PALMER STATION
PLANNING + DESIGN

MassDOT Palmer Station Planning & Design

Transportation Impact and Access Study
Palmer Station
South Main Street, Palmer, Massachusetts

PREPARED FOR

massDOT
Massachusetts Department of Transportation

MassDOT Rail & Transit Division
10 Park Plaza
Boston, MA 02116
617.366.7133

PREPARED BY

vhb

99 High Street
13th Floor
Boston, MA 02110
617.728.1770

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Introduction

The Massachusetts Department of Transportation (MassDOT) proposes to construct a new passenger rail station in Palmer, Massachusetts, hereinafter referred to as the "Project." The Palmer Station Planning and Design project is planning for the station to inform its design. This Transportation Impact and Access Study (TIAS) is part of the study.

To understand access conditions to/from the station and the potential impacts of new travel activity generated by the Project, VHB has developed this TIAS. It consists of two general components (1) a **Traffic Impact Analysis** and (2) a **Multