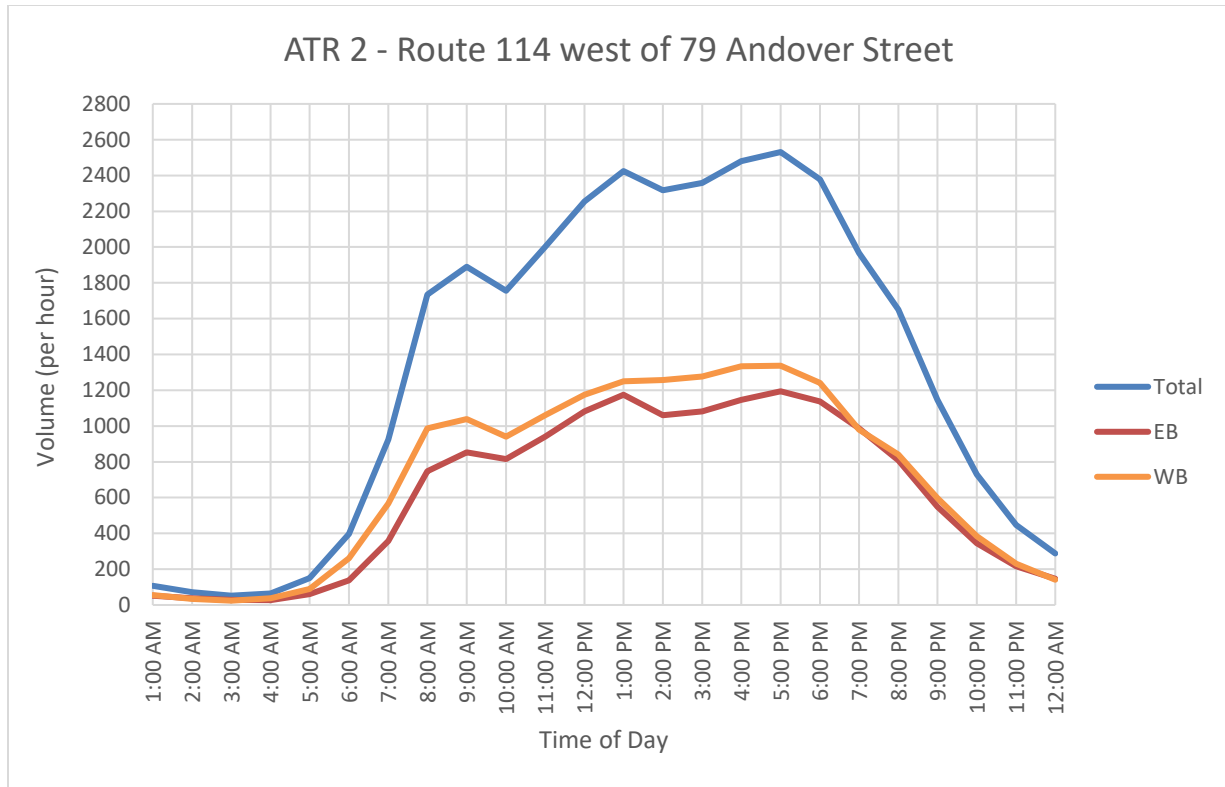


Figure 21. Daily Traffic Volumes (Route 114, west of 79 Andover Street)

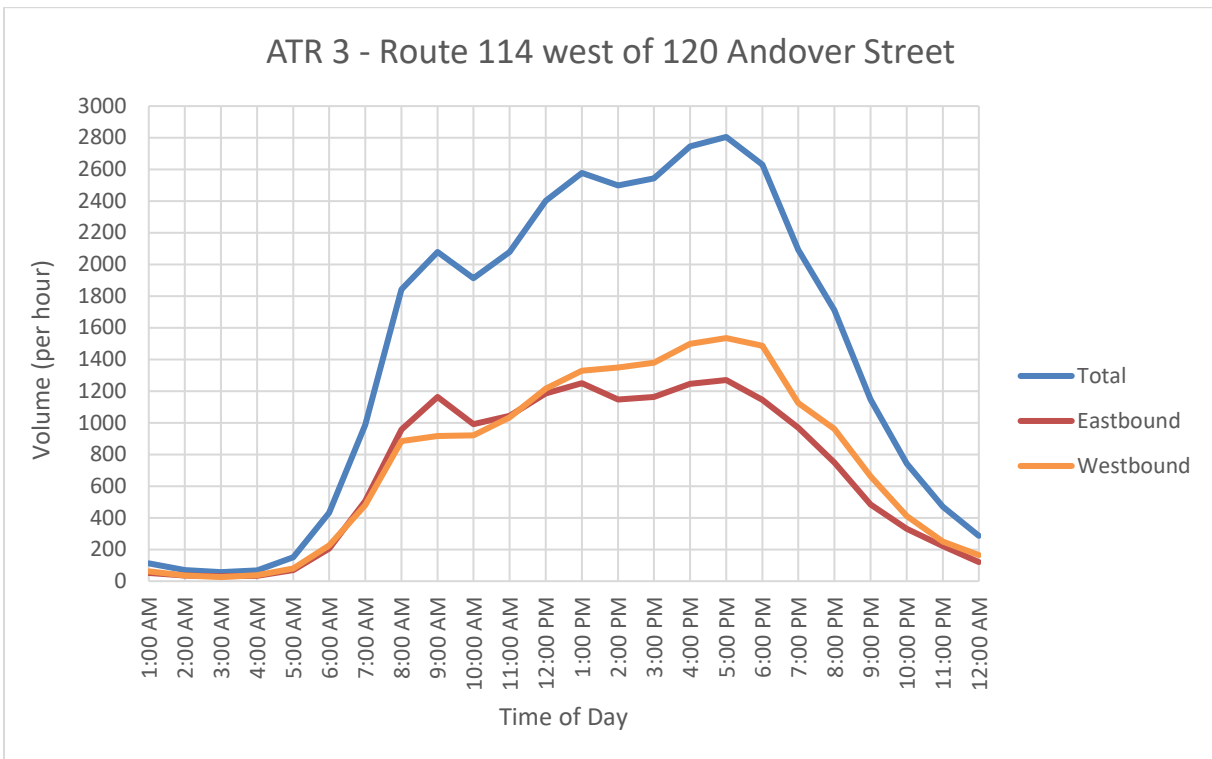


Figure 22. Daily Traffic Volumes (Route 114, west of 120 Andover Street)

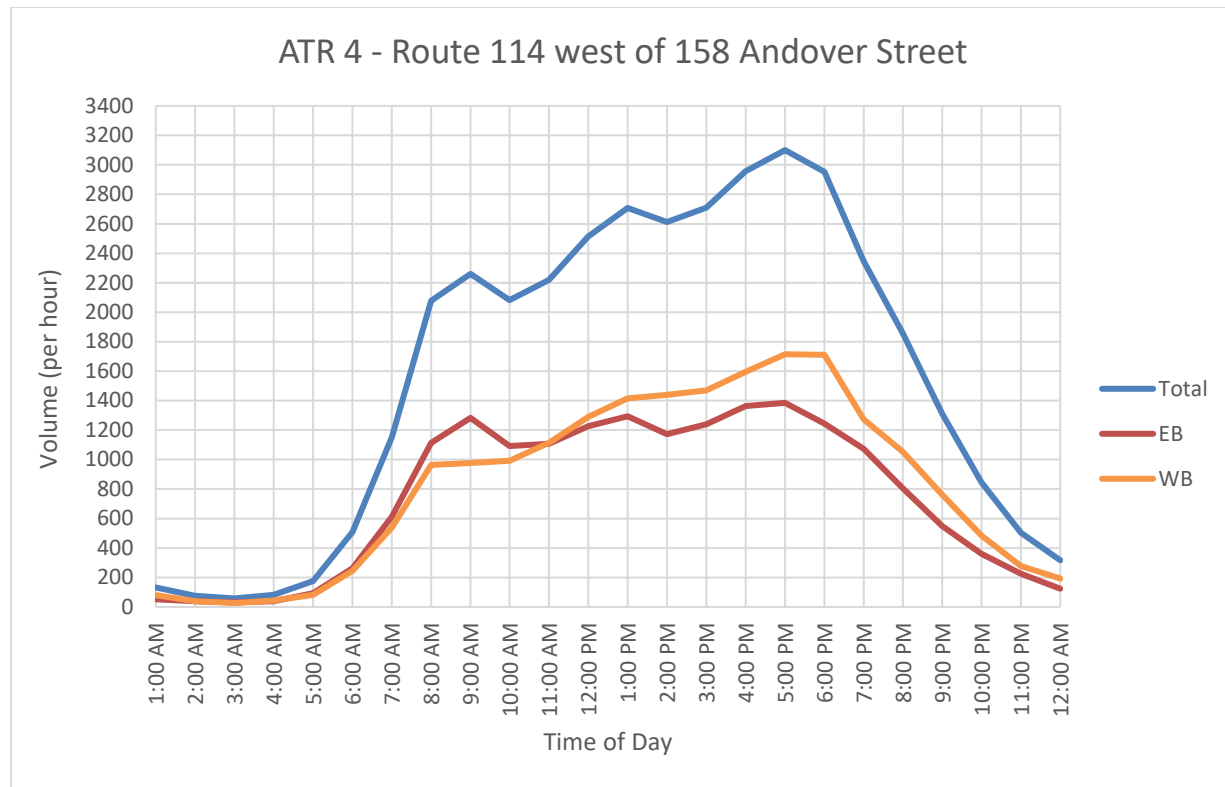


Figure 23. Daily Traffic Volumes (Route 114, west of 158 Andover Street)

Turning Movement Counts (TMCs) were conducted on Thursday, March 14, 2024, from 4:00 p.m. to 6:00 p.m. and Saturday, March 16, 2024, from 12:00 p.m. to 2:00 p.m. at the seven signalized study area intersections previously discussed as well as at the seven unsignalized roadways and major driveways listed below:

- Route 114 at Sylvan St/Prospect Street (Signalized)
- Route 114 at Willowdale Avenue (Unsignalized)
- Route 114 at Walter Road (Unsignalized)
- Route 114 at Mt. Pleasant Drive/Gates Street (Unsignalized)
- Route 114 at Ralph Road (Unsignalized)
- Route 114 at Palmer Ave/Peabody Place Driveway (Signalized)
- Route 114 at MacArthur Boulevard (Unsignalized)
- Route 114 at Brooksby Village Drive (Signalized)
- Route 114 at Cranberry Farm Road (Unsignalized)
- Route 114 at Walmart Drive (Signalized)
- Route 114 at Garden Street (Signalized)
- Route 114 at Sheldon Avenue (Unsignalized)
- Route 114 at Lowe's Driveway (Signalized)
- Andover Street/Route 114 at Avalon Bay Drive (Signalized)

Based on the count data, the Weekday Evening peak hour occurred from 4:15 p.m. to 5:15 p.m. and the Saturday Mid-Day peak hour occurred from 1:00 p.m. to 2:00 p.m. The count data for the study area intersections can be found in Appendix C. A diagram of the existing conditions turning movement volumes can be found in **Figure 24** below.

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

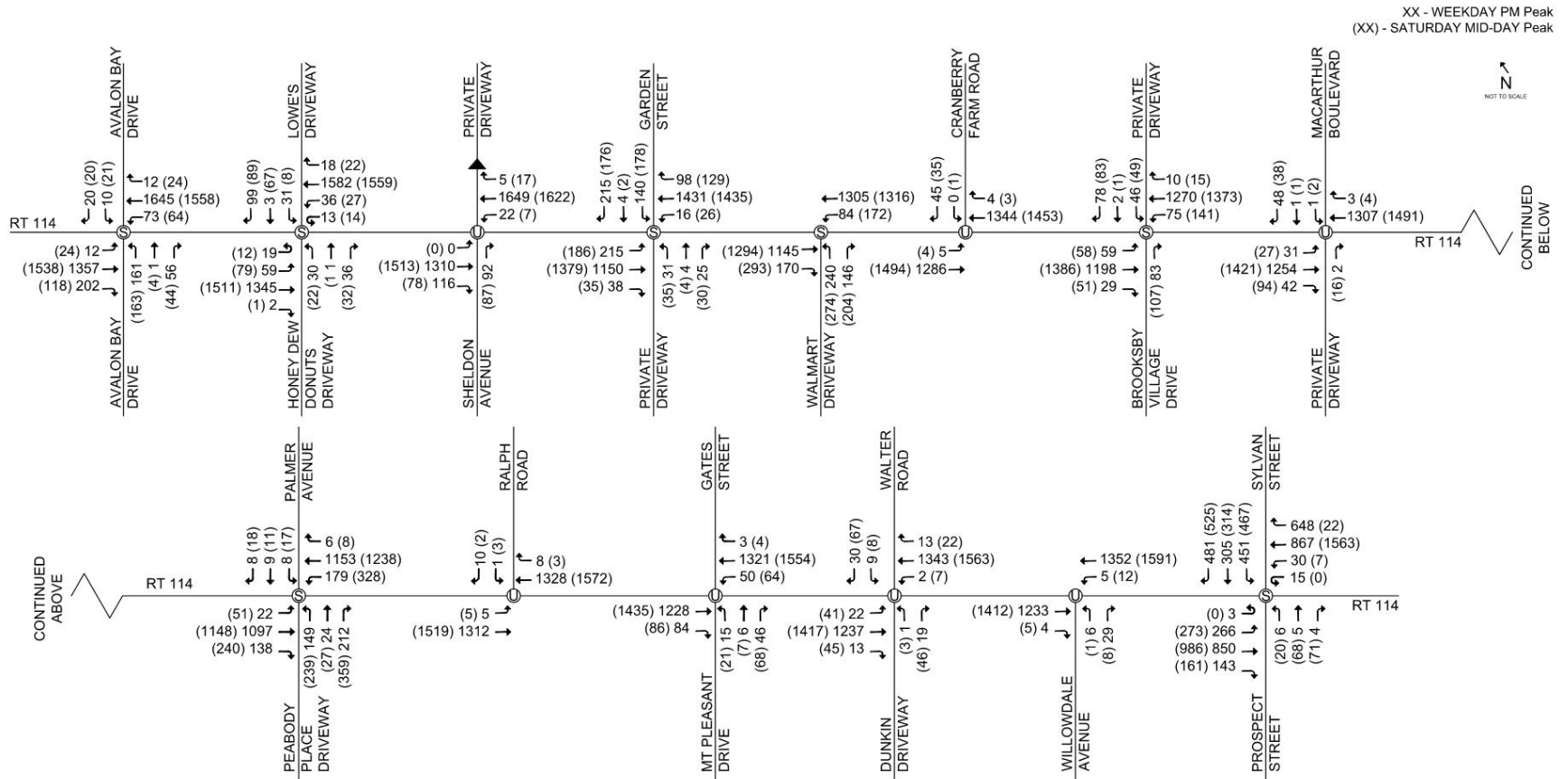


Figure 24. Existing (2024) Volume Diagram

2.4.6 Existing Conditions (2024) Operations Analysis

Intersection capacity analysis has been performed at each of the study area intersections for the Weekday P.M. and Saturday Mid-Day peak hours to determine the traffic operations under existing conditions. Operational analysis was completed using Synchro 10 software, which is based on the Highway Capacity Manual (HCM) 6th Edition. However, the HCM 6th Edition does not support non-standard NEMA phasing or exclusive pedestrian phases. Therefore, the HCM 2000 results are presented in this report for the signalized intersections within the study area.

Level of Service (LOS) is defined in terms of the average total vehicle delay of all movements through an intersection. Delay is measured based on multiple variables including signal phasing, signal cycle length, and traffic volumes with respect to intersection capacity. Table 9 includes the LOS criteria as defined by Exhibit 19-8 and 20-2 of the 6th Edition HCM.

Table 9: Level of Service Criteria for Intersections

LOS	Signalized Avg. Control Delay (sec/veh)	Unsignalized Avg. Control Delay (sec/veh)	Description
A	< 10	< 10	Free flow
B	> 10 - 20	> 10 - 15	Stable flow (slight delays)
C	> 20 - 35	> 15 - 25	Stable flow (acceptable delays)
D	> 35 - 55	> 25 - 35	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	> 55 - 80	> 35 - 50	Unstable flow (intolerable delay)
F	> 80	> 50	Forced flow (jammed)

The intersection capacity analysis for the overall intersection operations is summarized below in Table 10. The Synchro Reports are included in Appendix D.

Table 10: Existing Conditions (2024) Capacity Analysis Summary

Intersection	Weekday Evening Peak Hour		Saturday Mid-Day Peak Hour	
	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)
Route 114 at Sylvan Street (Signalized)	E	66.1	D	38.3
Route 114 at Willowdale Avenue (Unsignalized)	A	0.4	A	0.1
Route 114 at Walter Road (Unsignalized)	A	2.7	B	11.5
Route 114 at Mt. Pleasant Drive/Gates Street (Unsignalized)	A	1.0	A	0.1
Route 114 at Ralph Road (Unsignalized)	A	0.1	A	0.1
Route 114 at Palmer Drive/Peabody Place Driveway (Signalized)	C	20.5	C	28.8
Route 114 at MacArthur Boulevard (Unsignalized)	A	0.6	A	0.7
Route 114 at Brooksby Village Drive (Signalized)	B	16.9	C	31.3
Route 114 at Cranberry Farm Road (Unsignalized)	A	0.4	A	0.3
Route 114 at Walmart Driveway (Signalized)	B	17.9	E	75.4
Route 114 at Garden Street (Signalized)	F	80.5	F	136.3
Route 114 at Sheldon Avenue (Unsignalized)	A	3.8	A	2.9
Route 114 at Lowe's Driveway (Signalized)	B	11.1	A	8.0
Route 114 at Avalon Bay Drive (Signalized)	C	20.7	B	19.0

Under existing conditions, the following locations operate at an overall LOS E or LOS F:

- Route 114 at Garden Street operates at LOS F during the Weekday Evening and Saturday Mid-Day peaks.
 - Route 114 westbound through/right-turn movement operates at LOS F and queues exceed existing storage during both peak hours.
 - Route 114 westbound left-turn operates at LOS E in the Saturday Mid-Day peak, and LOS D in the Weekday Evening peak hour.
 - Queues on the Route 114 eastbound left and Garden Street southbound left-turn/through movements exceed capacity during both peak hours.
- Route 114 at Walmart Driveway operates at LOS E in the Saturday Mid-Day peak hour.
 - Walmart Driveway northbound left operates at LOS E in the Weekday Evening peak hour.
 - Route 114 eastbound through/right-turn movement operates LOS F in the Saturday Mid-day peak hour.
 - Queues on the Walmart Driveway northbound left and the Route 114 eastbound through/right-turn movements exceed capacity in the Weekday Evening peak hour.

- Queues on the Walmart Driveway northbound left, the Route 114 eastbound through/right-turn, and the Route 114 westbound movements exceed capacity in the Saturday Mid-day peak hour.

All other intersections operate at LOS D or better during the Weekday Evening and Saturday Mid-Day peaks. However, there are several individual movements that operate at LOS E or LOS F summarized below:

- Route 114 at Sylvan Street/Prospect Street:
 - Route 114 eastbound left operates at LOS F during the Weekday Evening peak hour and LOS E during the Saturday Mid-day peak hour.
 - Route 114 westbound left operates at LOS E during both peak hours.
 - Prospect Street northbound operates at LOS E during the Saturday Mid-day peak hour.
 - Sylvan Street southbound right operates at LOS E during the Saturday Mid-day peak hour.
- Route 114 at Walter Road:
 - Walter Road southbound movement operates at LOS F during both peak hours.
 - Dunkin Driveway northbound operates at LOS F during the Weekday Evening peak hour.
- Route 114 at Palmer Drive/Peabody Place Driveway:
 - Route 114 eastbound left operates at LOS E during the Weekday Evening peak hour.
 - Route 114 westbound left operates at LOS E during the Saturday Mid-day peak hour.
 - Peabody Place Driveway northbound left and through/right movements operate at LOS E during both time periods.
- Route 114 at Brooksby Village Drive:
 - Private Driveway left-turn/through movement operates at LOS E in the Weekday Evening peak hour.
 - Route 114 eastbound left movement operates at LOS E in the Weekday Evening peak hour.
- Route 114 at Lowe's Driveway:
 - Route 114 eastbound U-turn operates at LOS E during the Saturday Mid-day peak hour.
 - Honey Dew Donuts Driveway at LOS E during the Saturday Mid-day peak hour.
- Route 114 at Avalon Bay Drive:
 - Route 114 eastbound left operates at LOS E in the Weekday Evening peak hour.
 - Route 114 westbound left operates at LOS E during both peak hours.

- Avalon Bay Drive northbound left-turn/through operates at LOS E during the Saturday Mid-day peak hour.

The delays experienced on some side street movements may cause congestion in adjacent residential neighborhoods or pose safety issues related to driver frustration. Excessive delays on side street movements are due to the high mainline Route 114 volumes and a lack of acceptable gaps for vehicles entering from the side streets.

2.4.7 Existing Safety Analysis

Two Road Safety Audits (RSAs) were completed in the vicinity of the Route 114 study area. Both RSAs can be found in Appendix A. The purpose of an RSA is to identify existing safety issues and determine potential safety improvements for all roadway users that can be evaluated and included as a part of future design efforts. The first RSA occurred in January 2017 for the area encompassing Route 114 from Sylvan Street to Esquire Drive in Peabody.²⁵ In this area, the following four locations were identified as Highway Safety Improvement Program (HSIP) high crash locations for the years 2012 – 2014 by MassDOT:

- Route 114 at Sylvan Street/Prospect Street
- Route 114 at Cross Street
- Route 114 at Route 128 interchange
- Route 114 at Esquire Drive

This indicates that these locations fell within the top 5% of High Crash locations within the Boston Metropolitan Planning Organization region. As of the writing of this report, these locations are no longer identified as HSIP clusters for the most recent data available from 2018-2020 and have not been top crash locations since 2019. The RSA crashes included no fatal, pedestrian or bicycle crashes. The most common manner of collisions was rear-end crashes, followed by angle crashes. The 2017 RSA identified the following significant issues and countermeasures:

- Lack of Pedestrian and Bicycle Accommodations – Provide sidewalks on either side of Route 114 with ADA compliant crossings and pedestrian signage at all intersections. Consider a study to determine appropriate bicycle accommodations for the length of Route 114.
- Pavement Marking and Signage Condition – Evaluate pavement marking and signage condition. Restripe faded markings and trim vegetation for any blocked signage.

²⁵ While this segment is located along Route 114, it falls outside the boundaries of the current study area. It is referenced here due to its relevance to past safety evaluations and improvement recommendations.

Consider dotted extension lines for turning movements at signalized intersections. Evaluate signage to eliminate sign clutter and ensure MUTCD compliance.

- Traffic Signals – Provide vehicle detection, emergency vehicle preemption and signal coordination at all intersections. Evaluate the need for adaptive traffic signal system.

The second RSA occurred in May 2022 for the area encompassing Route 114 from Sylvan Street in Peabody to Leblanc Drive in Danvers. In this area, the following two (2) locations were identified as Highway Safety Improvement Program (HSIP) high crash locations for the years 2018 – 2020 by MassDOT:

- Route 114 at Garden Street
- Route 114 at Brooksby Village Drive

The RSA crashes included four fatal crashes, one of which involved a cyclist. There was also an additional pedestrian crash. The most common manner of collisions were angle crashes, followed by rear-end crashes. The 2022 RSA identified the following significant issues and countermeasures:

- Access Management – Evaluate the number of curb cuts along Route 114. Consider consolidating or narrowing driveways. Consider restricting left-turns from driveways and side streets with signage, pavement markings, channelizing islands, or a median along Route 114.
- Route 114 Cross-Section – Evaluate the Two-Way Left Turn Lane (TWLTL) along Route 114 and consider areas where the TWLTL can be replaced by raised medians, scored concrete or restriped as a one-way, left-turn lane at intersections. Consider a road diet to reduce speeds and provide space for pedestrian and bicycle accommodations.
- Pavement Marking and Signage – Evaluate pavement marking and signage throughout the corridor and consider additional elements such as dotted extension lines, high durability pavement markings, pedestrian warning signage, wayfinding signage.
- Intersection Signalization – Perform Signal Warrant Analyses at each intersection to identify locations to remove signals or install additional signals. Evaluate all clearance interval times. Provide retroreflective backplates for all traffic signals. Consider replacing span wires with mast arms at all locations. Evaluate traffic signal visibility for all approaches.
- Intersection Geometry – Evaluate sight distance on all side street approaches. Consider intersection reconstruction to allow all side streets to meet Route 114 at a 90-degree angle. Evaluate the number of turn lanes and receiving lanes at all intersections.
- Pedestrian and Bicycle Accommodations – Consider installing pedestrian and bicycle accommodations on either side of Route 114 including sidewalks, buffered bicycle lanes or shared-use paths. Evaluate the need for signalized crosswalks at all intersections as

well as mid-block locations based on demand. Consider connections to the Danvers Rail Trail.

Since the RSAs, MassDOT has implemented a number of short-term, low-cost improvements suggested in the RSA. The following countermeasures have been implemented as of the writing of this study:

- Flexposts and pavement markings along Route 114 to reduce the TWLTL, prevent left-turn related crashes on Route 114, and reduce lane widths.
- Additional signalized crosswalks across Route 114 at Esquire Drive, Loris Road, Cross Street, Sylvan Street, Palmer Avenue, Brooksby Village Drive, Walmart Drive, and Garden Street.
- A Raised Crosswalk on the Route 114 channelized right-turn to Sylvan Street due to the high vehicle travel speeds.
- Gore markings along the right shoulder of Route 114 at several locations to reduce the number of travel lanes and the vehicle travel lane width.
- Emergency vehicle preemption for the intersections at Esquire Drive, Loris Road, Cross Street, Sylvan Street, and Palmer Avenue.

2.5 No-Build (2034) Conditions

Future traffic volumes for the 2034 design year were determined by increasing the existing volumes by a growth rate consistent with historical trends in combination with traffic that will be generated in the future by known planned developments in the vicinity of the project area. Based on data and projections provided by the Metropolitan Area Planning Council (MAPC), the annual growth rate was determined to be 0.5% per year for the project area.²⁶ This growth rate is considered to be conservative compared to the regional growth rate of 0.1% provided by MAPC. The intention for the growth rate is to provide a more conservative analysis that also accounts for any traffic growth associated with developments that may occur between the existing year and the design year.

A diagram of the No Build (2034) turning movement volumes can be found in **Figure 25**.

The intersection capacity analysis for the No-Build overall intersection operations is summarized below in Table 11. The Synchro Reports are included in Appendix D.

²⁶ Note: Growth rates are based on socioeconomic forecasts developed by MassDOT and the UMass Donahue Institute, processed by MAPC, and incorporated into the CTPS TDM23 travel demand model (version 1.0). Growth rates represent the projected change of VMT within a given geography between the base scenario (2019) and the LRTP plan scenario (2050).

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

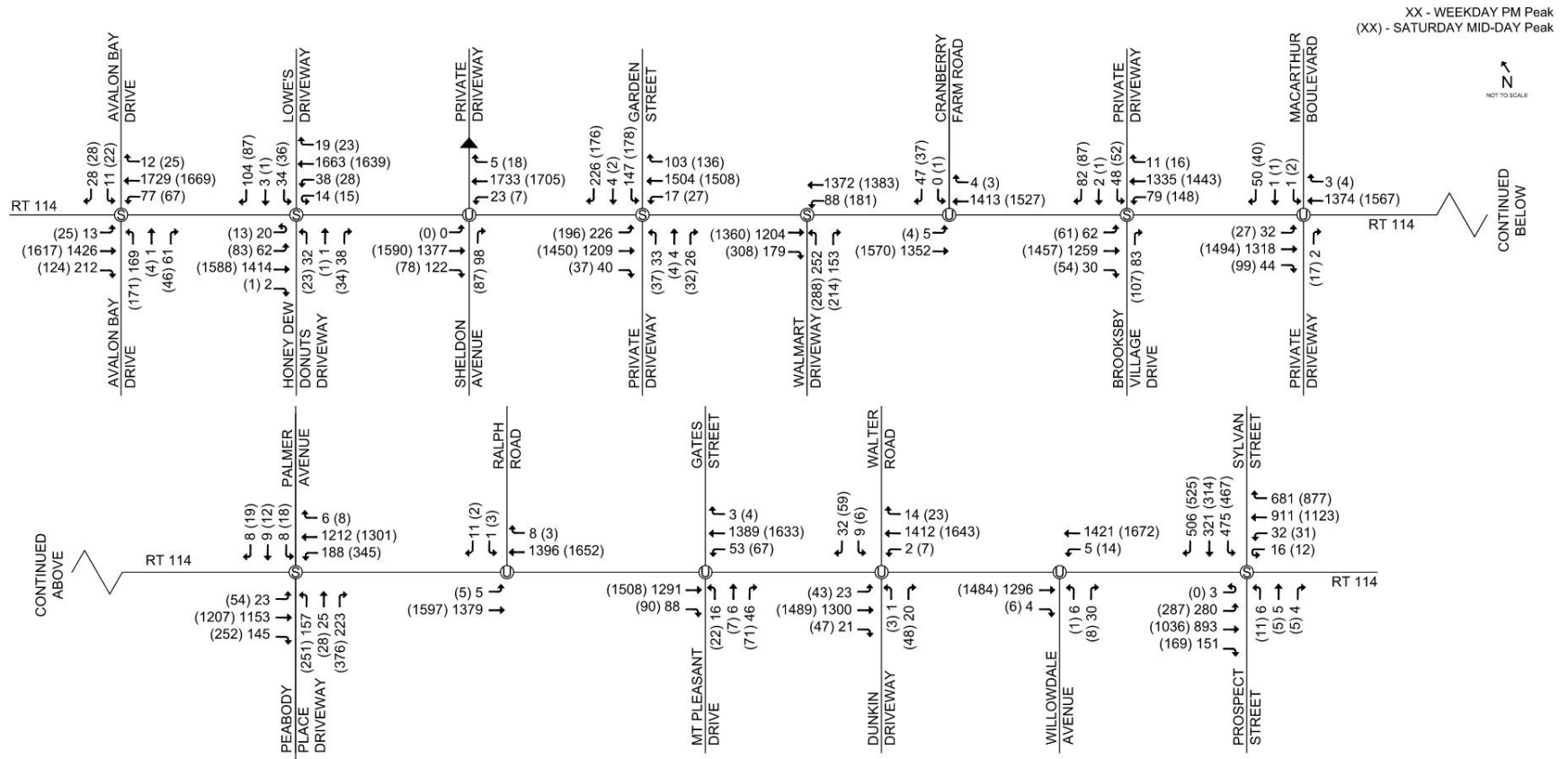


Figure 25 . No-Build (2034) Volume Diagram

Table 11: No-Build Conditions (2034) Capacity Analysis Summary

Intersection	Weekday Evening Peak Hour		Saturday Mid-Day Peak Hour	
	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)
Route 114 at Sylvan Street (Signalized)	E	61.6	D	42.8
Route 114 at Willowdale Avenue (Unsignalized)	A	0.3	A	0.1
Route 114 at Walter Road (Unsignalized)	A	2.5	B	11.5
Route 114 at Mt. Pleasant Drive/Gates Street (Unsignalized)	A	1.0	A	0.9
Route 114 at Ralph Road (Unsignalized)	A	0.1	A	0.1
Route 114 at Palmer Drive/Peabody Place Driveway (Signalized)	C	20.7	C	31.9
Route 114 at MacArthur Boulevard (Unsignalized)	A	0.5	A	0.7
Route 114 at Brooksby Village Drive (Signalized)	B	16.6	C	31.3
Route 114 at Cranberry Farm Road (Unsignalized)	A	0.3	A	0.3
Route 114 at Walmart Driveway (Signalized)	B	17.9	F	108.8
Route 114 at Garden Street (Signalized)	F	88.0	F	156.6
Route 114 at Sheldon Avenue (Unsignalized)	A	4.2	A	0.6
Route 114 at Lowe's Driveway (Signalized)	B	10.0	A	8.1
Route 114 at Avalon Bay Drive (Signalized)	B	16.3	B	17.1

No-Build (2034) traffic operations are for the most part consistent with Existing Conditions. A handful of intersection operations worsen slightly when compared to the Existing Conditions. The following summarizes intersections and approaches that degraded from a LOS D or better in the existing conditions:

- Route 114 at Walmart Driveway operations degraded from LOS E to a LOS F during the Saturday Mid-Day peak hour.
 - Route 114 eastbound through/right-turn movement remains LOS F, but delay increases from 137 seconds under Existing conditions to 215 seconds under No-Build conditions.
- Route 114 at Garden Street remains LOS F for both peak hours under No-Build conditions.
 - Route 114 eastbound through/right-turn movement degrades from LOS D under Existing conditions to LOS E under No-Build conditions during the Saturday Mid-day peak hour.

2.6 Findings

The analysis of existing traffic operations finds that overall operations fall within acceptable ranges for the majority of the study area intersections. The two intersections which experience excessive delays are the intersection of Route 114 at Garden Street and the intersection of Route

114 at Walmart Drive. Delay and queues are also locally high at a number of individual movements, despite overall intersection operations performing acceptably. Operations at all study area intersections are expected to deteriorate slightly from the Existing to No-Build condition due to background traffic growth.

The Two-Way Left Turn Lane (TWLTL) along Route 114 in the study area is a safety problem because as a shared lane for turning vehicles in each direction, it creates a high volume of conflict points between left-turning traffic and through traffic, increasing the likelihood of rear-end and sideswipe collisions. The wide roadway cross section, when combined with the high traffic volumes creates an unsafe condition for vehicles turning left out of any of the numerous unsignalized driveways. To improve safety, the area could be modified by installing raised medians, using scored concrete, or re-striping the area as a one-way left-turn lane at intersections.

Overall pedestrian and bicycle conditions along Route 114 are not comfortable for the average user and are not fully accessible. The narrow sidewalks and lack of amenities like shade and landscape buffers can create challenges for pedestrian navigation. The sidewalks do not meet MassDOT width standards, and the current conditions feature obstructions and deteriorating ramps. There are no dedicated bicycle facilities along the study corridor and there are minimal connections to nearby pedestrian and bicycle facilities. Opportunities for improvements include:

- Constructing a sidewalk on the south side of Route 114
- Formalizing connections to the Danvers Rail Trail
- Adding pedestrian refuge islands to long crossings at Palmer Avenue and Garden Street
- Improving connections to MBTA bus service on Sylvan Street

Extending and expanding the bicycle and pedestrian network could help connect residential neighborhoods, senior living communities, schools, malls, and key destinations along Route 114.

3. Alternatives Development and Analysis

3.1 Introduction

3.1.1 Alternatives Development

As part of the Route 114 Long-Term Safety Improvements Planning Study, the study team developed two preliminary Alternatives (Alternatives 1 and 2) to address the study's goals and objectives while ensuring feasibility. Both Alternatives maintain the existing horizontal and vertical alignment and replace the two-way left-turn lane in the center of the roadway with either a median (Alternative 1) or a barrier (Alternative 2) to control left-turn movements along the corridor, while also enhancing pedestrian and bicyclist infrastructure. This change is

intended to enhance safety, improve traffic flow, and reduce conflict points by restricting direct left turns at unsignalized locations.

To accommodate traffic that can no longer make direct left turns due to the proposed median and intersections, alternative routes will be required. Vehicles would instead use the proposed roundabouts, signalized intersections, or designated U-turn locations to complete their movements safely and efficiently. Both alternatives also include enhancements to pedestrian and bicyclist infrastructure, such as shared-use paths, sidewalks, safe pedestrian and bicyclist crossing treatments, and improved multimodal accommodations.

Alternative 1 explores a cross-section that may extend beyond the existing right-of-way in some locations, while Alternative 2 focuses on a design that remains within the existing right-of-way to the greatest extent possible. At this stage, right-of-way needs are preliminary, and more detailed evaluations will be conducted as the design progresses. Concept plans for both alternatives are included in Appendix E.

The intersections for each Alternative include a combination of geometric changes, signal phasing changes, and intersection control strategies from the Stage I Intersection Control Evaluation (ICE). This report presents the initial evaluation for implementation considerations.

3.1.2 Alternatives Analysis

In conjunction with MassDOT, the study team evaluated each alternative using the following methodologies and analyses:

- A. Mobility and Access to Destinations Analysis:** The study team analyzed the impacts of alternatives on mobility in the study area. Mobility as it relates to shared travel networks, vehicular, bicycle, and pedestrian systems were considered. The transportation system analysis includes corridor intersections and all bicycle and pedestrian infrastructure in the study area. Traffic conditions were analyzed for weekday afternoons and Saturday mid-day peak hours to reflect periods of highest congestion and demand. Each proposed design alternative was compared to a 'no build' condition, which represents future traffic conditions if no changes or improvements are made. The analysis was conducted using Synchro traffic modeling software. The data collected and analyzed for each alternative was used to develop a matrix of associated benefits, costs, and impacts.
- B. Safety Analysis:** The study team analyzed the traffic safety impacts in the study area for each alternative to the degree feasible, including examining the impacts on bicycles, pedestrians, and vehicles. Impacts to user safety can result from many factors, but includes changes in vehicle speeds, level of compliance with design standards, infrastructure that fully accommodates each type of use, and level of overall user

comfort. The designs for each alternative consider crash history at each intersection location.

- C. **Environmental Effects Analysis:** The study team conducted a desktop level review of the study area to determine the presence or absence of environmental resources and/or constraints. This review included the use of Massachusetts Geographic Information System (MassGIS), Federal Emergency Management Agency Flood Insurance Rate Maps (FEMA FIRM), Massachusetts Cultural Resource Information System (MACRIS), MA EJ Viewer, and other relevant electronic resources. Roadway concept alternatives were evaluated considering existing environmental conditions to identify preliminary impacts and permitting requirements. The analysis includes a narrative summary and graphics describing existing environmental conditions, preliminary impacts, and regulatory implications for each roadway segment.
- D. **Land Use and Economic Development Analysis:** The study team analyzed land use, economic development and business impacts for each alternative to the degree feasible, which included examining (as relevant): right of way; property values; tax base; planned and potential zoning changes; planned developments (including Chapter 40B and Transit-Oriented Developments); parking, car and truck access to existing or planned parcels; visibility; labor force impacts; regional and local employment; and other elements as necessary to fully analyze each alternative.
- E. **Community Effects/Environmental Justice Analysis:** The study team analyzed the possible social equity impacts of the alternatives and how they may impact, or benefit select populations that now reside and/or work in or adjacent to the study area. Special consideration was given to the project's impacts on access to community resources, assets, and industries. The study team also analyzed the possible social equity impacts of the alternatives analyzed.
- F. **Cost Analysis:** Approximate construction, right of way, and mitigation costs were estimated at a conceptual level for each alternative.

4. Design Approach

The design approach began with a review of the existing roadway cross sections shown in Figure 26 to identify deficiencies and opportunities for improvement. As part of the alternative development process, the study team also reviewed prior analyses, including findings from the Task 3 Report: Existing Conditions, Future No-Build Conditions, and Issues Evaluation. This report identified key safety concerns along Route 114, including historical crash patterns, access management challenges, and pedestrian and bicycle infrastructure deficiencies. The intersections at Garden Street and Brooksby Village Drive were classified as Highway Safety Improvement Program (HSIP) clusters, ranking among the top 5% of high-crash locations in the region. Additionally, the report documented constraints related to access management, the

existing two-way left-turn lane, the wide roadway cross section, a lack of pedestrian and bicycle facilities, and signal issues from a lack of protected left turns and emergency vehicle preemption.

Several low-cost, short-term safety improvements were implemented in 2023 following the 2022 Road Safety Audit (RSA). These included flex posts and pavement markings to reduce mid-block turning movements and improve access management. However, observations and stakeholder feedback indicated that drivers continue to make unsafe U-turns by cutting through driveways instead of using designated turning locations, negatively impacting operations and safety. Given these ongoing issues, long-term solutions are needed to address high-risk turning movements, pedestrian and bicycle infrastructure deficiencies, and overall corridor safety.

Based on the study team assessment, two primary roadway cross sections were developed to address long-term transportation safety improvements along the corridor. In certain constrained locations, a third variation was introduced to accommodate site-specific challenges. The design approach also included an analysis of the feasibility of providing U-turn movements for the displaced left turns caused by the median.

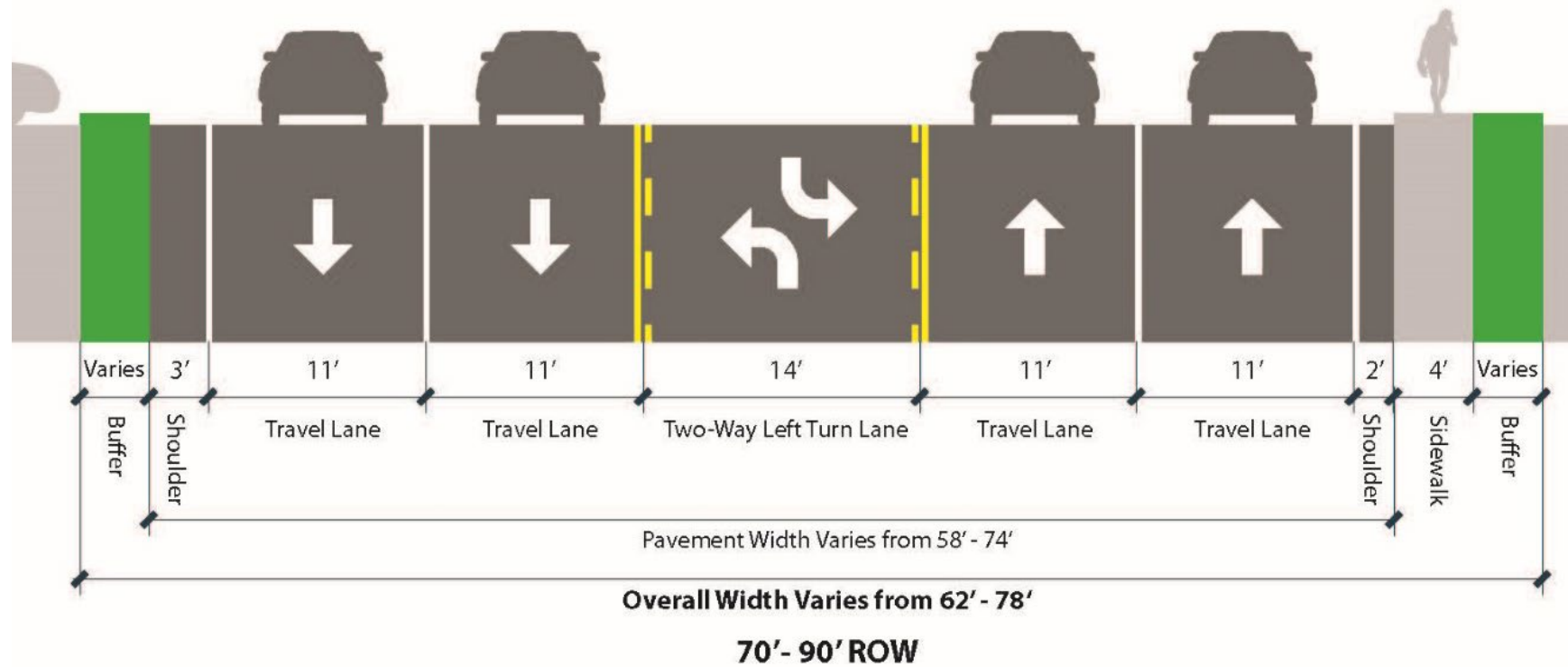


Figure 26. Existing Conditions Typical Section

Table 1 lists the cross-section design criteria established for this project. Pinch point minimums are broken out separately from general minimums to indicate the absolute narrowest widths possible which are to be avoided to the greatest extent practical. Table 2 lists the alignment and profile design criteria, relating to minimum curve radii, vertical clearance, and others. These tables aggregate guidance from the following documents:

- MassDOT Project Development and Design Guide (PDDG) (*Accessed October 2024*)
- AASHTO Guide for the Development of Bicycle Facilities (*Fourth Edition*)
- MassDOT Separated Bike Lane Planning & Design Guide (*2015*)
- AASHTO A Policy on Geometric Design of Highways and Streets (*Sixth Edition*)
- AASHTO A Guide on Achieving Flexibility in Highway Design (*2004*)
- FHWA Achieving Multimodal Networks (*2016*)
- FHWA Update to Controlling Criteria (*2016*)
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (*Second Edition*)
- US AAB Public Right-of-Way Accessibility Guidelines (PROWAG) (*Published 2023*)
- National Association of City Transportation Officials (NACTO) Urban Street Design Guide (*2013*)
- NACTO Urban Bikeway Design Guide (*Second Edition*)

It should be noted that the guidance adhered to throughout this document is relative to the standards that were current at the time of this study. New editions of some documents have been released since this report was produced, and some recommendations in this report may not adhere to guidelines released after this report was produced.

Table 12: Cross-Section Design Criteria

	Preferred [ft]	General Minimum [ft]	Pinch Point Minimum [ft]
Vehicle Travel Lane ²⁷	11	10	10
Bus Lane ²⁸	12	11	11
Shoulder	4 ²⁹	2 ³⁰	1 ³⁰
Shared Use Path ³¹	12	10	8
Buffer from SUP to Vehicle Edge of Traveled Way ³²	5	2	2
Buffer from SUP to Vertical Obstruction ³² (Shy Distance ³³)	2	2	2
Bridge Barrier ³⁴	1.5	1.5	1.5
Bike Lane ³⁵	6	5	4
Sidewalk ³⁶	8	5	4
Buffer from Sidewalk to Bicycle Edge of Traveled Way ³⁷	4	2	2

²⁷ AASHTO - A Policy on Geometric Designs of Highways and Streets, Section 4.3

²⁸ AASHTO - Guide for Geometric Design of Transit Facilities on Highways and Streets, Section 3.1.1.2

²⁹ MassDOT - Project Development and Design Guide, Section 5.3.3.1

³⁰ AASHTO - A Policy on Geometric Designs of Highways and Streets, Section 4.4.2

³¹ AASHTO - Guide for the Development of Bicycle Facilities, Section 6.4.3

³² AASHTO - Guide for the Development of Bicycle Facilities, Section 6.6.1.1

³³ Shy Distance is defined in the AASHTO Guide for the Development of Bicycle Facilities as the buffer that bicyclists and pedestrians give themselves to avoid traveling immediately adjacent to building faces, fences, trees, fixed objects, parked motor vehicles, or other similar physical obstructions. The guide discusses shy distance in Section 2.5.3.2.

³⁴ MassDOT - Bridge Manual, Part II, Standard Drawing 12.4.1

³⁵ MassDOT - Separated Bike Lane Planning and Design Guide, Section 3.3.2

³⁶ AASHTO - Guide for the Planning, Design, and Operation of Pedestrian Facilities, Section 3.3.4

³⁷ AASHTO - Guide for the Planning, Design, and Operation of Pedestrian Facilities, Section 3.3.5

Table 13: Alignment and Profile Design Criteria

General Traffic Design Speed ³⁸		25 MPH
Bicycle Design Speed ³⁹		20 MPH
Minimum Horizontal Curve Radius	Roadway	144 ft (6.0% e_{max})
Minimum Horizontal Curve Radius	SUP ⁴⁰	74 ft
Maximum Profile Grade	Where Pedestrian & Bicyclist Facilities Are Present ⁴¹	4.5%
Maximum Profile Grade	Where Pedestrian & Bicyclist Facilities Are Not Present ⁴²	8.0%
Minimum Vertical Clearance	Over Railroad Tracks ⁴³	22'-6"
Minimum Vertical Clearance	Under Bridge Structure (General Traffic) ⁴⁴	14'-0"
Minimum Vertical Clearance	Under Bridge Structure (Pedestrian/Bicycle Facility) ⁴⁵	10'-0" Preferred 8'-0" Minimum

4.1 Roadway Cross Sections

This analysis resulted in two Alternatives (Alternatives 1 and 2) for Route 114 to address long-term transportation needs. Both Alternatives maintain the existing horizontal and vertical alignment and prioritize pedestrian and bicyclist space due to medium demand identified in the 2022 MassDOT analysis. Removing the 14-foot-wide two-way left-turn lane allows for a 6-foot-wide median (Alternative 1) or barrier (Alternative 2), while also creating space to widen sidewalks to six feet on the north side for continuous pedestrian access and add a shared-use path on the south side.

Primary cross sections were developed for each of the Alternatives, along with a third variation used in constrained locations where space limitations required adjustments. The alternatives are structured as follows:

³⁸ MassDOT - Project Development and Design Guide, Section 3.6

³⁹ AASHTO - Guide for the Development of Bicycle Facilities, Section 6.6.3.1

⁴⁰ AASHTO - Guide for the Development of Bicycle Facilities, Section 6.6.3.1

⁴¹ PROWAG - Section R302.4.1, (0.5% Construction Tolerance)

⁴² MassDOT - Project Development and Design Guide, Chapter 4, Table 4-9

⁴³ MassDOT - Bridge Manual, Part II, Drawing Number 2.2.4

⁴⁴ AASHTO - A Policy on Geometric Design of Highway and Streets, Section 5.2.2.7.2

⁴⁵ AASHTO - Guide for the Development of Bicycle Facilities, Section 2.5.3.3

- Alternative 1 follows the first cross section, which includes a 6-foot-wide median restricting left-turn and U-turn movements, in addition to providing preferred multi-modal design considerations. See Figure 27.
- Alternative 2 follows the second cross section, which includes a 2-foot-wide median barrier and left-turn pockets or loon truck apron geometry to allow for U-turns, while multi-modal accommodations were held to minimum standards to decrease right-of-way impacts. See Figure 28 , and refer to Table 12 and Table 13 for design criteria.
- A third cross section was developed for use in the most constrained locations along the corridor, where additional adjustments were necessary. This cross section applies to both Alternative 1 and Alternative 2 in these areas. See Figure 29.

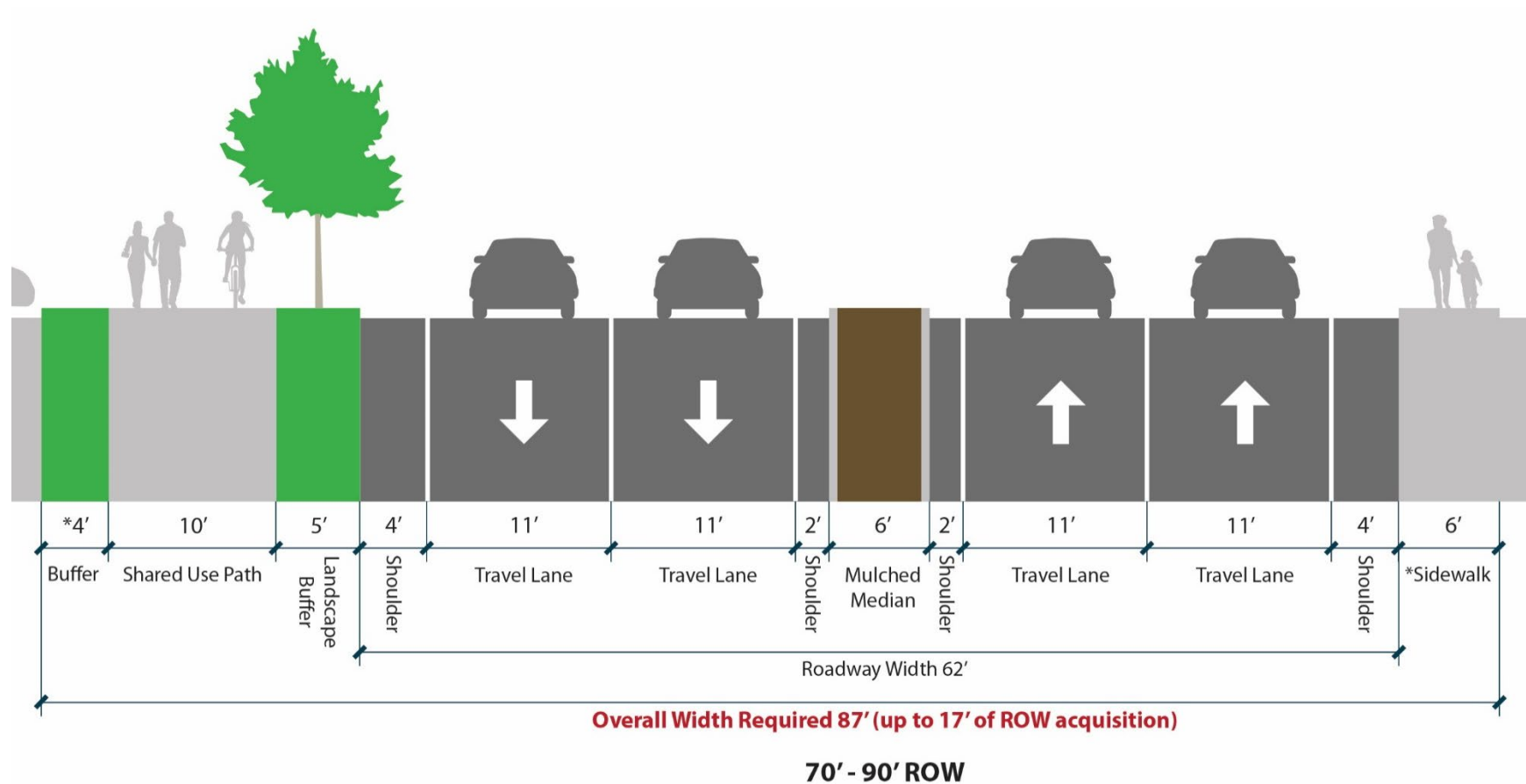


Figure 27. Proposed Alternative 1 Cross Section

* Shared-use path and sidewalk buffers are to be increased in areas with available right-of-way.

The Alternative 1 cross section meets MassDOT's requirements for multi-modal design and provides the width necessary for comfortable and safe facilities for all modes of transportation regardless of right-of-way impacts. The roadway cross section consists of two 11-foot-wide travel lanes in each direction separated by 2-foot-wide inside shoulders and a 6-foot-wide center median. 4-foot-wide outside shoulders are provided for both directions of travel. A 6-foot-wide concrete sidewalk is proposed on the north side of Route 114. A 10-foot wide hot-mix asphalt (HMA) shared-use path is proposed on the south side of Route 114 with a 5-foot-wide landscaped buffer to provide horizontal separation from the vehicles using the corridor. The landscaped buffer would also allow for planting shade trees to provide a more comfortable travel experience for pedestrians and bicyclists. To accommodate this roadway cross section, widening would be required along Route 114. The right-of-way impacts are primarily limited to the southern side of Route 114.

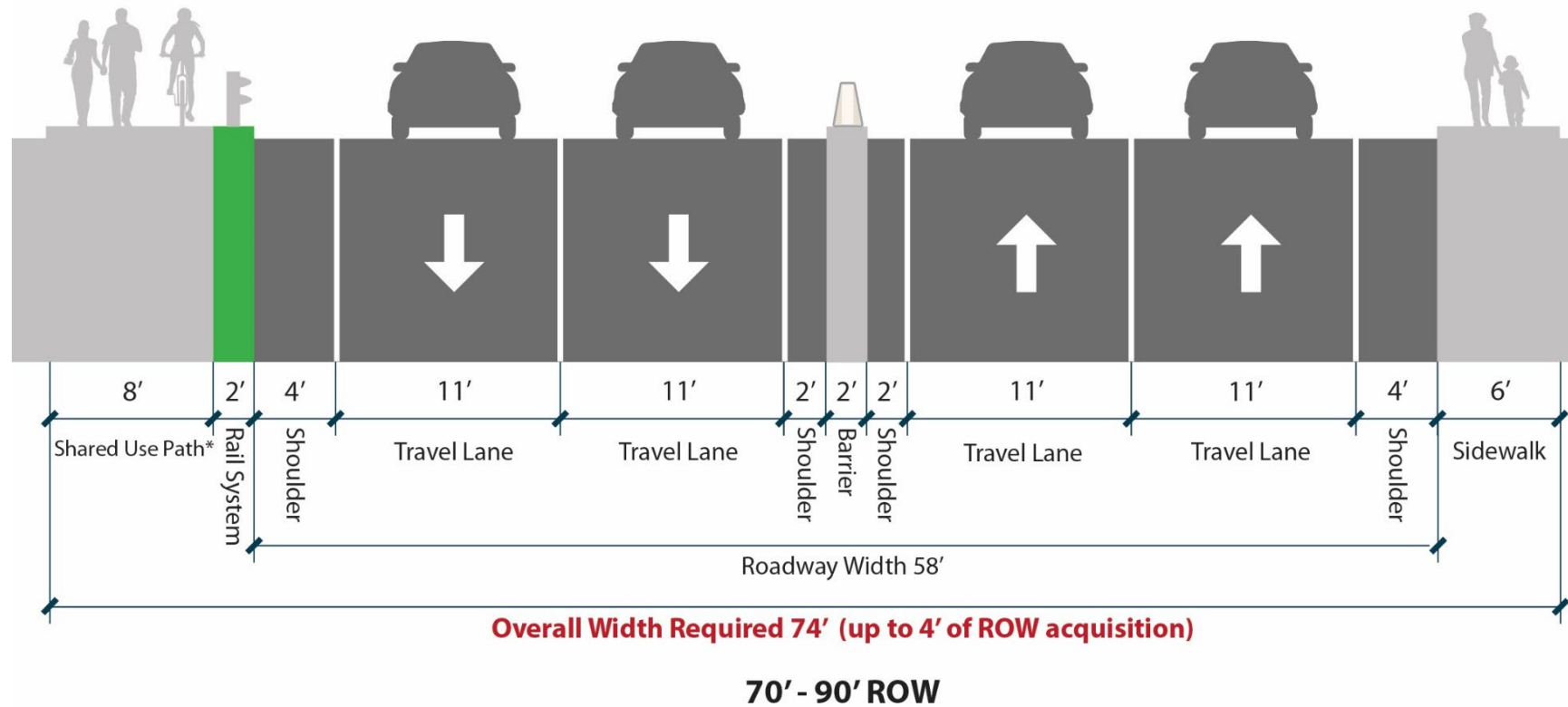


Figure 28. Proposed Alternative 2 Cross Section

* Shared-use path and sidewalk buffers are to be increased in areas with available right-of-way.

The Alternative 2 cross section provides the minimum widths required for multi-modal design while maintaining, to the most practical extent possible, the existing right-of-way widths and limiting impacts to adjacent properties and utilities. The roadway cross section consists of two 11-foot-wide travel lanes in each direction, separated by 2-foot-wide inside shoulders, and a double-faced concrete barrier down the center of Route 114. Outside shoulders are provided for both directions of travel and widths vary between 2-feet and 4-feet wide depending on existing infrastructure and utility constraints. A 6-foot-wide concrete sidewalk is proposed on the north side of Route 114. An 8-foot wide HMA shared-use path is proposed on the south side of Route 114 with a 2-foot-wide HMA buffer to provide some horizontal separation from the vehicles using the corridor. A railing or guardrail would be required within the buffer between the shared-use path and roadway due to its narrow offset to vehicular traffic.

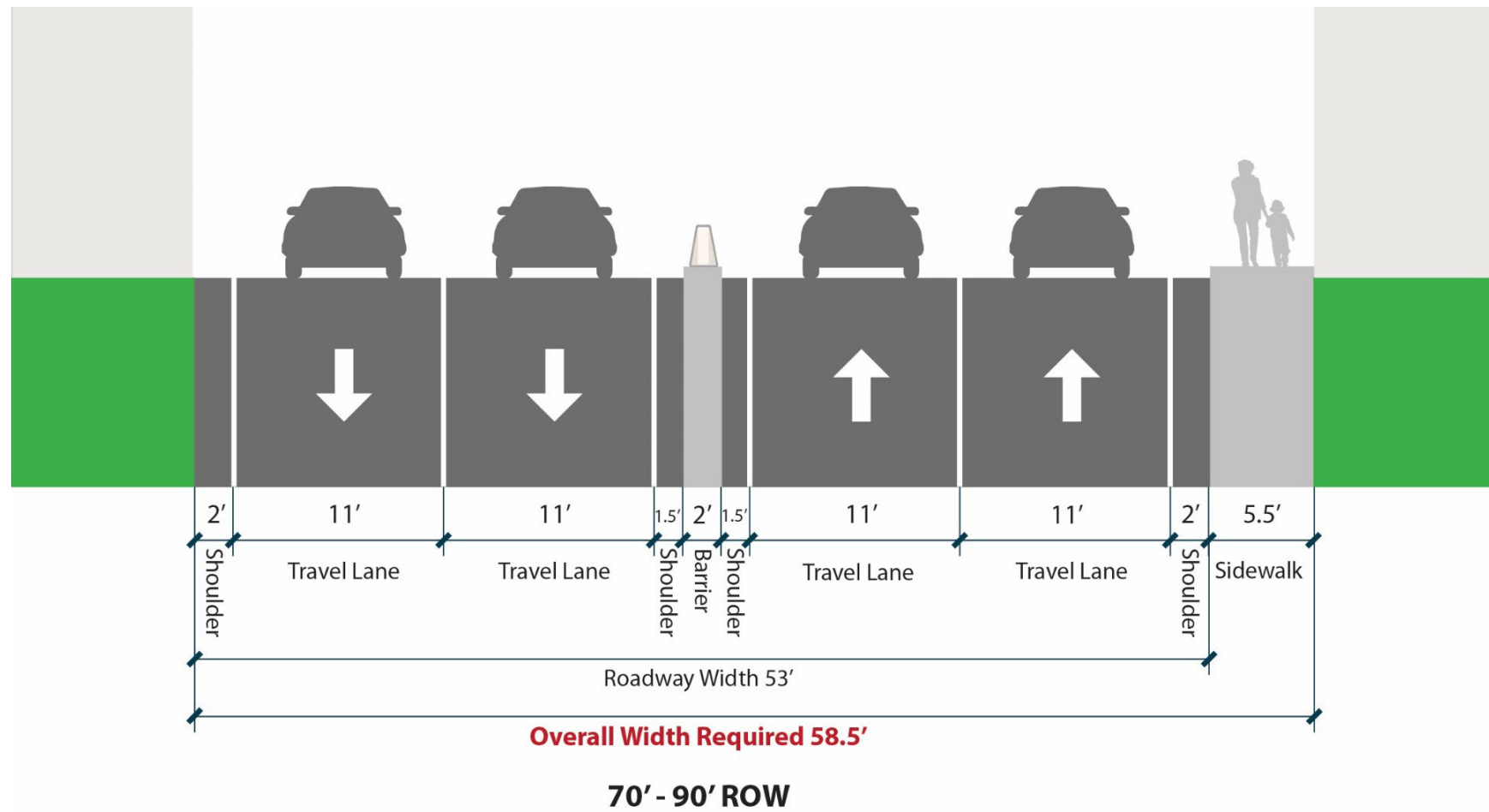


Figure 29. Constrained Typical Section

A third cross section was evaluated for the constrained conditions along the study corridor. The roadway cross section consists of two 11-foot-wide travel lanes in each direction separated by 1.5-foot-wide inside shoulders and a double-faced concrete barrier running down the center of Route 114. Outside shoulders are provided for both directions of travel, narrowing to 2 feet in width. A 5.5-foot-wide concrete sidewalk is proposed on the north side of Route 114 and has been narrowed to the minimum width to meet the guidance outlines in MassDOT Project Development and Design Guide (PPDG). A shared-use path is not provided in the most constrained locations, such as at the existing bridge for Danvers Rail Trail and in Alternative 2 at the existing culvert that carries Crane Brook from Judith Road to the Chevrolet of Danvers. At the constrained location created by the bridge for the Danvers Rail Trail, there is a continuous path available by using the ramp up to the path and back down again.

4.2 Intersections

The center median proposed in the Alternatives and the associated changes in traffic patterns required revised intersection designs at many locations throughout the Route 114 corridor. To accommodate these changes, several types of intersection control types were considered using the Stage 1 ICE criteria.

4.2.1 Change in Traffic Patterns with U-Turns

All proposed cross sections feature a center median throughout the corridor that would prohibit midblock left turns across Route 114, meaning everywhere except at signalized intersections. Vehicles would instead make U-turns at the signalized intersection downstream from their destination to reverse direction and then enter the desired midblock driveway or street by making a right turn. Vehicles entering from side streets and driveways would turn right onto Route 114 and then use the next signalized intersection to U-turn to achieve the desired direction of travel. These changes would increase through and right turn volumes at intersections, introduce U-turn volumes, and eliminate left-turn volumes. Truck U-turns are accommodated at signalized intersections with “loons,” wide pavement areas in the shoulder to allow for larger vehicles with wider turning radii. Roundabouts are another method to accommodate the new U-turn volumes.

4.2.2 Intersection Control Evaluation (Phase 1)

In the alternative development process, all intersections were evaluated for ICE applicability. The following intersections met the criteria for ICE applicability:

- Route 114 at Avalon Bay Drive (Signalized)
- Route 114 at Lowes Drive (Signalized)
- Route 114 at Walmart Driveway (Signalized)
- Route 114 at Brooksby Village Drive (Signalized)

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- Route 114 at Palmer Avenue and Peabody Place Driveway (Signalized)
- Route 114 at Sylvan Street and Prospect Street

Each intersection location was reviewed using the Federal Highway Administration (FHWA) CAP-X tool to determine which types of intersection controls provided acceptable operations. All intersection control strategies from the Stage 1 ICE were considered.

Table 14: CAP-X Review of High-Level Intersection Control Evaluation

Intersecting Roads with Route 114	Avalon Bay Drive	Lowes Drive	Garden Street	Walmart Driveway	Brooksby Village Drive	Palmer Avenue	Sylvan Avenue
Two-way Stop Control	X	X	X	N/A	X	X	X
Signalized Control	✓	✓	✓	✓	✓	✓	✓
Roundabout (1 N-S Lane)	✓	✓	X	✓	✓	✓	X
Roundabout (2 Lanes)	✓	✓	✓	✓	✓	✓	X
Median U-Turn (MUT)	✓	✓	✓	N/A	✓	✓	X
Partial Median U-Turn (PMUT)	✓	✓	✓	N/A	✓	✓	✓
Restricted Crossing U- Turn (RCUT) Signalized	✓	✓	✓	✓	✓	✓	X
Restricted Crossing U- Turn (RCUT) Unsignalized	X	X	X	X	✓	X	X
Displaced Left- Turn (DLT)	✓	✓	✓	N/A	✓	✓	✓
Continuous Green Tee	N/A	N/A	N/A	✓	N/A	N/A	N/A

Roundabouts were evaluated along the Route 114 corridor for their potential traffic operations and safety benefits, despite their significant right of way (ROW) impacts. Because roundabouts and signalized intersections needed to be considered in the context of the entire corridor rather than in isolation, only the Palmer Avenue and Sylvan Street intersections were evaluated independently due to their greater distance from adjacent intersections.

However, roundabouts were not advanced at certain locations due to site constraints. A roundabout was ruled out at the Walmart Driveway and Brooksby Village Drive intersections because of their close proximity to each other, with the Brooksby Village Drive intersection

facing additional challenges due to the adjacent Crane Brook culvert. At the Sylvan Street intersection, the CAP-X tool indicated the roundabout would be over capacity, and a SIDRA analysis confirmed that operations would not meet acceptable levels.

In addition to roundabouts, other specialized intersection treatments were also evaluated for feasibility along the corridor. Specialized U-turn intersections such as Median U-turn (MUT), Partial Median U-turn (PMUT) and Reduced Conflict U-turn (RCUT) intersections were judged to be impractical due to the proximity of adjacent intersections, limited ROW, and abutter concerns. “Jughandle” or Displaced Left Turn, Continuous Green Tee, and Quadrant Roadway intersection types were also ruled impractical due to right of way and abutter concerns.

5. Alternatives Analysis

Alternatives 1 and 2 were developed to address the study goals. This section analyzes the corridor wide safety, operations, and cost of each Alternative in Section 3.6 Corridor-Level Analysis. The roadway geometry, pedestrian/bicycle, and environmental considerations of each alternative are then examined for three distinct segments, grouping areas where similar design updates were applied: Section 5.3 Segment 1 – Avalon Bay Drive to Garden Street, Section 5.4 Segment 2 – Danvers Rail Trail to Palmer Avenue, and Section 5.5 Segment 3 – Palmer Avenue to Sylvan Street.

5.1 Alternative Descriptions

5.1.1 Alternative 1

Alternative 1 proposes the replacement of the 14-foot wide, left-turn lane down the center of Route 114 with a 6-foot-wide mulch median. Roundabouts replace three of the seven signalized intersections. The proposed roundabouts are located at the intersections of Route 114 and Avalon Bay Drive, Garden Street, and Palmer Drive.

Alternative 1 also proposes improvements to pedestrian and bicycle facilities throughout the corridor. A 6-foot-wide concrete sidewalk is proposed primarily along the north side of Route 114 and a 10-foot-wide HMA shared-use path with a 5-foot-wide landscape buffer is proposed primarily along the south side of Route 114.

5.1.2 Alternative 2

Alternative 2 proposes the replacement of the 14-foot wide left-turn lane down the center of Route 114 with a 2-foot-wide double-faced concrete barrier. Alternative 2 proposes loons at several intersections instead of roundabouts to permit truck U-turn movements at intersections. The proposed loons are located at four of the seven existing signalized intersections: Lowe's Driveway, Garden Street, Palmer Avenue, and Sylvan Street.

Alternative 2 also proposes improvements to pedestrian and bicycle facilities throughout the corridor. A 6-foot-wide concrete sidewalk is proposed primarily along the north side of Route 114. An 8-foot-wide hot mix asphalt (HMA) shared-use path with a 2-foot-wide HMA buffer is proposed primarily along the south side of Route 114.

5.2 Corridor-Level Analysis

The two alternatives were analyzed at the corridor level to estimate the resulting traffic volumes, traffic operations, safety implications, and estimated costs. The two alternatives were analyzed at the corridor level to estimate resulting traffic volumes, traffic operations, safety implications, and project costs. Collecting traffic volume data is essential to understanding current travel patterns and forecasting future demand. This information helps determine how each alternative would impact congestion, intersection performance, and overall corridor efficiency, providing a basis for comparing the effectiveness and feasibility of each option

5.2.1 Corridor Traffic Volumes

Figure 30 and Figure 31 below show the new volume patterns for Alternatives 1 and 2, respectively. It should be noted that east of Brooksby Village Drive the volumes are the same for each alternative. West of Brooksby Village Drive, the volumes at Lowe's Driveway, and Sheldon Avenue intersections are altered to accommodate roundabouts at the Avalon Bay Drive and Garden Street intersections. Appendix C contains a detailed breakdown of the traffic volumes that were displaced by the addition of the center median for all roadways in the study area as well as the major driveways for abutters along Route 114.

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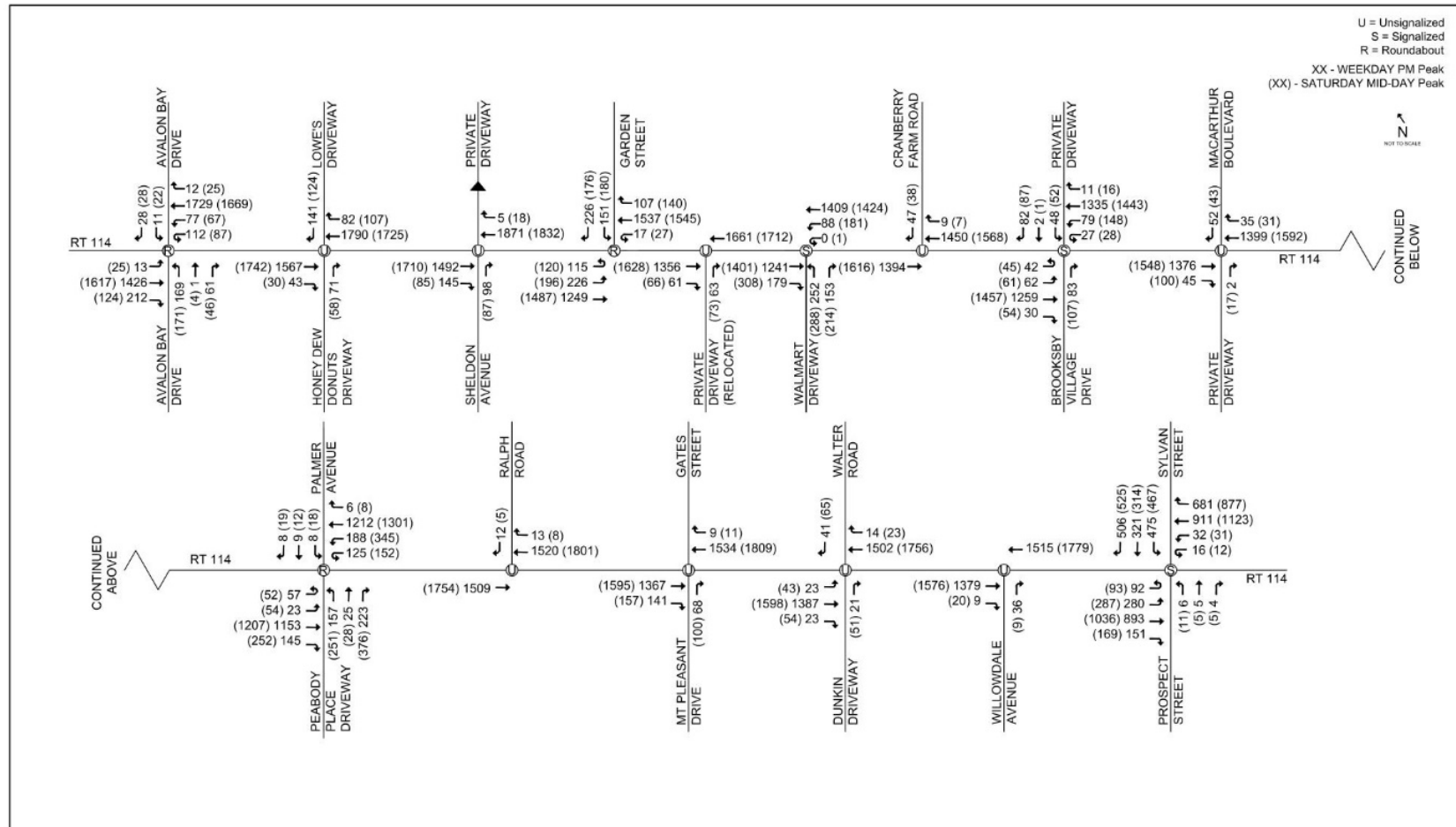


Figure 30. 2034 Build - Alternative 1 Volumes

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

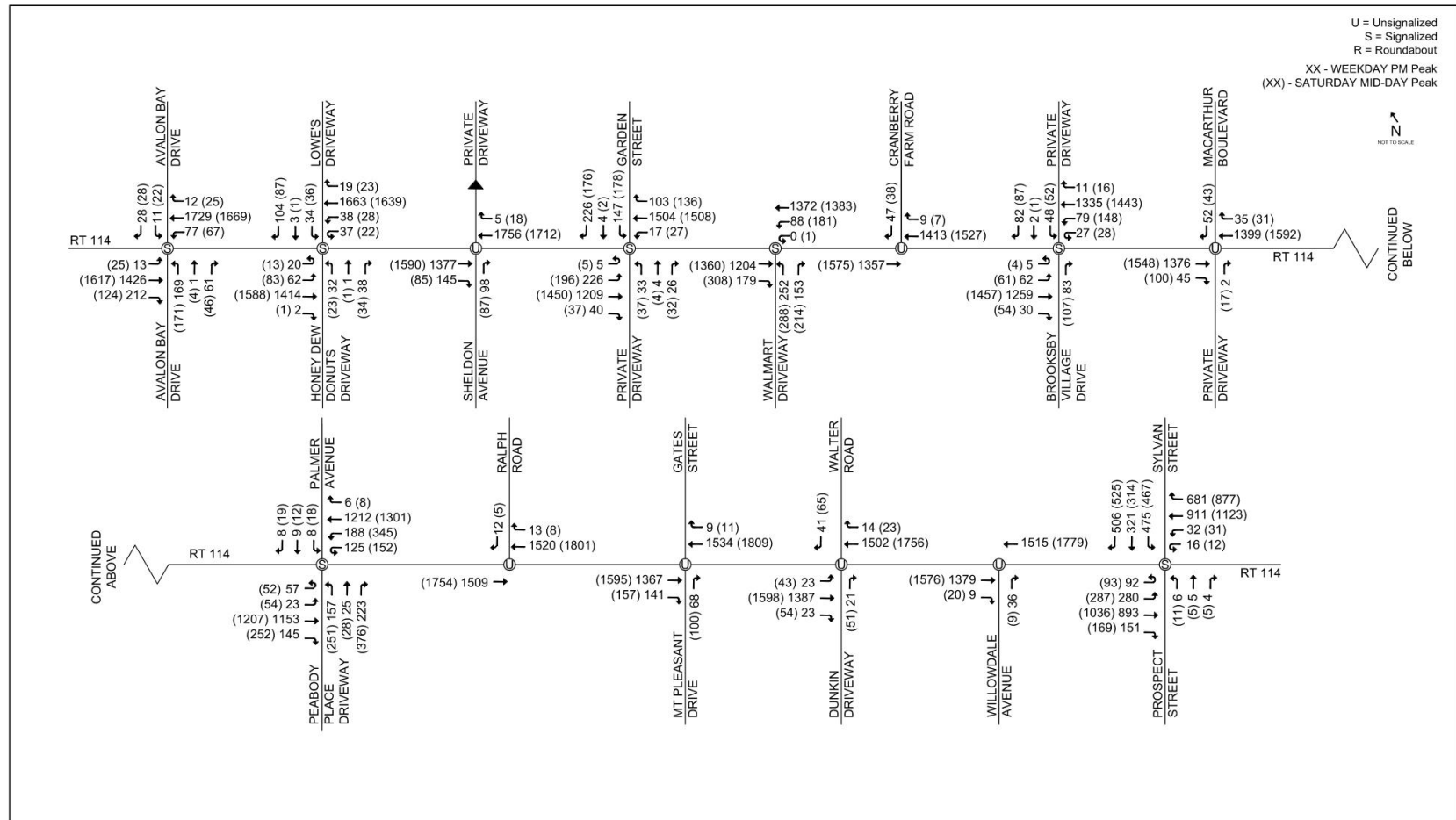


Figure 31. 2034 Build - Alternative 2 Volumes

5.2.2 Safety Analysis

To address the issues previously identified, both proposed Alternatives include new sidewalks, signalized crosswalks, and a shared-use path to improve safety for pedestrians and bicyclists. Traffic signal updates and optimization are also proposed at all signalized intersections to introduce protected left-turn phases and emergency vehicle preemption, enhancing overall safety and operations.

Both Alternatives include a center median along Route 114 which would be expected to increase safety and reduce left-turn and head-on collisions. The center median eliminates the existing two-way left-turn lane and limits access from side-streets and driveways by preventing left turns across Route 114. While the raised median does not change the overall roadway width, it may contribute to reduced vehicle speeds by providing a more defined roadway edge and potential traffic calming effects. The Crash Modification Factor (CMF) for raised medians indicates a positive correlation with crash reduction across all severity levels, demonstrating its usefulness as a safety countermeasure. Additionally, narrower lanes are proven to reduce speeds by creating a psychological impact of a more constrained or constricted condition resulting in more cautious driving and slower speeds. By adding a shoulder line marking and by restriping narrower travel lanes drivers would experience a narrower space, resulting in more cautious driving.

5.2.3 Cost Analysis

5.2.3.1 Summary

A Rough Order of Magnitude (ROM) Construction Cost Estimate was prepared for the two Alternatives using MassDOT's "Weighted Average" unit prices and recent MassDOT construction contracts for the standard items. Detailed construction cost estimates are provided in Appendix F.

Alternative 1 estimated construction cost:

- \$22,380,000 (including contingency)
- \$35,080,000 (including contingency, right of way, and escalation)

Alternative 2:

- \$20,800,000 (including contingency)
- \$30,620,000 (including contingency, right of way, and escalation)

Focusing on the estimated base construction cost, including contingency, Alternative 1 would be approximately \$1.6 million more expensive than Alternative 2. The main drivers of the price

gap include the additional excavation, roadway widening, and culvert extension required for the roundabout and shared-use path configuration.

Additionally, the estimated right of way takings differ between the Alternatives. Alternative 1 would require the taking of approximately 41,600 square feet more right of way than Alternative 2. For these estimates, the right of way cost is valued at a unit price of \$50 per square foot in 2024 dollars.

In total, Alternative 1 is estimated to cost approximately \$4.46 million more than Alternative 2 when accounting for construction, right of way, and escalation.

5.2.3.2 Study Area Scope

The estimates include all labor, equipment, and material to perform the main scope of work listed below.

- Roadway widening
- New pavement
- Milling
- Shared-use path
- Sidewalks and curb
- Mulched medians
- Median barriers
- Signalized crossings and intersections
- Signage
- Roundabouts (Alternative 1 only)
- Pavement markings
- Drainage
- Culvert modification/extension

5.2.3.3 Utility Relocations Methodology

The cost estimates developed are unit price-based estimates. The estimates are considered a Class IV estimate as defined by the Association for Advancement of Cost Engineering International (AACE). Class IV estimates support strategic planning, business development, project screening, alternative analysis, feasibility confirmation, and preliminary budget approval.

5.2.3.4 Estimate Basis and Assumptions

The cost estimates were prepared under the following basis and assumptions:

- General
 - The estimates are based on historical unit cost rates for similar work.
 - The estimate prices have been priced in 2024 dollars.
 - The estimates include right of way costs priced at \$50 per square foot in 2024 dollars.
 - The unit prices include general contractor mark-ups including profit, insurance, permits, and home office overhead.
- Earthwork
 - Earthwork excavation and excavation backfill quantities assume 1'-0" depth for excavation.
 - It is assumed that 75% of the excavated material would be unregulated soil, meaning it would be clean and could be reused on-site or disposed of without special handling. The remaining 25% would be expected to be regulated soil, which requires proper disposal per environmental regulations. Regulated soil is considered contaminated with levels of pollutants exceeding regulatory limits, meaning its handling, transport, and disposal are subject to specific rules and regulation. Regulated soil is often disposed of at out-of-state facilities and subject to testing, therefore the unit price for disposal of regulated soil is much higher than that of unregulated soil.
 - The quantity for Fine Grading and Compacting Subgrade includes the areas of full depth widening, raised concrete islands, new sidewalks, the shared-use path, and roundabouts. Mill and Overlay unit prices include fine grading.
- Roadways and Traffic
 - Except for the areas of full depth widening, it is assumed that all roadways within the project limits would be milled and paved.
 - Granite curb and granite curb edging quantities assume that existing materials would be reused.
 - Guardrail Separation at the shared-use path quantity assumes that guardrail would only be installed in areas where the shoulder is 2'-0" wide or less (Alternative 2 only).
 - It is assumed that all traffic signals, including the signals at the intersection of Andover Street and Sylvan Street, would be replaced.

5.2.3.5 Contingency

The estimate includes a contingency of 30% of the estimated cost of construction. A contingency is the additional amount added to the estimate to account for errors, omissions, risks, and uncertainties. Design Contingency is a value included in a project estimate which is intended to account for the anticipated cost increases as design progresses. The allocated

contingency will decrease with each design submission as detail increases and uncertainty decreases. Therefore, the design contingency amount should be highest at planning stages and be reduced to zero at final design once all project elements have been identified and estimated. This amount is applied when entering the estimate in the Contract Advertising and Planning Estimator (CAPE) and is based on design maturity. Contingency is also defined at the estimated cost to cover risk or uncertainty.

5.2.3.6 Escalation

The estimate includes escalation to the mid-point of construction at 4% per year to 2029.

5.2.3.7 Exclusions

- Design engineering costs
- Owner management and inspection costs
- Permitting costs
- Weather delays
- Overtime premiums
- State sales tax
- State police details
- Additional soft costs not mentioned above

5.2.4 Alternative Operations Analysis

The study evaluated how well intersections in the study area would manage traffic during the Weekday Evening Peak hour and Saturday Mid-Day Peak hour under each proposed alternative. The analysis uses Synchro 11 software, which is based on the 6th Edition Highway Capacity Manual (HCM).

However, because the standard HCM methods do not fully account for signal timing with respect to non-standard dual ring phasing or pedestrian phases, the study used older 2000 HCM methodologies for this analysis. Additionally, roundabout operations for the build conditions were analyzed separately using SIDRA Intersection 9 software to better understand how traffic would flow through these locations.

Level of Service (LOS) is defined in terms of the average total vehicle delay of all movements through an intersection, and delay is measured based on multiple variables including signal phasing, signal cycle length, and traffic volumes with respect to intersection capacity. Table 12 includes the LOS criteria as defined by Exhibit 18-4 and 19-1 of the 6th Edition HCM.

Table 15: Level of Service Criteria for Intersections

LOS	Signalized Avg. Control Delay (sec/veh)	Unsignalized Avg. Control Delay (sec/veh)	Description
A	< 10	< 10	Free flow
B	> 10 - 20	> 10 - 15	Stable flow (slight delays)
C	> 20 - 35	> 15 - 25	Stable flow (acceptable delays)
D	> 35 - 55	> 25 - 35	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	> 55 - 80	> 35 - 50	Unstable flow (intolerable delay)
F	> 80	> 50	Forced flow (jammed)

Because unsignalized intersections have lower delay thresholds than signalized intersections, this analysis applies signalized intersection Level of Service (LOS) criteria to all roundabout locations. This ensures a fair comparison between signalized and roundabout intersections. Alternative 1 includes roundabouts, while Alternative 2 includes only signalized intersections. Table 2 provides the full capacity analysis for both Alternatives, and full intersection capacity results can be found in Appendix C.

Table 16: Alternatives 1 and 2 Build (2034) Capacity Analysis Summary

Intersection	No-Build				Alternative 1				Alternative 2			
	Weekday Evening Peak Hour		Saturday Mid-Day Peak Hour		Weekday Evening Peak Hour		Saturday Mid-Day Peak Hour		Weekday Evening Peak Hour		Saturday Mid-Day Peak Hour	
	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)	Overall LOS	Delay (seconds)
Route 114 at Sylvan Street (Signalized)	E	61.6	D	42.8	D	41.9	D	52.7	D	41.9	D	52.7
Route 114 at Willowdale Avenue (Unsignalized)	A	0.3	A	0.1	A	0.2	A	0.0	A	0.2	A	0.0
Route 114 at Walter Road (Unsignalized)	A	2.5	B	11.5	A	0.5	A	1.0	A	0.5	A	1.0
Route 114 at Mt. Pleasant Drive/Gates St. (Unsignalized)	A	1.0	A	0.9	A	0.4	A	0.8	A	0.4	A	0.8
Route 114 at Ralph Road (Unsignalized)	A	0.1	A	0.1	A	0.1	A	0.0	A	0.1	A	0.0
Route 114 at Palmer Drive/Peabody Pl. Driveway (Signalized)	C	20.7	C	31.9	B	18.3	E	63.3	C	29.6	D	54.4
Route 114 at MacArthur Boulevard (Unsignalized)	A	0.5	A	0.7	A	0.3	A	0.4	A	0.3	A	0.4
Route 114 at Brooksby Village Drive (Signalized)	B	16.6	C	31.3	C	22.9	C	30.0	C	22.5	X	21.7
Route 114 at Cranberry Farm Road (Unsignalized)	A	0.3	A	0.3	A	0.3	A	0.2	A	0.3	A	0.2
Route 114 at Walmart Driveway (Signalized)	B	17.9	F	108.8	C	33.9	D	40.1	C	28.6	F	80.6
Route 114 at Garden Street (Signalized)	F	88.0	F	156.6	C	23.9	C	26.7	E	67.6	D	53.3
Route 114 at Sheldon Avenue (Unsignalized)	A	4.2	A	0.6	A	0.7	A	0.6	A	0.6	A	0.6
Route 114 at Lowe’s Driveway (Signalized)	B	10.0	A	8.1	A	2.0	A	1.5	C	12.8	A	10.0
Route 114 at Avalon Bay Drive (Signalized)	B	16.3	B	17.1	C	21.6	C	22.3	C	19.0	C	22.6

The analysis considers how pedestrian signal timing and traffic signal coordination would function under each Alternative. The analysis for both Alternatives assumes an exclusive pedestrian phase for all signalized intersections except for the Sylvan Street intersection, which remains unchanged and continues to operate with a concurrent pedestrian phase. Exclusive pedestrian phases were at other locations to improve pedestrian safety, particularly due to high turning vehicle volumes at all locations. In Alternative 2, traffic signals are coordinated between the Avalon Bay Drive to the Brooksby Village Drive intersections to enhance traffic flow. However, traffic coordination was not included for the Palmer Avenue or Sylvan Street intersections because they are too far from other signalized intersections to benefit from synchronization.

The capacity analysis for Alternative 1 in Table 2 evaluates how intersections would operate with the proposed changes, including new roundabouts, signalized intersections, and access restrictions. The capacity analysis for Alternative 1 in Table 2 includes intersection operations for the three proposed roundabout locations: Palmer Drive, Garden Street, and Avalon Bay Drive. The Lowes Driveway and Sheldon Street intersections are proposed to be unsignalized, right-in/right-out intersections because the cross section for Alternative 1 includes a continuous median through these locations, which would eliminate left-turn movements. The Walmart Driveway and Brooksby Village Drive intersections would remain signalized but would not be coordinated because the proposed roundabouts would replace the signalized intersections along the corridor to the west. Other changes at these locations would include traffic signal optimization and the addition of an eastbound right-turn lane at the Walmart Driveway intersection to better manage eastbound queues and prevent spillback into the upstream Garden Street roundabout to the west. This eastbound right-turn lane at Walmart was not included in Alternative 2, which proposes signalizing the Garden Street intersection.

Intersection operations were analyzed for both alternatives to determine how traffic would perform compared to the No-Build condition. The results indicate that some locations improve due to intersection design changes, while others worsen or remain constrained due to traffic volume and turning movement patterns. The analysis focuses on peak-hour conditions for both the Weekday Evening Peak Hour and Saturday Mid-Day Peak Hour.

Alternative 1: Operations Compared to No-Build

Intersections that improve or stay the same under Alternative 1:

- Sylvan Street Intersection: Improves from LOS E to LOS D during the Weekday Evening Peak hour and remains LOS D during the Saturday Mid-Day Peak hour.
- Garden Street Intersection: Improves from LOS F to LOS C in both peak periods with the proposed roundabout.

Intersections that show mixed results (some improvement and some worsening):

- Palmer Avenue Intersection:
 - Weekday Evening Peak: Improves from LOS C to LOS B with the roundabout.
 - Saturday Mid-Day Peak: Worsens from LOS C to LOS D due to high volumes on Peabody Place Driveway, but overall operations are more balanced and avoid individual movements at LOS F.
- Avalon Bay Drive Intersection:
 - Both Peak Periods: Worsens slightly from LOS B to LOS C, largely due to increased U-turn volumes caused by the center median.
- Walmart Driveway Intersection:
 - Weekday Evening Peak: Worsens slightly from LOS B to LOS C but remains acceptable.
 - Saturday Mid-Day Peak: Improves significantly from LOS F to LOS D due to the eastbound right-turn lane.

Alternative 2: Operations Compared to No-Build

Intersections that improve or stay the same under Alternative 2:

- Sylvan Street Intersection: Improves from LOS E to LOS D in the Weekday Evening Peak hour due to traffic signal optimization.
- Garden Street Intersection: Improves from LOS F to LOS E (Weekday Evening Peak) and LOS D (Saturday Mid-Day Peak) due to signal coordination with adjacent intersections.

Intersections that show mixed results (some improvement and some worsening):

- Palmer Avenue Intersection:
 - Weekday Evening Peak: Maintains LOS C (no change).
 - Saturday Mid-Day Peak: Worsens from LOS C to LOS D due to new traffic patterns caused by the median.
- Brooksby Village Drive and Walmart Drive Intersection:
 - Weekday Evening Peak: Worsen slightly from LOS B to LOS C due to traffic shifts but remain stable in the Saturday Mid-Day Peak.
- Avalon Bay Drive Intersection:
 - Both Peak Periods: Worsens slightly from LOS B to LOS C despite traffic signal optimization, as signal timing adjustments were made to improve coordination along the corridor.

Alternative 1 results in greater operational improvements than Alternative 2 due to the conversion of key intersections into roundabouts, particularly at Garden Street and Palmer Avenue. While some locations experience slight LOS reductions in one time period, the

roundabouts in Alternative 1 generally provide more balanced operations, preventing individual movements from reaching LOS F.

By contrast, Alternative 2 relies on traffic signal optimization and coordination rather than intersection redesigns. While this results in some operational improvements at locations like Sylvan Street and Garden Street, the overall changes are less significant than in Alternative 1. Additionally, some intersections, including Avalon Bay Drive—experience minor LOS reductions due to signal timing modifications to improve corridor-wide traffic flow.

5.2.5 Environmental Effects Analysis

An environmental desktop analysis of the study area was performed to determine the presence or absence of environmental resources and/or constraints. The Alternatives were evaluated with existing environmental conditions to identify preliminary impacts and permitting requirements. Figure 32 identifies potential environmental constraints in the study area.

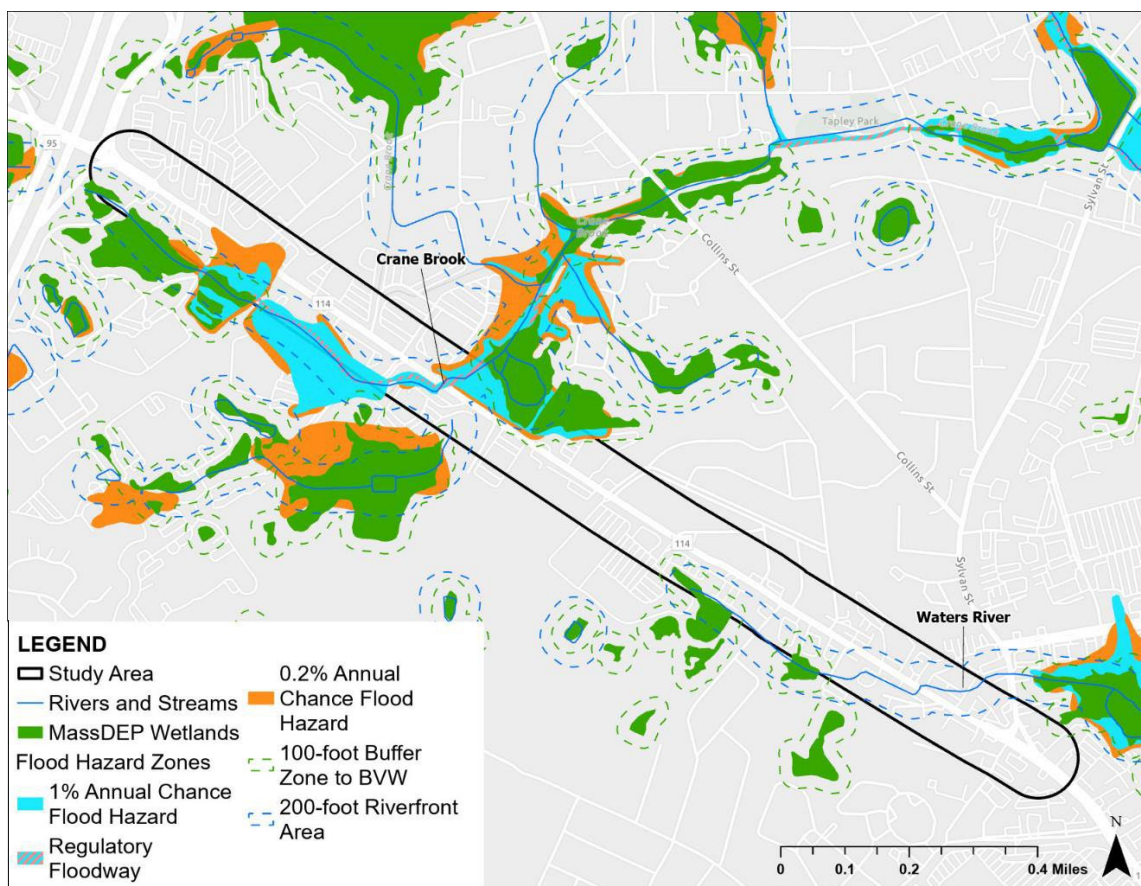


Figure 32. Route 114 Study Area Environmental Constraints

5.2.5.1 Wetland Resource Areas

Crane Brook and Waters River are perennial streams within the Route 114 study area. Crane Brook flows parallel to Route 114, approximately 300 feet south of the state highway layout (SHLO) and is culverted under Route 114 just east of Judith Road. Waters River is also culverted under Route 114, just west of Sylvan Road.

Based on the conceptual design, both Alternatives would require authorization under the Massachusetts Wetlands Protection Act (MA WPA) and its implementing regulations (310 CMR 10.00) due to work within the 100-foot buffer zone to Bordering Vegetated Wetlands (BVW), 200-foot riverfront area (RFA), Bordering Land Subject to Flooding (BLSF), Bank, and Land Under Water (LUW) associated with Crane Brook and Waters River. As such, both Alternatives would require the issuance of an Order of Conditions from the local Conservation Commission to ensure compliance with the MA WPA.

Additionally, work for both Alternatives are expected to impact Crane Brook, which is federally protected under Sections 401 and 404 of the U.S. Clean Water Act (US CWA). Because both Alternatives would result in less than 5,000 square feet (sf) of cumulative impacts to vegetated wetlands and bank, it is anticipated that the Order of Conditions issued by the local Conservation Commission would serve as the Water Quality Certificate to satisfy Section 401 compliance. Section 404 compliance would be met through the submittal of a Pre-Construction Notification to the US Army Corps of Engineers (USACE) under General Permit 23 of the 2023 General Permits for the Commonwealth of Massachusetts.

For Waters River, neither Alternative would be expected to result in impacts to resources subject to the US Clean Water Act. Therefore, no permitting under Section 401 or Section 404 would be anticipated for Waters River.

5.2.5.2 Floodways and Floodplain

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Essex County (Map No. 25009C0412F, effective 07/03/2012), portions of the Route 114 corridor near Garden Street are located within Zone AE (areas subject to inundation by the 1-percent annual chance flood event with a defined base flood elevation [BFE]) and Zone X (areas subject to inundation by the 0.2-percent annual chance flood event without a defined base flood elevation). According to FEMA, any place with a 1-percent or higher chance of experiencing a flood each year is identified as a Special Flood Hazard Area (SFHA). At this desktop level assessment, it is presumed that the FEMA Flood Zone AE is coincident with and regulated as BLSF under the MA WPA.

Additionally, according to the FEMA FIRM, a regulatory floodway associated with Crane Brook is culverted beneath the Route 114 corridor. The National Flood Insurance Program (NFIP) regulations (44 CFR § 60.3(d)(3)) prohibit encroachments, including fill, new construction, substantial improvements and other development within the regulatory floodway unless it has been demonstrated that the proposed encroachment would not result in any increase in flood-levels during the 100-year flood discharge. An engineering analysis must be conducted before a permit can be issued for the project, documenting that the project would not impact the BFE, floodway elevations, or floodway widths.

As discussed in Section 2.1, the proposed cross section for Alternative 1 would require the extension of the existing Crane Brook culvert headwall by 10-feet on the south side of Route 114. While Alternative 2 proposes narrowing the shared-use path to 8-feet, it is anticipated that the design would require minor reconstruction of the Crane Brook culvert to accommodate the updated cross section. Any work for either Alternative occurring below the BFE of the regulatory floodway would require a no-rise analysis to confirm that the design would not result in an increase in flood heights. The extent of proposed work below the BFE of the regulatory floodway would be identified for each Alternative as the design progresses. The No-Rise Certification must be completed before permits can be issued.

5.2.5.3 Additional Environmental Considerations

The study area is not located within Priority and/or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP) or an Area of Critical Environmental Concern (ACEC). The site does not contain any structures listed in the State or National Register of Historic Places.

Because the project is proposed and funded by MassDOT, the selected Alternative must be evaluated in light of Massachusetts Environmental Policy Act (MEPA) review thresholds. If the proposed Alternative requires federal agency action, such as funding or permitting, the project must be evaluated in accordance with the National Environmental Policy Act (NEPA).

5.3 Segment 1 –Avalon Bay Drive to Garden Street

5.3.1 Alternative 1 in Segment 1

The concept design for Alternative 1 from Avalon Bay Drive to Garden Street is presented in Figure 33.

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

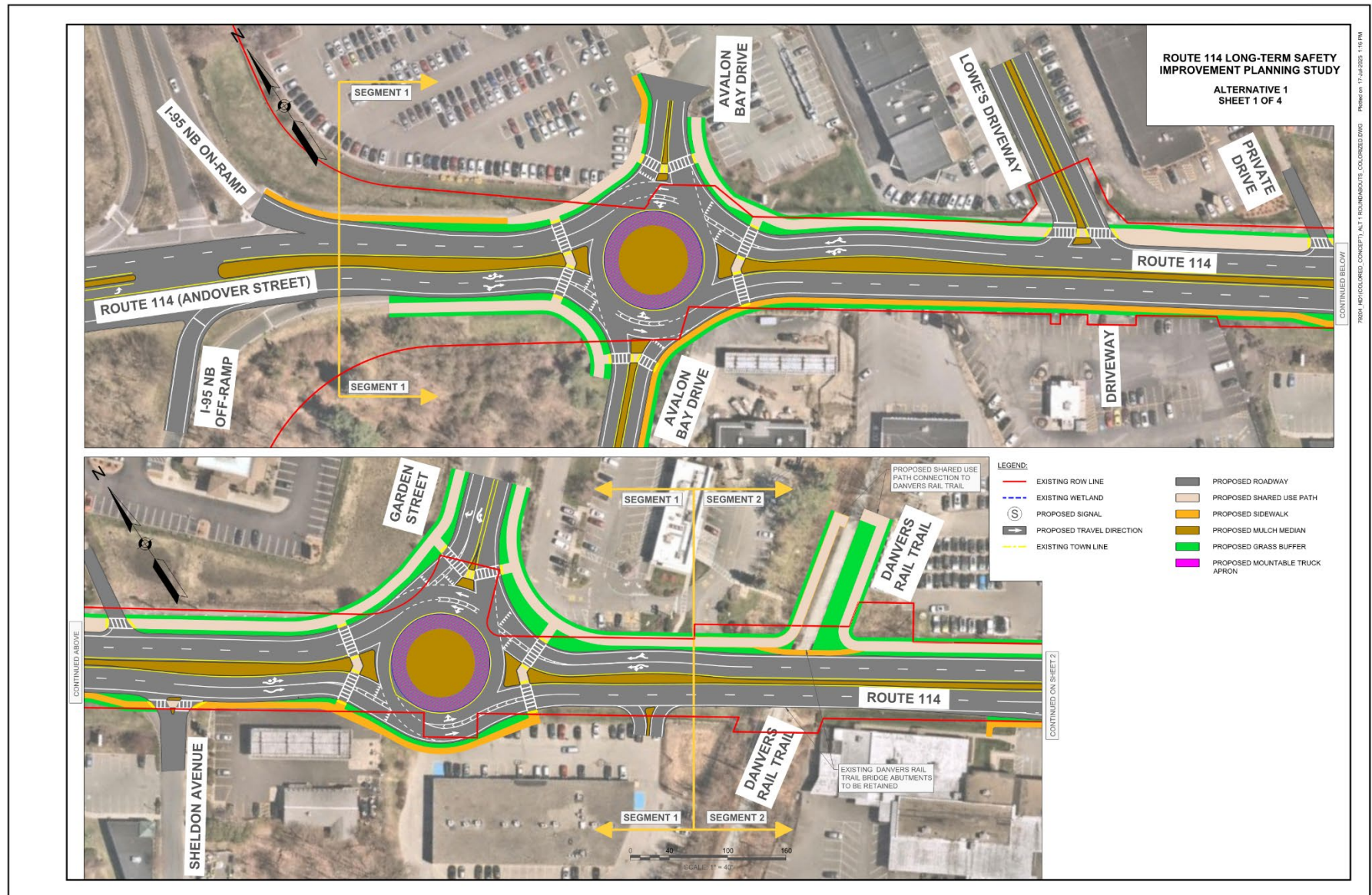


Figure 33. Avalon Bay Drive to Garden Street, Alternative 1

5.3.1.1 Roadway Facility Description

To improve safety and reduce conflict points along Route 114, Alternative 1 replaces the existing two-way left-turn lane with a raised median, controlling left-turn movements and reducing angle crashes, which are a primary cause of collisions in the corridor. The proposed median extends between Avalon Bay Drive and Garden Street, ensuring a safer separation between opposing travel lanes and restricting direct left-turn access to commercial properties. Drivers needing to make left turns would be directed to use roundabouts, signalized intersections, or designated U-turn locations to complete their movements.

To enhance traffic flow and manage turning movements more efficiently, Alternative 1 introduces multi-lane roundabouts at Avalon Bay Drive and Garden Street. These roundabouts replace existing signalized intersections, improving traffic efficiency, and reducing delays. The Avalon Bay Drive roundabout features two through lanes for Route 114 traffic, with one-lane entrances and exits for north and south street connections. The Garden Street roundabout also maintains two through lanes for Route 114, with a two-lane entrance and a one-lane exit at Garden Street. To minimize property impacts, the southern leg of the Garden Street roundabout was omitted, requiring the driveway access to 136 Andover Street Shopping Center to be relocated approximately 200 feet east as a right-in/right-out driveway.

To accommodate these improvements, some existing infrastructure would be modified or removed. A gas station driveway near Avalon Bay Drive would be impacted by the roundabout, but an alternative access point to the south would be available. Existing traffic signals, traffic cabinets, utility poles, and landscaped signage within the project limits would also be removed to facilitate the new roadway configuration.

To improve multimodal accessibility, Alternative 1 incorporates pedestrian and bicyclist infrastructure upgrades. A shared-use path is planned along the north side of Route 114, utilizing the available space from a third travel lane that was removed in 2023 between Garden Street and Avalon Bay Drive. This alignment provides a safer and more direct connection to the Danvers Rail Trail. A sidewalk is planned along the south side of Route 114, designed to minimize property and parking lot impacts. At the Garden Street intersection, the sidewalk shifts to the north to further enhance connectivity to the rail trail.

The overall roadway cross-section is designed to balance safety, mobility, and accessibility. The proposed pavement width is approximately 62 feet from curb to curb, accommodating two 11-foot-wide travel lanes in each direction, 2-foot-wide inside shoulders, and a 6-foot-wide mulch median. Outside shoulders vary between 4 feet and 2 feet, depending on constraints from utilities and available right-of-way. See Figure 27 of Section 4.1.

5.3.1.2 Pedestrian and Bicycle Facility Description

To enhance pedestrian and bicyclist safety, Alternative 1 introduces continuous and dedicated pedestrian and bicycle infrastructure along Route 114, ensuring improved connectivity, safer crossings, and strategic design to accommodate right-of-way constraints. These improvements aim to reduce conflicts between vehicles and non-motorized users, support multimodal travel, and provide better access to key destinations such as the Danvers Rail Trail.

To establish a safe and connected walking and biking network, Alternative 1 proposes a 6-foot sidewalk along the north side and a 10-foot shared-use path with a 5-foot buffer along the south side, stretching from the western extent of the corridor to Avalon Bay Drive. The northern sidewalk would tie into the existing pedestrian network westward, connecting to the sidewalk that crosses the I-95 ramp and continues to Newbury Street (Route 1). Eastward, the sidewalk would connect to a new crosswalk across the southbound approach of Avalon Bay Drive. Meanwhile, the shared-use path on the south side would terminate approximately 100 feet before the I-95 NB Off-Ramp and would connect eastward to a crosswalk across Avalon Bay Drive's northbound approach. Between Avalon Bay Drive and Garden Street, the shared-use path transitions to the north side of Route 114, while a 6-foot sidewalk continues along the south side, ensuring uninterrupted access for pedestrians and cyclists.

To improve pedestrian safety at key intersections, Alternative 1 incorporates two-stage crossings, pedestrian refuge islands, curb extensions, and Pedestrian Hybrid Beacons (PHBs) to shorten crossing distances, enhance visibility, and reduce pedestrian exposure to traffic. At both Avalon Bay Drive and Garden Street, roundabouts feature splitter islands that function as pedestrian refuges, allowing pedestrians to cross one direction of traffic at a time. PHBs would be installed at crossings with multiple lanes to alert drivers to the presence of pedestrians. At Lowe's Driveway, the removal of the existing traffic signal is mitigated by a new median with a pedestrian refuge island, while curb extensions on the northwest and northeast corners shorten pedestrian crossing distances. Additional crosswalks at Private Drive and Sheldon Avenue maintain continuous pedestrian and bicycle access across the corridor. At Garden Street, a curb extension on the northwest corner further shortens crossing distances at the southbound and eastbound approaches.

To balance connectivity and existing right-of-way constraints near the Danvers Rail Trail bridge, Alternative 1 modifies pedestrian and bicycle accommodations to maintain accessibility. A 10-foot shared-use path with a 5-foot buffer remains on the north side of Route 114, providing formalized and accessible ramps that connect directly to the Danvers Rail Trail. However, due to the constrained space under the bridge, a 6-foot sidewalk replaces the shared-use path in this section, deviating from the shared-use path at Garden Street and reconnecting east of the bridge. Because of space limitations, no pedestrian or bicycle facilities are proposed on the

south side of Route 114 between Garden Street and approximately 250 feet west of Walmart Drive.

5.3.2 Alternative 2 in Segment 1

The concept design for Alternative 2 from Avalon Bay Drive to Garden Street is presented in Figure 34.

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

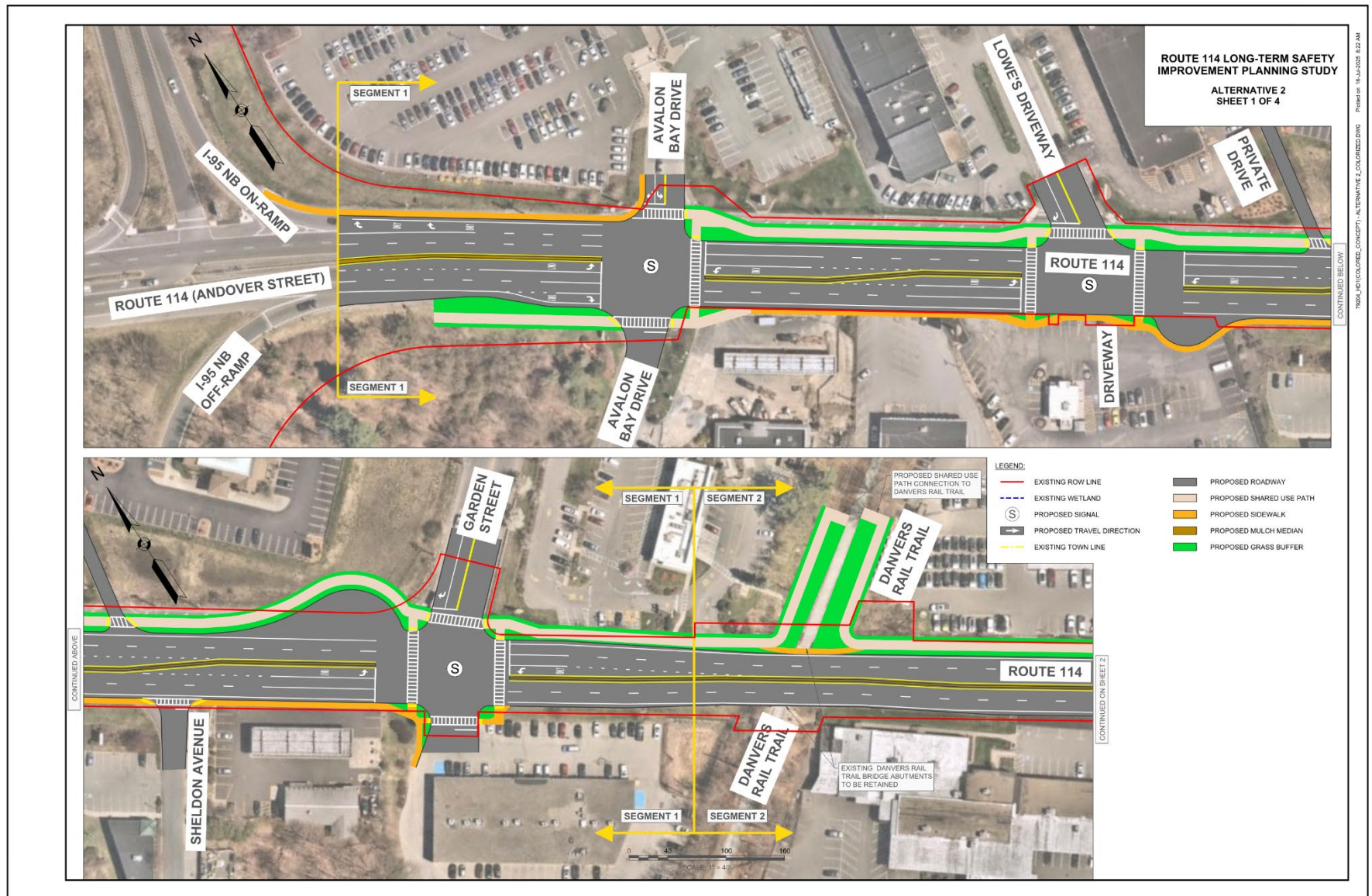


Figure 34. Avalon Bay Drive to Garden Street, Alternative 2

5.3.2.1 Roadway Facility Description

To improve safety and manage traffic flow along Route 114, Alternative 2 replaces the existing two-way left-turn lane with a double-faced concrete barrier, restricting left-turn movements between signalized intersections. This barrier reduces the risk of angle crashes while maintaining key left-turn opportunities at designated locations. To accommodate vehicles that would otherwise be unable to turn left directly into businesses or side streets, Alternative 2 introduces loon geometry at select intersections. Loons provide additional pavement width, allowing large vehicles to complete U-turns at signalized intersections.

To support these modifications, Alternative 2 proposes a pavement width of approximately 58 feet from curb to curb, accommodating two 11-foot-wide travel lanes in each direction, separated by 2-foot-wide inside shoulders and a concrete barrier. Outside shoulders are typically 4 feet wide but narrow to 2 feet where roadway constraints exist. At key intersections —Avalon Bay Drive, Garden Street, and Lowe’s Driveway —the pavement widens to 68 feet to incorporate 10-foot-wide left-turn lanes, for safe and efficient turning movements. See Figure 28 of Section 4.1.

To maintain access while preventing direct left turns across multiple lanes of traffic, Alternative 2 introduces loon geometry at the intersections with Lowe’s Driveway and Garden Street. The proposed loons are engineered to accommodate WB-67 trucks, which include standard 53-foot semi-trailers used in freight transportation. These U-turn treatments allow both commercial and passenger vehicles to navigate the corridor efficiently despite the left-turn restrictions imposed by the median barrier.

Unlike Alternative 1, which replaces signalized intersections with roundabouts, Alternative 2 retains signalized intersections at Lowe’s Driveway and Garden Street. This ensures continuity for existing traffic control while integrating the median and loon geometry. At Lowe’s Driveway, the signal remains in place, and left turns into Lowe’s and Honey Dew Donuts are still permitted because there is no median at this location. However, left turns into other businesses between signalized intersections would be restricted due to the continuous concrete barrier. The Garden Street intersection also remains signalized, with the southern driveway entrance to 136 Andover Street Shopping Center maintained in its current location, avoiding the need for relocation.

To support multimodal access, Alternative 2 includes pedestrian crosswalks and curb ramps at key intersections, improving walkability along the corridor. Crosswalks are provided across all four legs of the Garden Street intersection and three of the four legs at Lowe’s Driveway. Additionally, curb ramps and a pedestrian crosswalk are included across the Honey Dew Donuts driveway. At Avalon Bay Drive, crosswalks are provided across three of the four legs; however, a crosswalk across the west leg is not included due to the excessive crossing distance of 88 feet

across seven travel lanes. Instead, pedestrians are directed to cross at the southern leg and continue across Route 114 at the eastern leg, where the crossing distance is reduced to 68 feet across five lanes.

5.3.2.2 Pedestrian and Bicycle Facility Description

Alternative 2 proposes the same pedestrian and bicycle facilities as Alternative 1 with a few slight differences to preserve right of way. These modifications are described below.

To preserve space, Alternative 2 proposes reducing the width of the buffer from 5 feet to 2 feet between the shared-use path on the roadway from Garden Street to the Danvers Rail Trail. It also shortens the sidewalk segment providing connectivity under the bridge.

Unlike Alternative 1, which includes roundabouts at Avalon Bay Drive and Garden Street, Alternative 2 retains signalized intersections at these locations and instead proposes loons at Lowe's driveway and Garden Street intersections that provide space for heavy vehicles to make U-turns.

5.3.3 Mobility and Access to Destinations Analysis for Segment 1

5.3.3.1 Vehicle and Truck Access to Destinations

In all segments, both Alternatives would maintain vehicle and truck access to driveways throughout the corridor. However, the addition of a median presents alterations to routing when entering/exiting driveways. In Segment 1, driveways would be restricted to right-in/right-out movements, and in Alternative 1, vehicles would need to use the roundabouts at Avalon Bay Drive and Garden Street to approach some driveways as a right turn movement. In Alternative 1, the existing signalized intersection at the Lowe's Driveway is proposed to be removed and replaced with right-in/right-out movements and traffic would maintain access by using the roundabouts at Avalon Bay Drive and Garden Street. In Alternative 2, vehicles may need to use the loons at the Lowe's driveway and Garden Street to approach some driveways/side-streets as a right-turn movement.

5.3.3.2 Pedestrian and Bicycle Mobility and Access to Destinations

In both Alternatives, a new sidewalk along the south side of Route 114 enhances pedestrian connectivity by providing a continuous and accessible route to key destinations. This improvement expands access to businesses, restaurants, the Danvers Indoor Sports Complex, and residential neighborhoods south of the corridor. Both Alternatives also include new crosswalks across Route 114, improving accessibility between the north and south sides of the corridor. Additionally, the continuation of the sidewalk under the bridge carrying the Danvers

Rail Trail over Route 114 provides a direct pedestrian route, reducing conflicts with cyclists at the Danvers Rail Trail access ramps and ensuring a safer, more efficient connection.

Both Alternatives also introduce a shared-use path along the north side of Route 114, creating a dedicated space for pedestrians and bicyclists that significantly improves safety and mobility. The 10-foot path with a 5-foot buffer provides a wider, more comfortable walking space than the existing 4-foot sidewalk, while also offering a safe, designated route for bicyclists, who currently have no dedicated infrastructure. Additionally, formalized connections to the Danvers Rail Trail improve multimodal access, allowing users to seamlessly transition between Route 114 and the Rail Trail. The narrowed buffer east of Garden Street proposed in Alternative 2 provides a less comfortable facility than Alternative 1 as users are closer to roadway traffic, but overall, the increased connectivity and access to destinations are similar between Alternatives.

Alternative 2 maintains the existing signalized intersections at Avalon Bay Drive and Garden Street, preserving traditional pedestrian crossing signals and push buttons. These signalized crossings offer clear pedestrian phases, providing a predictable crossing environment, especially for individuals with disabilities.

Alternative 1 replaces the existing signalized intersections at Avalon Bay Drive and Garden Street with roundabouts, altering how pedestrians and bicyclists cross the roadway. This change aims to improve traffic flow, reduce conflict points, and enhance safety for all users by slowing vehicle speeds and eliminating left-turn conflicts. By introducing two-stage pedestrian and bicyclist crossings, roundabouts require users to navigate one direction of traffic at a time, helping to increase visibility and reduce exposure to moving vehicles. However, the removal of signalization removes dedicated pedestrian crossing phases, pedestrian signals, and accessible push buttons, which may create challenges for older adults, individuals who are blind, or have other visual impairments. Additionally, crossing delays may vary based on driver yielding behavior and traffic flow, potentially making crossings feel less predictable. To mitigate these concerns, Pedestrian Hybrid Beacons (PHBs) are included as a countermeasure to enhance pedestrian safety at key locations.

5.3.4 Land Use and Economic Development Analysis for Segment 1

As the Route 114 corridor in the study area mostly serves commercial land uses, business access is important when comparing the two Alternatives. Both Alternatives add a hardened median that limits left-turn access for safety along the corridor, but to different degrees.

Alternative 1 removes direct left-turn access to driveways and side streets between Avalon Bay Drive and Garden Street, requiring vehicles to use one of the two roundabouts for U-turns to then turn right into their destination. The removal of the signalized intersection at the Lowe's driveway further restricts mid-corridor access but increases safety by eliminating left-turn

conflicts. This change also removes a pedestrian and bicyclist crossing point across Route 114. While current demand at this crossing is lower than at other intersections, it remains a trade-off between access and safety.

Alternative 2 also restricts vehicular left-turn access to businesses and side streets access with a median, but to a lesser extent than Alternative 1. In contrast, Alternative 2 maintains the signalized intersection at Lowe's Driveway, which allows left turns at that location. This provides an additional U-turn opportunity closer to adjacent businesses and side streets, though left-turn lane storage is limited due to the close spacing of intersections. Alternative 2 provides left-turn lanes for eastbound and westbound vehicular traffic at all three intersections (Avalon Bay Drive, Lowe's Driveway, and Garden Street). Additionally, loons are introduced for heavy vehicle access for eastbound U-turns at the Garden Street intersection to access Private Drive and westbound U-turns at Lowe's Driveway intersection to access Sheldon Avenue.

From a traffic operations perspective, Alternative 2's U-turns at the signalized intersections would require protected left-turn phasing, which would cause more vehicular delays than the roundabouts in Alternative 1. However, Alternative 2 provides more frequent and accessible pedestrian crossings, including crosswalks at Lowe's Driveway, and improving walkability and connectivity for pedestrians and bicyclists.

From a business impact perspective, Alternative 2 minimizes disruptions to business access as compared to Alternative 1 while providing lower overall safety benefits compared to Alternative 1. Additionally, Alternative 1 would remove four parking spaces from different businesses in Segment 1, while Alternative 2 would preserve all existing parking spaces, lessening the impacts on businesses.

5.3.5 Community Effects/Environmental Justice Analysis for Segment 1

Ensuring accessible and inclusive transportation is a key priority in evaluating the two Alternatives, particularly for transportation-disadvantaged populations such as older adults, individuals with disabilities, and households without vehicles, as well as MA-defined Environmental Justice (EJ) populations. The study area includes two EJ-designated block groups in Peabody near the Danvers town line. Block Group 2 (Census Tract 2103.01) has a minority population of 33% and qualifies under the EJ minority criteria,⁴⁶ while Block Group 4 (Census Tract 2103.02) qualifies based on its median household income of \$53,450.⁴⁷

⁴⁶ EJ Minority classification is defined as minorities make up 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

⁴⁷ EJ Income classification is defined as the annual median household income is 65 percent or less of the statewide annual median household income.

Additionally, the community has a higher proportion of older adults (34.6%) than the state average (16.5%), a higher percentage of residents with disabilities (18.8% vs. 11.7% statewide), and a greater share of zero-vehicle households (16.5% vs. 12.2% statewide).⁴⁸

Both alternatives enhance mobility for these populations by introducing ADA-compliant pedestrian facilities, improved multimodal access, and safety-focused design elements. The removal of the existing two-way left-turn lane and addition of a 6-foot-wide median with controlled breaks at key intersections would significantly reduce unsafe mid-block crossings and U-turns, improving conditions for all travelers. The wider sidewalks, new shared-use path, and protective buffers would create a safer and more comfortable environment for pedestrians, bicyclists, and mobility device users. These improvements particularly benefit EJ populations and households without vehicles by providing continuous, protected connections to businesses, housing developments, and the Danvers Rail Trail.

Alternative 1 enhances pedestrian safety by introducing roundabouts at Avalon Bay Drive and Garden Street, which calm traffic and lower vehicle speeds. This results in safer and more comfortable crossings for older adults, individuals with disabilities, and mobility device users. The roundabouts also feature two-stage pedestrian crossings, pedestrian refuge islands, and PHBs to improve visibility and allow pedestrians to cross one direction of traffic at a time. A potential drawback is the removal of traditional pedestrian signals and push buttons, which may pose challenges for individuals with visual impairments. PHBs serve as an additional countermeasure to help address this concern.

Alternative 2 retains signalized intersections at Avalon Bay Drive, Lowe's Driveway, and Garden Street, maintaining pedestrian crossing phases and push buttons, which are particularly beneficial for visually impaired pedestrians. However, compared to Alternative 1, crossing distances are longer, and fewer pedestrian refuge areas are included, which may create challenges for some older adults and individuals with mobility disabilities.

Between Garden Street and the Danvers Rail Trail, Alternative 1 provides a continuous shared-use path with a buffer, enabling safer and more direct access to the trail for all travelers. Additionally, a wider sidewalk under the bridge maintains connectivity to the shared-use path, ensuring a safer and more accessible route. Alternative 2 provides similar benefits but with a reduced buffer width and a shorter sidewalk segment under the bridge, slightly diminishing pedestrian comfort and ease of access.

Overall, both alternatives could provide significant improvements for transportation-disadvantaged groups by expanding safe and accessible walking, biking, and transit options.

⁴⁸ American Community Survey 5-Year Estimates, 2016-2020.

Alternative 1 would offer greater safety benefits through traffic calming and protected crossings, while Alternative 2 would preserve signalized crossings and traditional pedestrian phasing for those with visual impairments.

5.4 Segment 2 –Danvers Rail Trail to Palmer Avenue

5.4.1 Alternative 1 in Segment 2

The concept design for Alternative 1 from Danvers Rail Trail to Palmer Avenue are presented in Figure 35, Figure 36, and Figure 37.

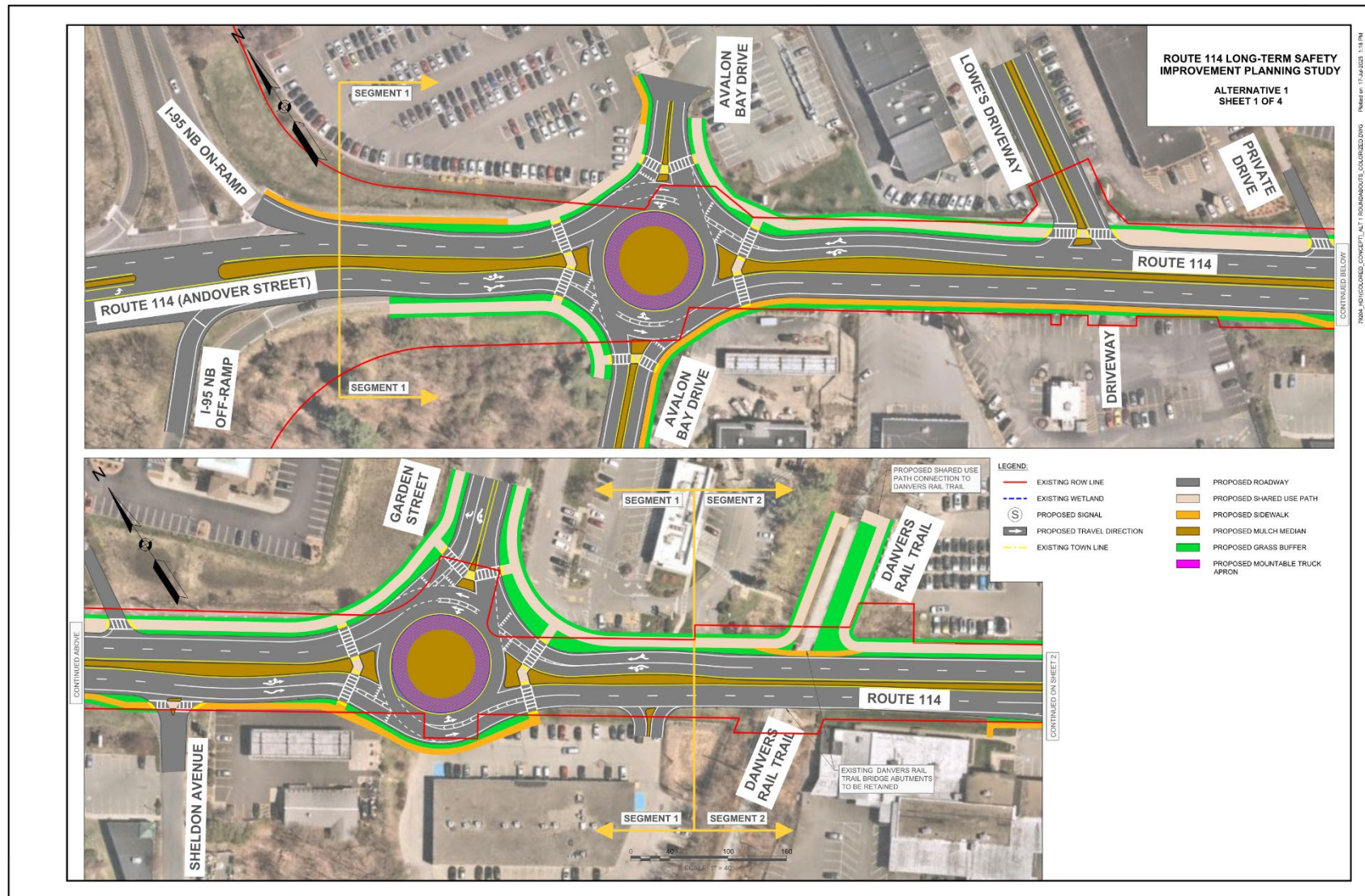


Figure 35. Danvers Rail Trail to Palmer Avenue, Alternative 1, Part 1

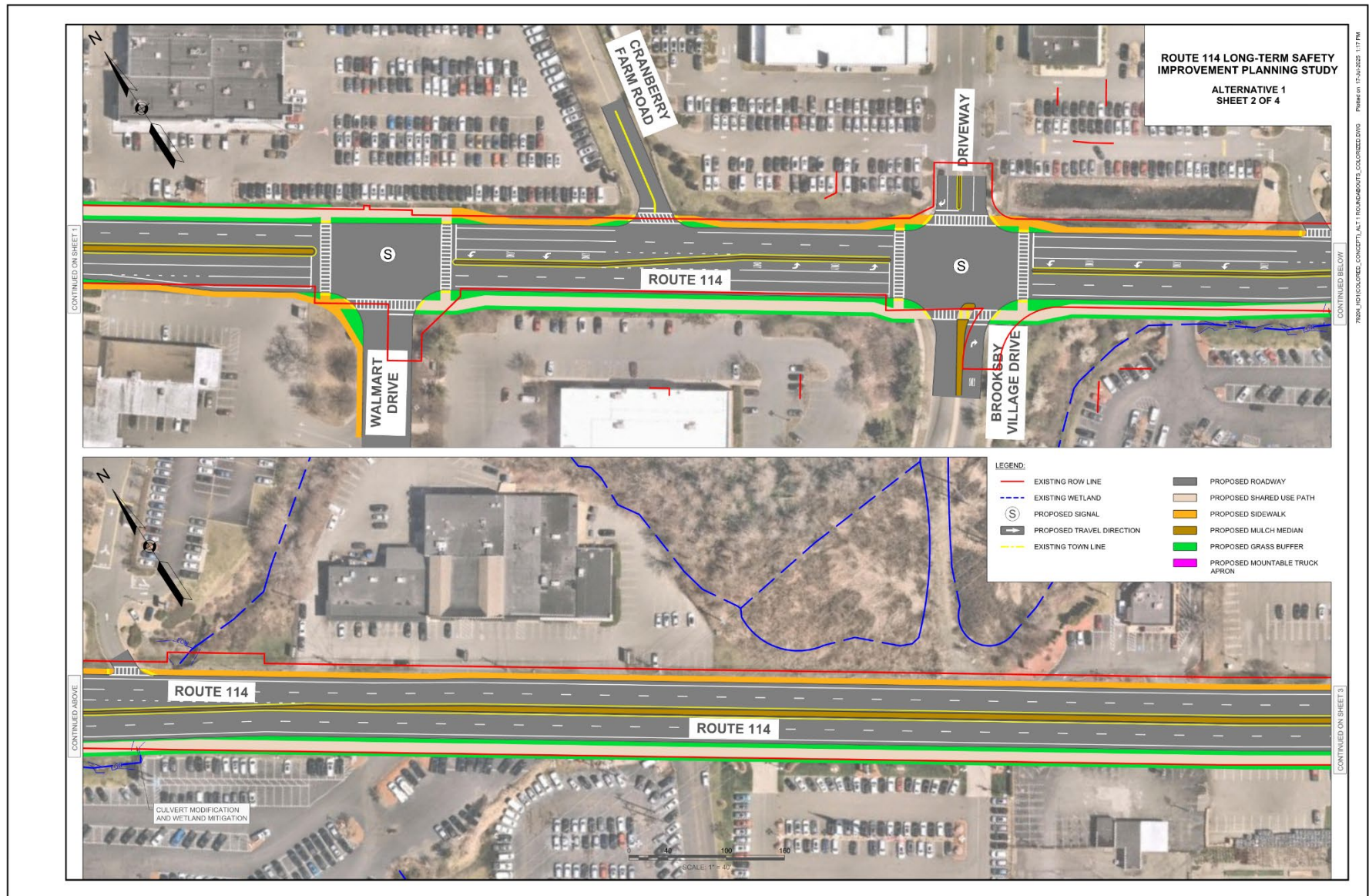


Figure 36. Danvers Rail Trail to Palmer Avenue, Alternative 1, Part 2

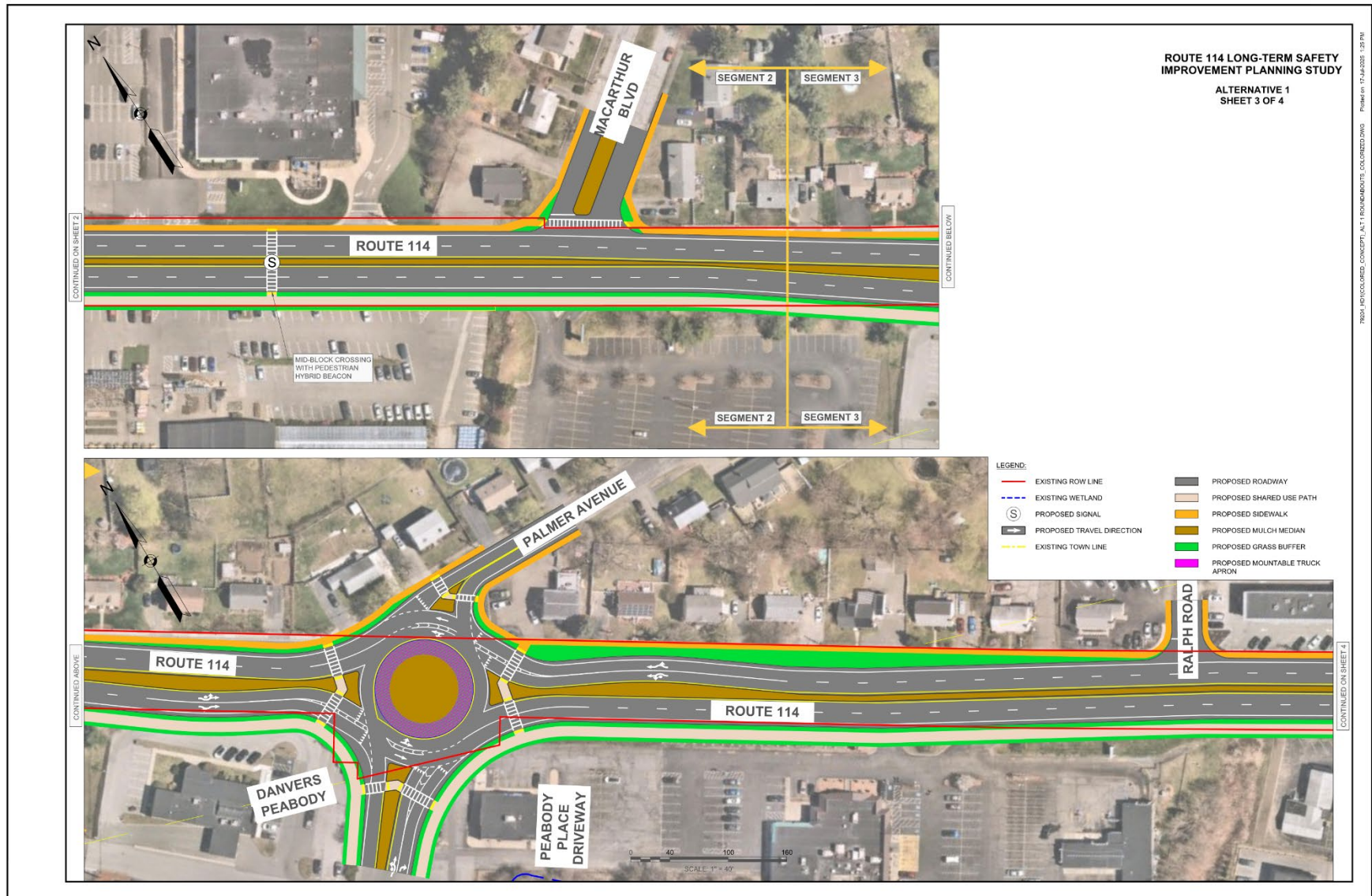


Figure 37. Danvers Rail Trail to Palmer Avenue, Alternative 1, Part 3

5.4.1.1 Roadway Facility Description

Segment 2 continues the proposed cross section from Segment 1, with adjustments made at constrained locations to minimize impacts while maintaining functionality. The primary constraints occur at the Danvers Rail Trail bridge crossing and the Crane Brook culvert crossing, where the roadway width is reduced to fit within the existing infrastructure. The constrained cross section narrows to two 11-foot-wide travel lanes in each direction separated by 1.5-foot-wide inside shoulders and a 2-foot-wide double-faced concrete barrier. Outside shoulders are provided for both directions of travel and are narrowed from 4 feet to 2 feet wide at the bridge abutments.

The roadway cross section is also constrained at the existing culvert crossing that carries Crane Brook just east of Judith Road. The constrained cross section is needed to limit the impacts to the existing culvert and the adjacent swale that continues along Brooksby Village Drive and crosses to join Crane Brook. The roadway width is narrowed similarly to the constrained condition at the Danvers Rail Trail bridge abutments; however, the 4-foot-wide outside shoulders and the 6-foot-wide concrete sidewalk are maintained. The proposed sidewalk matches the existing back of sidewalk to have no impacts to the existing concrete headwall to the north. Additionally, the cross section narrows by reducing the landscape buffer width from 5-feet to 2-feet to minimize impacts to the existing swale and culvert headwall on the south side of Route 114. The narrowed cross section would minimize overall impacts, but it is still expected that the existing culvert would need to be extended approximately 10 feet to the south and the concrete headwall would need to be replaced. It is also expected that the swale adjacent to the south side of Route 114 would be impacted and may need to be regraded, and/or a retaining wall would need to be installed.

Between the signalized intersections of Walmart Drive and Brooksby Village Drive, the proposed cross section is constrained as both intersections need to include a 10-foot-wide left-turn lane at the signal approach. The cross section transitions from a 6-foot-wide mulch median to a 2-foot double-faced concrete barrier at the Walmart Drive intersection. The concrete barrier continues through the Brooksby Village intersection.

The constrained cross section transitions back to the typical cross section proposed for Alternative 1 approximately 500-feet east of the Brooksby Village Drive intersection and continues to the intersection with Palmer Avenue. The continuous 6-foot-wide mulch median is proposed between the driveway for the Chevrolet of Danvers and Palmer Avenue to restrict left turns.

Two signalized intersections are proposed to remain signalized at Walmart Drive and Brooksby Village Drive. Pedestrian crosswalks are proposed across all three legs of the intersection of

Route 114 with Walmart Drive. Additionally, an eastbound right turn lane is added at Walmart Drive. Pedestrian crosswalks are proposed across all four legs of the intersection of Route 114 with Brooksby Village Drive and a commercial shopping plaza driveway.

The shared-use path transitions from the north side of Route 114 proposed in Segment 1, providing access to Danvers Rail Trail, to the south side of Route 114 at the Walmart Drive intersection. A sidewalk is proposed on the south side to access the businesses at 120 Andover Street; however, the sidewalk crosses to the north side of Route 114 east of the intersection with Walmart Drive. The proposed sidewalk remains on the north side of Route 114 for the remainder of the corridor in the study area. The sidewalk is proposed on the north side and matches the existing back of sidewalk to limit impacts to residential properties, existing retaining walls and front steps, as well as existing utilities. The shared-use path continues on the south side of Route 114 through the remainder of the corridor in the study area. The sidewalk located on the north side matches the existing back of sidewalk to limit impacts to residential properties, existing retaining walls and front steps, as well as existing utilities. There is more frontage along the south side of Route 114 than the north side through the rest of the study area. Additionally, the north side of Route 114 becomes residential as it approaches Palmer Avenue and width required for a shared-use path would likely have impacts to existing infrastructure on private properties.

5.4.1.2 Pedestrian and Bicycle Facility Description

Alternative 1 proposes a 10-foot shared-use path with a 5-foot buffer along the north side of Route 114 from the Danvers Rail Trail to Walmart Drive, transitioning to a 6-foot sidewalk just east of the crosswalk on the westbound approach of Route 114. On the south side of Route 114, Alternative 1 also proposes a 6-foot sidewalk extending 250 feet west of Walmart Drive to connect with the existing sidewalk fronting businesses. The sidewalk on the south side of Route 114 would transition to a 10-foot shared-use path at the same point as the north side, just east of the crosswalk of the westbound approach.

At the Route 114 and Walmart Drive intersection, two additional high-visibility crosswalks are proposed, one crossing Route 114 across the westbound approach and one crossing Walmart Drive.

From Walmart Drive to Palmer Avenue, Alternative 1 proposes a continuous 6-foot sidewalk along the north side and a continuous 10-foot shared-use path with a 5-foot buffer along the south side of Route 114. The 5-foot buffer for the shared-use path would narrow to 2 feet for about 250 feet around the culvert across from Judith Road, before returning to a width of 5 feet after the culvert. High-visibility crosswalks are proposed across side streets Cranberry

Farm Road, Judith Road, and MacArthur Boulevard to provide continuity for the pedestrian pathways along the north side of Route 114.

At the Route 114 and Brooksby Village Drive intersection, an additional high-visibility crosswalk with a pedestrian refuge in the median is proposed across the northbound approach. Alternative 1 also proposes curb extensions on the southeast and southwest corners of the intersection which would shorten the crossing distance of the crosswalk on the northbound approach.

About 250 feet west of MacArthur Boulevard, Alternative 1 proposes a mid-block crossing with a pedestrian hybrid beacon across Route 114.

5.4.2 Alternative 2 in Segment 2

The concept designs for Alternative 2 from Danvers Rail Trail to Palmer Avenue are presented in Figure 38, Figure 39, and Figure 40.

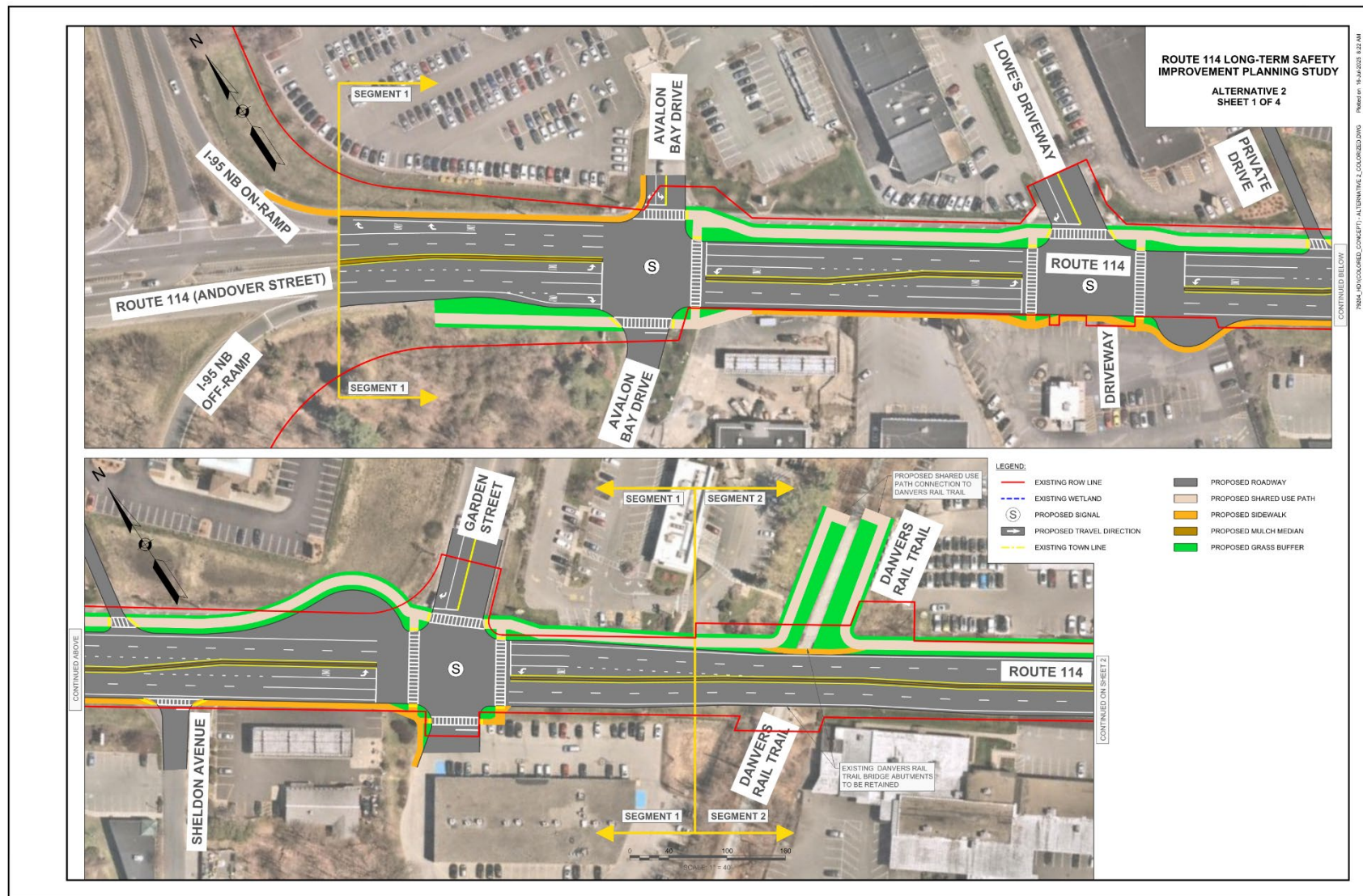


Figure 38. Danvers Rail Trail to Palmer Avenue, Alternative 2, Part 1

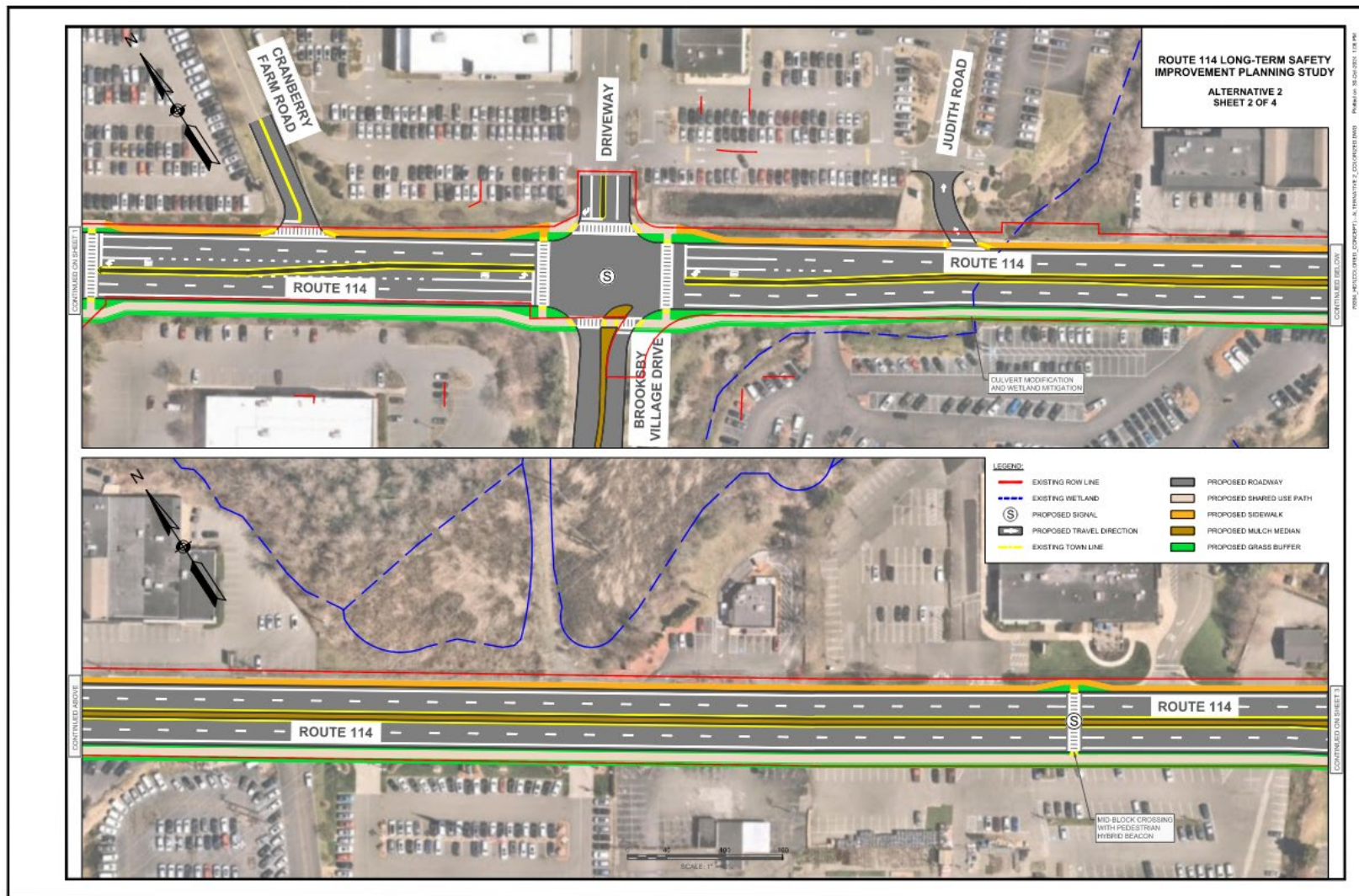


Figure 39. Danvers Rail Trail to Palmer Avenue, Alternative 2, Part 2

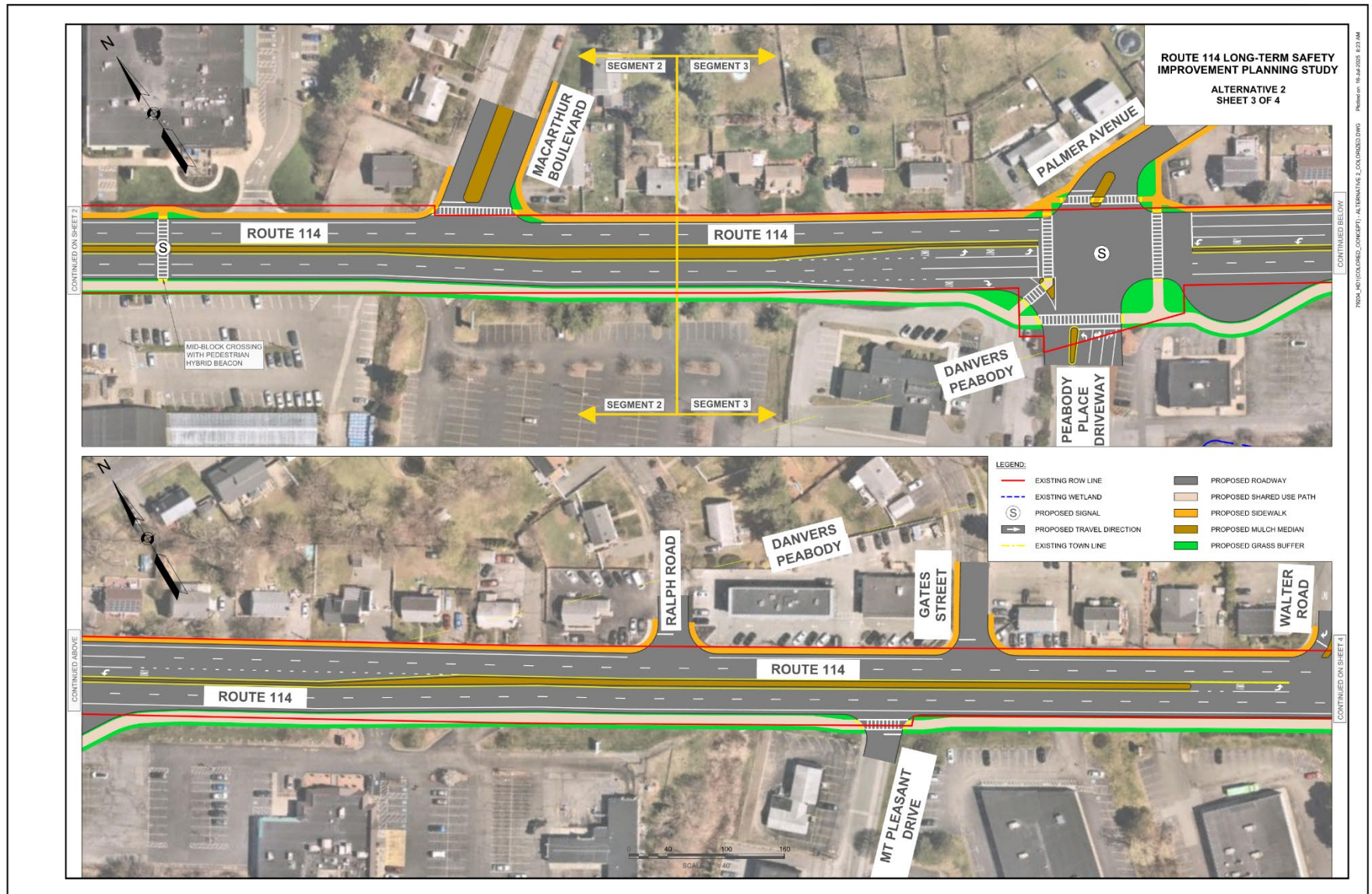


Figure 40. Danvers Rail Trail to Palmer Avenue, Alternative 2, Part 3

5.4.2.1 Roadway Facility Description

The proposed cross section in Segment 2 is the same as described in Segment 1 except at specific constrained width locations. The roadway width is constrained at the existing Danvers Rail Trail bridge crossing and the existing culvert crossing. At these locations, the roadway width is narrowed to two, 11-foot-wide travel lanes in each direction separated by 1.5-foot-wide inside shoulder and a double-faced concrete barrier. Outside shoulders are provided for each direction of travel and the width narrows from 4-feet to 2-feet in the most constrained locations like the Danvers Rail Trail bridge abutment. The sidewalk is also narrowed from 6-feet to 5.5-feet wide within the limits of the existing bridge abutment.

The cross section proposed for Alternative 2 in Segment 2 is very similar to the cross section described for Alternative 1 for Segment 2. A key difference in the constrained condition is at the existing culvert crossing. Alternative 2 proposes narrowing the shared-use path to 8-feet for approximately 200-feet to reduce the impacts to the existing culvert, concrete headwall, and adjacent swale. There would still be impacts to all three; however, the roadway, sidewalk and shared-use paths are narrowed to the maximum extent possible to limit the impacts.

Like Alternative 1, the constrained cross section for Alternative 2 transitions back to the typical cross section proposed for approximately 500-feet east of the Brooksby Village Drive intersection and continues to the intersection with Palmer Avenue. The continuous 6-foot-wide mulch median is proposed between the driveway for the Chevrolet of Danvers and Palmer Avenue to restrict left turns.

Alternative 2 proposes maintaining two signalized intersections at Walmart Drive and Brooksby Village Drive. Pedestrian crosswalks are proposed across all three legs of the intersection of Route 114 with Walmart Drive. Pedestrian crosswalks are proposed across all four legs of the intersection of Route 114 with Brooksby Village Drive and a commercial shopping plaza driveway.

Alternative 2 proposes the shared-use path transition from the north side to the south side of Route 114 and the sidewalk transition from the south side to the north side of Route 114 for the rest of the corridor within the study area.

5.4.2.2 Pedestrian and Bicycle Facility Description

Alternative 2 proposes the same pedestrian and bicycle facilities as Alternative 1 with a few slight differences to preserve ROW. These changes are explored in detail below.

Between the Danvers Rail Trail and Walmart Drive, Alternative 2 omits the sidewalk connection proposed in Alternative 1 on the south side of Route 114 west of Walmart Drive.

In Alternative 2, the north side shared-use path is proposed to narrow from 10-feet wide with a 5-foot buffer to an 8-foot-wide shared-use path with a buffer ranging from 4 to 5-feet as it approaches the Walmart Drive intersection, before transitioning into a 6-foot-wide sidewalk. For the south side shared-use path, Alternative 2 proposes a 2-foot buffer instead of 5-foot from Walmart Drive to Palmer Avenue. The south side shared-use path would be 10-feet wide, except for a 500-foot-long segment around the culvert which would narrow the shared-use path to 8-feet wide.

In Alternative 2, the crosswalk across Cranberry Farm Road would be about 10 feet longer than the proposed crosswalk in Alternative 1, as the crossing aligns with the edge of the pavement instead of aligning 6 feet back from the edge of pavement as is proposed in Alternative 1.

Alternative 2 proposes to maintain the existing median shape on the northbound approach of Brooksby Village Drive, which would shorten the crossing distance in comparison to Alternative 1. Alternative 2 proposes to align the northern sidewalk 6.5-feet back from the edge of pavement at the mid-block crossing, and to provide less buffer distance between the sidewalk and the roadway at the MacArthur Boulevard intersection, in comparison to Alternative 1.

5.4.3 Mobility and Access to Destinations Analysis for Segment 1

5.4.3.1 Vehicle and Truck Access to Destinations

In all segments, both Alternatives maintain vehicle and truck access to driveways throughout the corridor. However, the addition of a median would present alterations to routing when entering/exiting driveways. In Segment 2, Cranberry Farm Road and MacArthur Boulevard are restricted to right-in/right-out movements. In Alternative 1, southbound vehicles would need to use the roundabouts at Palmer Avenue to approach those driveways/intersections as a right turn movement. Northbound vehicles may use the signalized intersections at Walmart Drive or Brooksby Village Drive to make a U-turn movement. Larger trucks would need to U-turn at the Garden Street roundabout. In Alternative 2, southbound vehicles may U-turn at the Palmer Avenue intersection, and larger trucks would need to U-turn at the Sylvan Street loon. Northbound vehicles may U-turn at the Walmart Drive or Brooksby Village Drive intersections, and larger trucks would need to U-turn at the Avalon Bay Drive roundabout.

5.4.3.2 Pedestrian and Bicycle Mobility and Access to Destinations

Both Alternatives in this segment would provide increased mobility, connectivity, and access to destinations for pedestrians and bicyclists through the continuous shared-use path along the south side of Route 114, which previously had no pedestrian or bicycle facilities. Crucially, the proposed shared-use path along the south side of the corridor and additional crosswalks at the Brooksby Village Drive intersection would connect the elderly population at Brooksby Village

Senior Living Community to businesses and services along the entire north and south side of the corridor, as well as to the Danvers Rail Trail. These destinations are inaccessible by foot to the Brooksby Village residents under existing conditions. Both Alternatives propose a widened sidewalk along the north side of Route 114 and shortened crossing distances, which would provide safer and more comfortable facilities for all pedestrians. The new mid-block crossing and pedestrian hybrid beacon, included in both Alternatives, would address a major crossing gap along the corridor, would improve connectivity across Route 114 while also calming traffic along a stretch between signals. Under both Alternatives, the new and improved facilities would be continuous and fully accessible for people of all ages and abilities.

While both Alternatives would offer improvements to pedestrian and bicyclist mobility and access over existing conditions, Alternative 2 provides less access to destinations and a less comfortable pedestrian experience than Alternative 1. Alternative 2 does not include a sidewalk connection on the south side of Route 114, west of Walmart Drive, which impedes pedestrian access to businesses along the south side of the corridor, as pedestrians would have to cross the driveway and parking lot aisles to access businesses in that lot under Alternative 2. Due to the narrower buffer and shared-use path that Alternative 2 proposes at constrained points in this segment, the pedestrian experience would be less comfortable because people walking would be closer to roadway traffic and have less space to pass, in addition to longer crossing distances. Overall, the increased connectivity and access to destinations are similar between Alternatives, with Alternative 1 providing a little more access and comfort than Alternative 2.

5.4.4 Land Use and Economic Development Analysis for Segment 2

Both Alternatives propose adding a median between intersections that would limit vehicular left-turn access to business driveways and side streets along the corridor, which would necessitate U-turns to access the opposite side of Route 114. Alternative 1 would remove one existing parking space from the segment, while Alternative 2 would retain all existing parking spaces.

Alternative 1 provides a longer left-turn storage lane for westbound traffic at the Brooksby Village Drive intersection than is proposed in Alternative 2. This lengthened left-turn lane provides more storage for left-turn and U-turn vehicles. Alternative 1 also provides an extra sidewalk connection to business on the south side of Route 114 west of Walmart Drive which Alternative 2 does not provide. This sidewalk connection provides more access to businesses for pedestrians.

Overall, both Alternatives could impact businesses along the corridor due to restricted vehicular left-turn access, but Alternative 1 provides more vehicular and pedestrian access than Alternative 2 through the extra storage length and sidewalk connection proposed.

5.4.5 Community Effects/Environmental Justice Analysis for Segment 2

Both Alternatives improve travel conditions and expand multimodal access along the Route 114 corridor from the Danvers Rail Trail to Palmer Avenue, enhancing safety and mobility for older adults, individuals with disabilities, and households without vehicles. By introducing a 10-foot shared-use path with a 5-foot buffer on the south side and a 6-foot sidewalk on the north side, both Alternatives provide protected and continuous pedestrian and bicycle access to businesses, services, and residential areas. Additionally, replacing the existing two-way left-turn lane with a median that includes high-visibility crosswalks at intersections would improve safety by reducing vehicle speeds and enhancing pedestrian visibility, making crossings more accessible for those who need additional time. Both Alternatives also propose a mid-block crossing with a PHB west of Macarthur Boulevard, allowing residents of the Macarthur Boulevard neighborhoods to access community services and businesses on either side of the corridor.

Beyond these shared improvements, Alternative 1 enhances connectivity by extending a sidewalk west of Walmart Drive, ensuring a seamless pedestrian link to the Danvers Rail Trail. Alternative 2 does not include this sidewalk extension, requiring pedestrians and bicyclists to cross Route 114 at Walmart Drive to continue their path on the north side, increasing travel distance and inconvenience, especially for individuals with mobility challenges.

Alternative 1 also improves pedestrian crossings at Brooksby Village Drive by introducing a high-visibility crosswalk with a pedestrian refuge island, creating a safer, more comfortable experience for older adults and residents of Brooksby Village Senior Living Community. In contrast, Alternative 2 maintains the existing median shape, resulting in a slightly shorter crossing distance but lacking the added protection of a refuge island.

Additionally, Alternative 2 reduces the width of the shared-use path, buffer, and sidewalk in constrained areas, including Walmart Drive, Palmer Avenue, and the culvert crossing at Judith Road. These reductions increase perceived safety concerns and create a more stressful travel environment, particularly for those with disabilities or people who rely on walking and biking as their primary mode of transportation.

Overall, while both Alternatives improve accessibility and safety compared to existing conditions, Alternative 1 provides a more comfortable and seamless experience by eliminating breaks in the pedestrian network, reducing conflict points, and adding key safety features such as pedestrian refuge islands.

5.5 Segment 3 –Palmer Avenue to Sylvan Street

5.5.1 Alternative 1 in Segment 3

The concept designs for Alternative 1 from Palmer Avenue to Sylvan Street are presented in Figure 41 and Figure 42.

Route 114 Long-Term Safety Improvements Planning Study in Danvers and Peabody

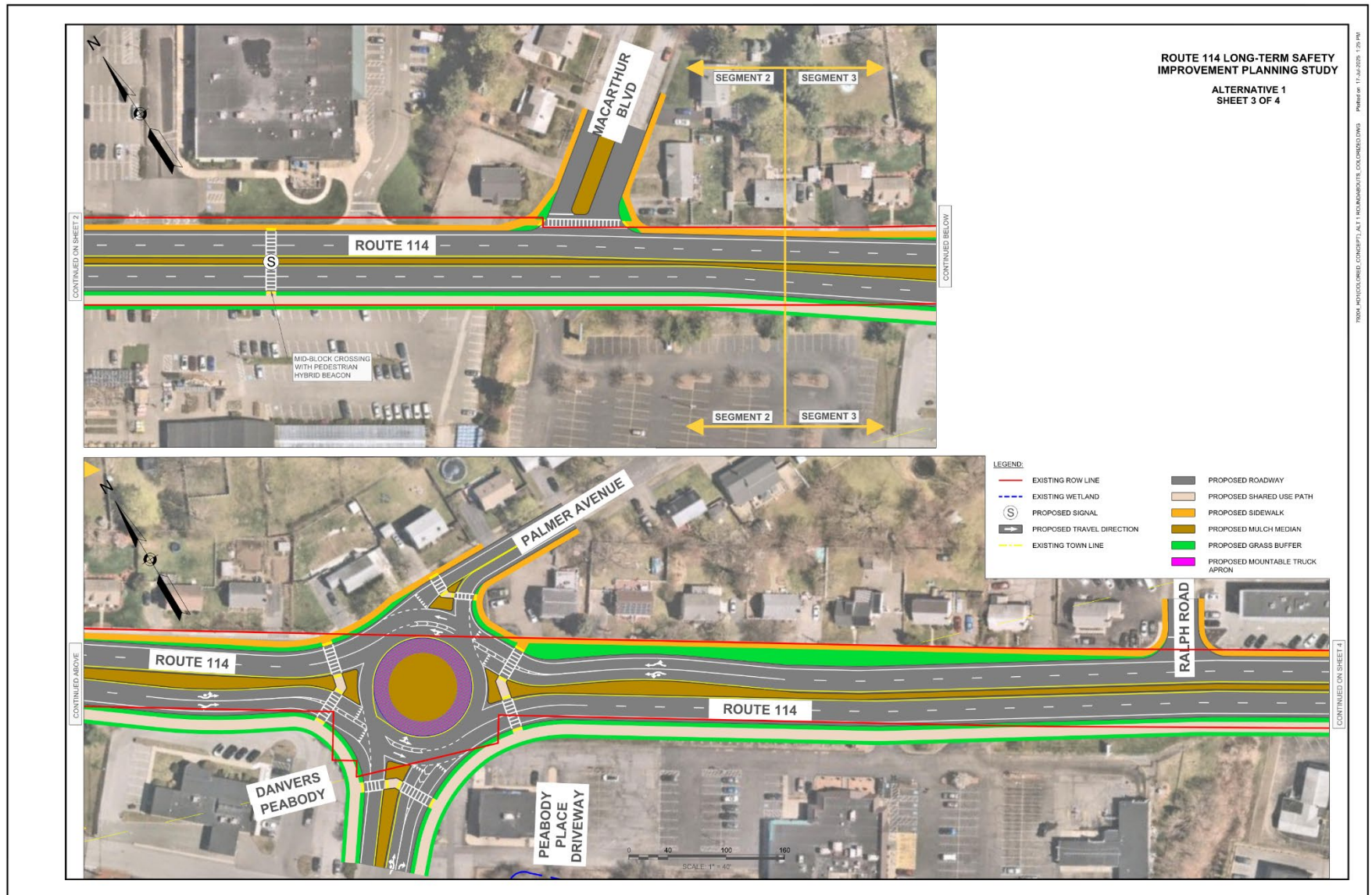


Figure 41. Palmer Avenue to Sylvan Street, Alternative 1, Part 3

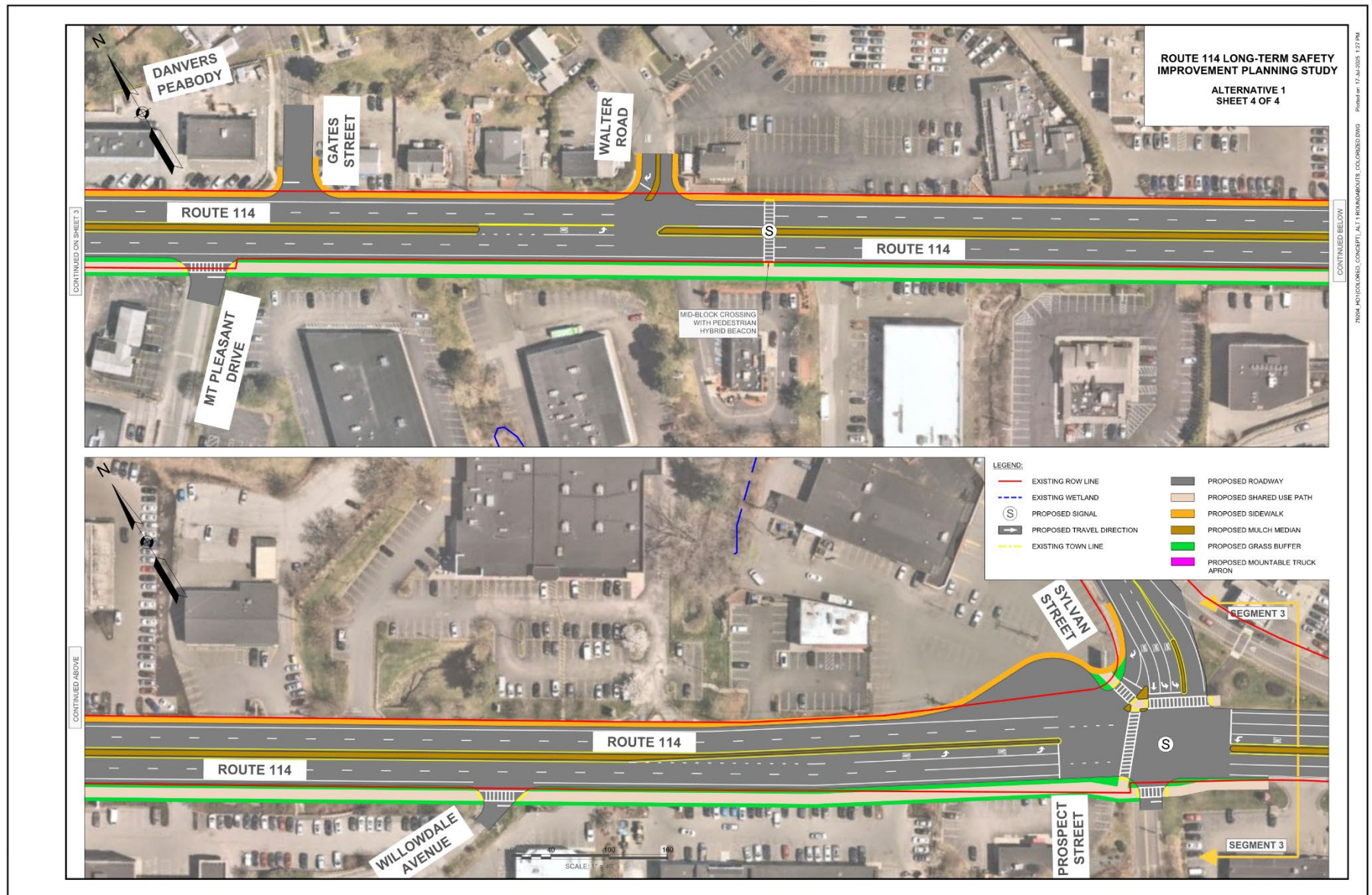


Figure 42. Palmer Avenue to Sylvan Street, Alternative 1, Part 4

5.5.1.1 Roadway Facility Description

The proposed cross section in Segment 3 is the same as the full width cross section described in Segments 1 and 2. There are no locations with constrained conditions requiring the narrower constrained cross section in this segment of the study area between Palmer Drive and the end of the study area at the intersection of Route 114 and Sylvan Street. The 6-foot-wide mulch median is proposed from Palmer Avenue to about 500 feet west of the Sylvan Street intersection.

Alternative 1 proposes a multi-lane roundabout at the intersection of Route 114 and the minor streets of Palmer Avenue and Peabody Place Driveway. The roundabout at Palmer Avenue proposes two travel lanes to continue through the mainline movement of Route 114 and narrows to one lane entrances and exits for the minor streets. Peabody Place has enough volume to require two entrances to the roundabout.

Palmer Avenue is an entrance to a residential neighborhood. Some of the residential properties are located adjacent to the northern half of Route 114 and the proposed roundabout. The roundabout was placed as far north as possible within the intersection while maintaining the existing back of sidewalk to limit impacts to those private properties and their existing front steps, retaining walls and landscaping. To the south of the intersection are two businesses: a Santander Bank and a Vitamin Shoppe. Due to the inscribed diameter and entry/exit radii requirements for a multilane roundabout with a WB-67⁴⁹ for a design vehicle, there are significant impacts to both commercial properties. The parking lots along the frontage of Route 114 would need to be redesigned and may no longer provide a circulatory route around the properties. Impacts could be reduced by narrowing the 5-foot-wide landscape buffer and/or the width of the shared-use path. However, both the buffer and the proposed shared-use path width are recommended to provide a safe and comfortable facility for pedestrians and bicycles.

A continuous 6-foot-wide mulch median is proposed from the roundabout at Palmer Avenue and Peabody Place Driveway to 500 feet west of the Sylvan Street Intersection. The mulch median provides separation between the two directions of vehicular travel at 40 mph along Route 114. A break in the mulch median is provided at the intersection of Route 114 and Walter Road. The break in the median provides enough space for a short left-turn lane and permits only left-turn access to Walter Road and the Century House Restaurant. A median is proposed on Walter Road at the intersection with Route 114 to restrict left turns to Route 114 eastbound.

The mulch median ends at the approach to the Sylvan Street intersection, where the 6-foot-wide mulch median narrows to a 2-foot-wide double-faced concrete barrier. The roadway width

⁴⁹ A WB-67 is a standard large truck classification defined by AASHTO, commonly representing a 67-foot long semi-trailer used in geometric roadway design.

also widens to fit a 10-foot-wide left-turn lane. A loon is proposed on the north side of Route 114 at the Sylvan Street intersection to provide U-turn options for the roadway users unable to turn left from eastbound Route 114 to the many properties located on the north side of Route 114. The loon geometry would have significant right-of-way impacts to the Petco parking lot within the 10 Sylvan Street shopping plaza and the billboard located on the corner of Sylvan Street and Route 114 westbound.

5.5.1.2 Pedestrian and Bicycle Facility Description

Alternative 1 proposes a continuation of the 6-foot sidewalk along the north side and the 10-foot shared-use path with a 5-foot buffer along the south side of Route 114 from Palmer Avenue to Sylvan Street and Prospect Street. The northern sidewalk would connect into existing sidewalks along side streets Palmer Avenue, Ralph Road, Gates Street, Walter Road, and Sylvan Street. High-visibility crosswalks are proposed across the side streets Mt. Pleasant Drive and Willowdale Avenue to provide continuous facilities along the south side shared-use path.

At the Route 114 and Palmer Avenue intersection, Alternative 1 proposes constructing a roundabout, which would provide two-stage crossings with pedestrian refuge islands and Rectangular Rapid Flashing Beacons (RRFB) across all approaches. The splitter islands would serve as pedestrian refuges for crossings, allowing pedestrians to cross only one direction of vehicular travel at a time. Each crossing would have an RRFB on either side of the roadway to alert drivers in both directions of the oncoming crossing. If a roundabout is not viable, Alternative 1 also provides the option of maintaining the existing signal and adding two additional crosswalks: across the eastbound approach of Route 114 and across Peabody Place Driveway, the northbound approach. The crossing across Palmer Avenue would be substantially shortened due to proposed curb extensions at the northeast and northwest corners of the intersection and people walking could cross in two stages due to the addition of a pedestrian refuge in the median. The crossings across Route 114 would also be shortened with curb extensions and a formalized pedestrian refuge island at the southwest corner of the intersection.

About 75 feet east of Walter Road, Alternative 1 proposes a mid-block crossing with a pedestrian hybrid beacon across Route 114.

At the Route 114 and Sylvan Street/Prospect Street intersection, Alternative 1 proposes minimal changes to the existing intersection. The sidewalk along the north side of Route 114 connects into sidewalk along Sylvan Street and existing crosswalks across Sylvan Street. The south side shared-use path continues across Prospect Street and ends at the next driveway east of Prospect Street where the existing sidewalk ends.

5.5.2 Alternative 2 in Segment 3

The concept designs for Alternative 2 from Palmer Avenue to Sylvan Street are presented in Figure 43 and Figure 44.

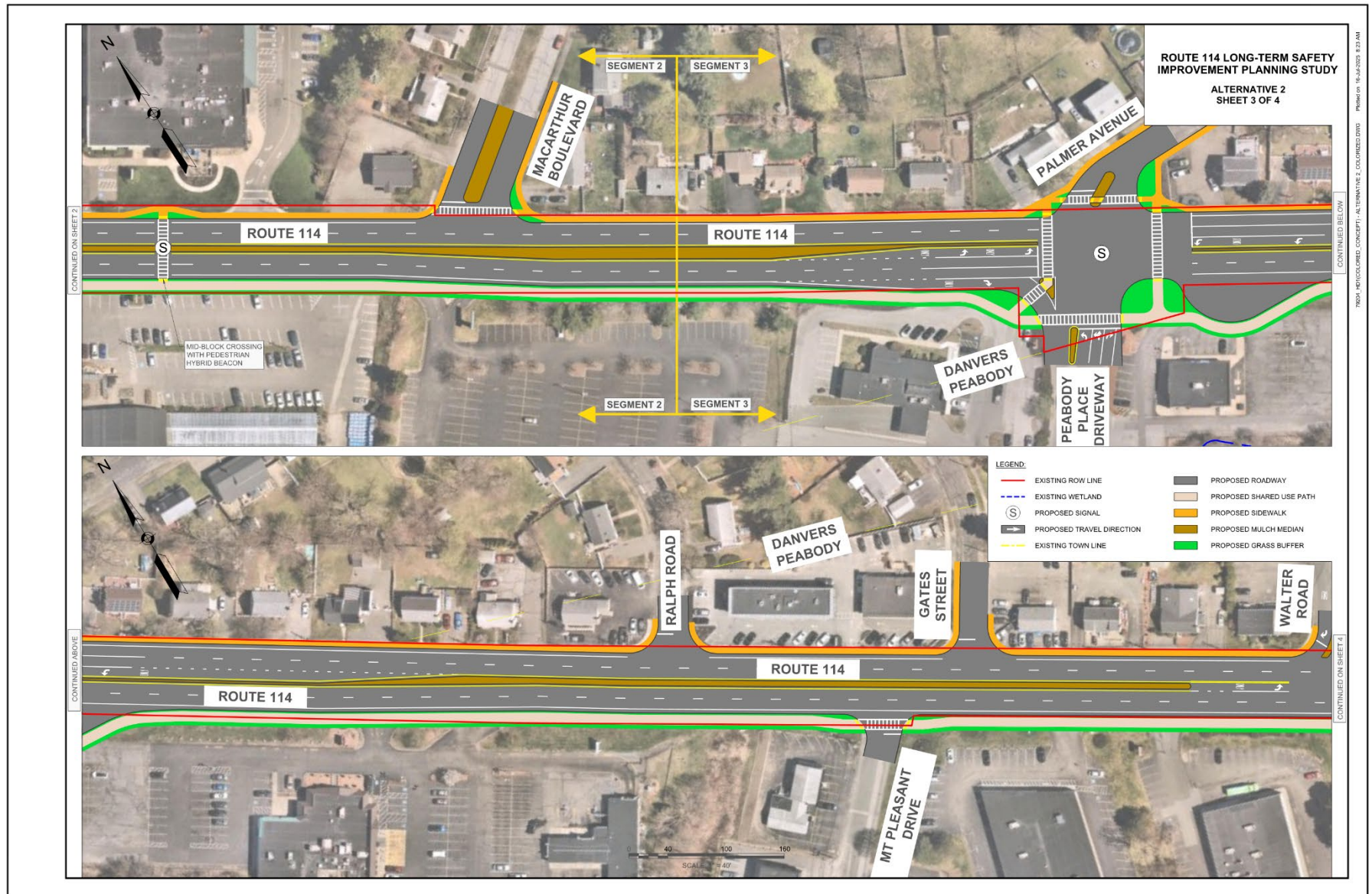


Figure 43. Palmer Avenue to Sylvan Street, Alternative 2, Part 3

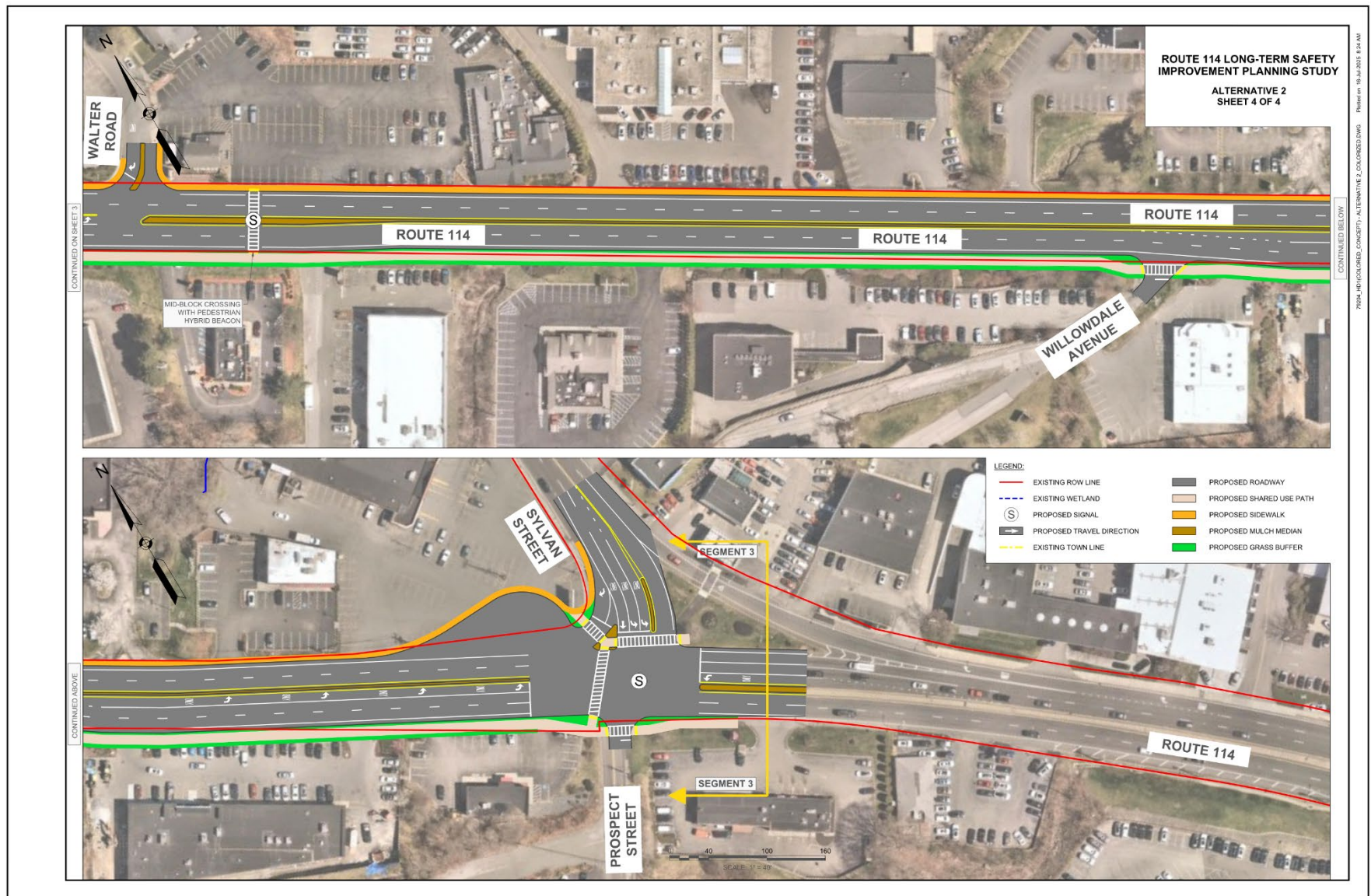


Figure 44. Palmer Avenue to Sylvan Street, Alternative 2, Part 4

5.5.2.1 Roadway Facility Description

The proposed cross section in Segment 3 is the same as the cross section described in Segments 1 and 2. There are no locations with constrained conditions requiring the narrower cross section in this segment of the study area between Palmer Drive and the end of the study area at the intersection of Route 114 and Sylvan Street.

Loon geometry replaces the roundabout proposed for Alternative 1 at Palmer Avenue. The loon is located on the south side of Route 114 along the east approach to the intersection. The loon geometry has significant impacts to the Vitamin Shoppe commercial property and would impact the parking lot along the frontage of Route 114 and the circulatory route around the building.

The cross section widens to the full width, 6-foot-wide mulch median at the approach to Walter Road to provide enough roadway width for a short, eastbound left-turn-only lane. The median ends for approximately 150 feet, providing enough length for a 100-foot left-turn lane into Walter Road and providing access to the Century House Restaurant. A median is proposed on Walter Road at the intersection with Route 114 to restrict left turns across to Route 114 eastbound.

After Walter Road, the median narrows to the 2-foot-wide double-faced concrete barrier again and remains the typical cross section for Alternative 2 until the approach to Sylvan Street. The concrete barrier continues to the intersections; however, the roadway width widens to fit a 10-foot-wide left-turn lane for 500-feet. Like Alternative 1, loon geometry is proposed on the north side of Route 114 at the intersection with Sylvan Street. The loon has significant impacts to the Petco parking lot and billboard at the intersection.

5.5.2.2 Pedestrian and Bicycle Facility Description

Alternative 2 proposes the same pedestrian and bicycle facilities as Alternative 1 with a few slight differences to preserve ROW. These changes are explored below.

Alternative 2 proposes that the south side shared-use path maintains 10-feet width and a 2-foot buffer from Palmer Avenue to Sylvan Street.

Alternative 2 also proposes a narrower buffer width between the sidewalk and the roadway on the northwest corner of the Palmer Avenue intersection and a smaller pedestrian refuge island in the southwest corner of the intersection as compared to Alternative 1.

Alternative 2 does not include the option of constructing a roundabout at the intersection of Palmer Avenue. Alternative 2 instead proposes a loon at Palmer Avenue that provides space for heavy vehicles to make U-turns.

5.5.3 Mobility and Access to Destinations Analysis for Segment 3

5.5.3.1 Vehicle and Truck Access to Destinations

In all segments, both Alternatives maintain vehicle and truck access to driveways throughout the corridor. However, the addition of a median may present alterations to routing when entering/exiting driveways and side-streets. In Segment 3, several driveways/side-streets are restricted to right-in/right-out movements. In Alternative 1, vehicles would need to use the roundabout at Palmer Avenue and loon at Sylvan Street to approach those driveways/side-streets as a right turn movement. In Alternative 2, vehicles would need to use the loons at Palmer Avenue and Sylvan Street to approach those driveways/side-streets as a right-turn movement. For both Alternatives, a break in the median for left turns from Route 114 southbound onto Walter Road is provided.

5.5.3.2 Pedestrian and Bicycle Mobility and Access to Destinations

In this segment, both Alternatives provide increased mobility, connectivity, and access to destinations for pedestrians and bicyclists through the continuous shared-use path along the south side of Route 114 which does not have pedestrian or bicycle facilities under existing conditions. The widened sidewalk along the north side of Route 114 and shortened crossing distances at intersections would provide safer and more comfortable facilities for all pedestrians. The new and shortened crossings increase mobility and connectivity for neighborhood residents north of Route 114 to access essential businesses and restaurants on the south side of Route 114, such as Trader Joe's, the UPS store, and other businesses in the Peabody Place shopping mall. The new mid-block crossing and pedestrian hybrid beacon would also address a major crossing gap along the corridor, improving connectivity across Route 114 while also calming traffic along a stretch between signals. The new and improved facilities would be continuous and fully accessible for users of all ages and abilities.

The potential roundabout proposed in Alternative 1 at the Palmer Avenue intersection would create two-stage crossings for pedestrians and cyclists across all approaches, which could add delay and make crossings more inconvenient for pedestrians and cyclists depending on traffic flow and driver yielding behavior but would also enable better visibility of users crossing. The roundabout would also remove the signal at the intersection, eliminating the pedestrian crossing phases, pedestrian crossing signals, and the accessible push buttons, which could make it more difficult for the elderly, or visually impaired to cross. Additional countermeasures or signals could be considered to address these challenges, such as the application of PHB instead of RRFBs, which is recommended by the MassDOT Guidelines for the Planning and Design of Roundabouts based on the vehicle speeds and volumes. Roundabouts also provide significant traffic calming benefits and reduce conflict points, creating a safer and more comfortable

environment for pedestrians and bicyclists overall. The roundabouts in Alternative 1 may hinder the mobility of pedestrians and bicyclists at crossings but would increase overall safety of all roadway users.

With the narrowed buffer space, Alternative 2 proposes a less comfortable shared-use path facility than Alternative 1 as users are generally closer to roadway traffic, but overall, the increased connectivity and access to destinations are similar between Alternatives.

5.5.4 Land Use and Economic Development Analysis for Segment 3

Both Alternatives propose adding a median between intersections that would restrict vehicular left-turn access to business driveways and side streets Ralph Road, Mt. Pleasant Drive, Gates Street, and Willowdale Avenue along the corridor to similar degrees. Both Alternatives would necessitate U-turns at the Palmer Avenue and Sylvan Street intersections to access businesses, residential driveways, or side streets on opposite sides of Route 114. Both Alternatives provide a left-turn pocket for eastbound traffic to turn left onto Walter Road or make a U-turn. Both Alternatives also remove around 16-20 parking spaces from various lots along the corridor, but Alternative 1 could impact about 4 more parking spaces than Alternative 2 through the proposed roundabout at Palmer Avenue. These parking space impacts would marginally affect business capacity for vehicles, but the increased connectivity and accessibility for people walking and biking could encourage more economic activity and development for multimodal users.

Alternative 2 maintains the existing signal at Palmer Avenue and provides left-turn lanes for eastbound and westbound traffic. The signal would require a protected left-turn phase to allow for U-turns. Alternative 1 proposes a multilane roundabout at Palmer Avenue, which has greater right of way impacts but provides a more straightforward turning point for vehicles making U-turns, and the potential for less delay than the signal in Alternative 2. Alternative 2 also proposes a loon for heavy vehicle access to westbound U-turns at Palmer Avenue. In Alternative 1, the left-turn pocket at Walter Road has a longer storage length than in Alternative 2. Both Alternatives provide a loon for eastbound heavy vehicle U-turns at the Sylvan Street intersection.

Overall, both Alternatives could impact businesses along the corridor due to limited vehicular left-turn access, but Alternative 1 has greater parking impacts but also provides more access through increased left-turn storage at Walter Road and less vehicular delay for U-turns at the Palmer Avenue roundabout.

5.5.5 Community Effects/Environmental Justice Analysis for Segment 3

Both Alternatives improve travel conditions and expand multimodal access along the Route 114 corridor from Palmer Avenue to Sylvan Street, particularly benefiting older adults, individuals with disabilities, and households without vehicles. The introduction of a 10-foot shared-use path on the south side and a 6-foot sidewalk on the north side provides a protected and continuous route for pedestrians and bicyclists, improving access to businesses, services, and essential destinations. These enhancements reduce mobility barriers and create a more navigable and connected corridor for those who rely on walking, biking, or transit.

In addition to improved multimodal access, replacing the existing two-way left-turn lane with a median enhances safety by lowering vehicle speeds and increasing pedestrian visibility at crossings. The median includes breaks at intersections with high-visibility crosswalks, making it easier for older adults and individuals with disabilities to cross safely. A mid-block PHB east of Walter Road further enhances neighborhood connectivity by providing a safer crossing near Dunkin' Donuts and Epicurean Shoppe. This allows residents of Walter Road and MacArthur Boulevard neighborhoods to reach businesses on the south side of Route 114 without having to walk to Sylvan Street or Palmer Avenue. Similarly, residents of the Mt. Pleasant Drive housing development gain more direct access to retail stores, restaurants, and car dealerships on the north side of the corridor. These changes reduce travel distance, improve safety, and make the corridor more accessible for individuals without vehicles and those with mobility challenges.

Alternative 1 further improves pedestrian safety and traffic flow by introducing a roundabout at Palmer Avenue, which slows vehicle speeds and increases driver attentiveness at a key intersection connecting Palmer Avenue and MacArthur Boulevard neighborhoods to commercial destinations, including shopping malls, grocery stores, and restaurants. Additional safety features, such as two-stage crossings, pedestrian refuge islands, and rectangular rapid flashing beacons (RRFBs), provide shorter crossing distances, improved sightlines, and increased pedestrian visibility to make crossings safer and more comfortable for all users.

Alternative 2, in contrast, maintains the existing signalized intersection at Palmer Avenue with fewer pedestrian safety enhancements. While it includes a pedestrian refuge island at the southwest corner and narrows the buffer between the sidewalk and roadway on the northwest side, it results in longer crossing distances and fewer protected stopping points. This increases potential conflict points, particularly for older adults and individuals with disabilities who need additional time to cross.

While both Alternatives maintain the 10-foot shared-use path and 6-foot sidewalk, Alternative 2 reduces the buffer between the shared-use path and the roadway from 5 feet to 2 feet between Palmer Avenue and Sylvan Street. This decreases the sense of protection for

pedestrians and bicyclists, increases challenges for individuals with mobility disabilities, and creates a more stressful travel experience.

Overall, while both Alternatives provide meaningful improvements in accessibility, safety, and multimodal mobility compared to existing conditions, Alternative 1 would offer a safer and more comfortable experience for all users.

6. Findings

The alternative analysis findings as they related to the overall study goals and objectives are described below.

6.1 Goal #1: Improve safety and comfort for all transportation users

- The removal of the two-way left-turn lane and addition of the median or barrier within the study area would prevent dangerous, mid-block crossings and U-turns, improving safety conditions for all road users.
- Older adults, populations with disabilities, and mobility device users would experience more comfortable pedestrian conditions because of the wider sidewalk and shared-use path, greater separation from vehicles, and additional crossing opportunities at new high-visibility crosswalks, resulting in shorter, safer travel distances.
- For older adults and persons with disabilities, the addition of high-visibility crosswalks and/or roundabouts accompanied by pedestrian crossing refuges would provide a safer and more comfortable crossing experience. These improvements enable residents to safely cross busy intersections to access various businesses and recreational destinations along the corridor.
- The addition of roundabouts in Alternative 1 would greatly increase vehicle safety at those intersections, while providing acceptable traffic operations.

6.2 Goal #2: Provide mobility and accessibility for all transportation users

- Both Alternatives would provide new, ADA accessible pedestrian facilities and improved multimodal access to key neighborhood destinations along Route 114 for residents of the community.

6.3 Goal #3: Promote economic development and improved quality of life

- The wider sidewalks and new shared-use path with a protective buffer would enable bicyclist and pedestrian connectivity on both sides of the corridor for the entirety of the three segments, increasing mobility opportunities and fostering community cohesion through increased bicycle and pedestrian navigability of the area. EJ populations and

populations without vehicles would experience enhanced multimodal connectivity along the corridor resulting from the safe and protected connections to employment opportunities, housing developments, businesses, and recreational destinations.

- Mid-block crossings with a pedestrian hybrid beacon would facilitate additional connectivity for residents of proximate neighborhoods to access community services and businesses on the opposite side of the corridor without needing to walk or bicycle extensive distances. The minimization of travel distance and time, and improvement of safety and connectivity at this crossing would benefit residents without vehicles as well as residents with limited mobility.

6.4 Goal #4: Provide cost-effective improvements

- Both Alternatives offer improved safety for drivers and pedestrians alike while minimizing roadway widening and land taking. Certain measures were taken to further minimize the estimated construction costs for each Alternative including roadway milling and paving in lieu of full depth reconstruction, mulched medians and precast concrete barriers in lieu of raised concrete islands with granite curb edging and limiting the shared-use path to one side of the roadway rather than both.

6.5 Goal #5: Avoid or minimize impacts on environmental and other natural resources

- The study area is located within, and adjacent to, sensitive environmental resource areas, including wetlands, waterways, floodways, and floodplain. It is anticipated that both Alternatives would result in impacts to regulated resource areas requiring permitting under the MA WPA and US CWA. During design development, impacts to these resource areas would be avoided and or minimized to the maximum extent practicable.

6.6 Goal #6: Support local, regional, and statewide policies

- Both Alternatives were designed to meet and exceed the goals, policies, and standards that MassDOT has adopted, including:
 - [MassDOT Municipal Resources Guide for Walkability](#)
 - [Massachusetts Pedestrian Transportation Plan](#)
 - [MassDOT Municipal Resource Guide for Bikeability](#)
 - [Massachusetts Bicycle Transportation Plan](#)
 - [Massachusetts Clean Energy and Climate Plan for 2050](#)

7. Long-Term Recommendations

Despite the higher cost, this study recommends implementing Alternative 1 due to its better long-term safety and operations benefits for the community. MassDOT's Intersection Control Evaluation (ICE) process will ultimately dictate the selected intersection improvement. The specific improvements tied to Alternative 1 are described in this chapter and organized by type of improvement such as roadway, intersection, pedestrian and bicyclist, and other. Study recommendations per improvement type are as follows:

7.1 Roadway Cross Section

- Remove fourteen-foot-wide two-way left-turn lane.
- Restripe travel lanes to a width of eleven feet.
- Apply the dimensions of the cross section in Figure 27 to Alternative 1 and Figure 29 to all constrained locations.
- Install pedestrian hybrid beacons (PHBs) at crossings with multiple lanes.
- Create landscape/streetscape design guidelines for the five-foot-wide landscape buffer between the shared-use path and the roadway.
- Due to right-of-way width constraints, install a six-foot-wide sidewalk under the Danvers Rail Bridge.

7.2 Intersections

- Update and optimize all traffic signals.
- Convert intersection of Route 114, Cranberry Farm Road, and MacArthur Boulevard to right-in/right-out only.
- Install a ten-foot-wide left-turn lane at the signalized intersections of Walmart Drive and Brooksby Village Drive.
- Install median on Walter Road at the intersection of Route 114 to restrict left turns to Route 114 eastbound.
- Install Roundabouts at:
 - The intersection of Route 114 and Avalon Bay Drive.
 - The intersection of Route 114 and Garden Street. Extend curb at northwest corner to shorten crossing distances at the southbound and eastbound approaches.
 - The intersection of Route 114, Palmer Avenue, and Peabody Place Driveway:
 - Include two-stage crossings with pedestrian refuge islands and Rectangular Rapid Flashing Beacons (RRFBs) across all approaches.
 - Install retaining walls and landscaping to limit impacts.
- Convert the following intersections to right-in/right-out access only:

- The intersection of Route 114 and Lowe's Driveway.
 - Install new median with a pedestrian refuge island.
 - Install curb extensions on the northwest and northeast corners to shorten pedestrian distances.
 - The intersection of Route 114 and Sheldon Avenue.
- Relocate
 - The drive access to 136 Andover Street Shopping Center approximately 200 feet to the east and convert to right-in/right-out access only.
 - The gas station driveway near Avalon Bay Drive to the south, away from the proposed roundabout.
- Install curb extensions on the southeast and southwest corners of the intersection of Route 114 and Brooksby Village Drive.
- Install an eastbound right-turn lane at Walmart Drive.

7.3 Pedestrian and Bicycle Infrastructure

- Install six-foot-wide sidewalks along the north side of Route 114 from the Interstate-95 On-Ramp to the proposed roundabout at the intersection of Route 114 and Avalon Bay Drive and then along the south side moving east from the roundabout toward Sheldon Avenue. At the roundabout at the intersection of Route 114 and Garden Street, transition sidewalk back to the north side along Route 114 toward the Danvers Rail Trail.
- Transition the sidewalk from the south side of Route 114 at 120 Andover Street to the north side of Route 114 east of the intersection with Walmart Drive.
- Transition the shared-use path from the north side of Route 114 as proposed in Segment 1 to the south side of Route 114 at the Walmart Drive intersection.
- Shared-use paths to be constructed with hot-mix asphalt (HMA).
- Install mid-block crossing with a PHB approximately 250 feet west of MacArthur Boulevard
- Install ten-foot-wide shared-use path along the landscape buffer on the north side of Route 114 from the western extent of the study area to Avalon Bay Drive.
- Install formalized and accessible ramps that connect directly to the Danvers Rail Trail.
- Provide a mid-block crossing across Route 114 with a PHB approximately 75 feet east of Walter Road.
- Continue ten-foot-wide shared-use path with five-foot-wide landscape buffer along the north side Route 114 from the Danvers Rails Trail to Walmart Drive then transition to a six-foot-wide sidewalk just east of the crosswalk on the westbound approach of Route 114.
- Install six-foot-wide sidewalk extending 250 feet west of Walmart Drive to connect with existing sidewalk.

- Install high-visibility crosswalks at:
 - Sheldon Avenue.
 - The intersection of Route 114 and Walmart Drive, one crossing Route 114 across the westbound approach and one crossing Walmart Drive.
 - The intersections of Route 114 and Cranberry Farm Road, Judith Road, and MacArthur Boulevard.
 - The intersection of Route 114 and Brooksby Village Drive, with a median across the northbound approach.

7.4 Special Considerations

- Negotiate access to right-of-way where necessary.
- Obtain authorization under the Massachusetts Wetlands Protection Act (MA WPA) and its implementing regulations (310 CMR 10.00) via issuance of an Order of Conditions from the applicable local Conservation Commission.
- Submit Pre-Construction Notification to the U.S. Army Corps of Engineers (USACE) under General Permit 23 of the 2023 General Permits for the Commonwealth of Massachusetts.
- Obtain No-Rise Certification by conducting engineering analysis to document project impact on base flood elevations (BFE), floodway elevations, or floodway widths.
- Confirm if project is subject to Massachusetts Environmental Policy Act (MEPA) or National Environmental Policy Act (NEPA).
- For Crane Brook and associated culvert:
 - Apply the dimensions of the cross section in Figure 29 at the culvert crossing.
 - Reduce landscape buffer width from five-feet to two-feet.
 - Extend existing culvert headwall by ten feet on the south side of Route 114.
 - Regrade swale adjacent to the south side of Route 114 and/or install a retaining wall near the culvert crossing.
- Redesign parking lots for commercial properties impacted by proposed roundabout at the intersection of Route 114, Palmer Avenue, and Peabody Place Drive.
- Install retaining walls and landscaping to limit impacts of proposed roundabout at the intersection of Route 114, Palmer Avenue, and Peabody Place Drive.

These recommendations are the starting point of discussions for MassDOT, the Town of Danvers, and the City of Peabody to review more permanent safety solutions for the study area. They do not constitute a commitment or obligation by municipalities or MassDOT. Stakeholder and public participation should continue throughout the implementation process to build community support and address concerns. Implementation will take several years and requires extensive local and state permitting, and further design and engineering.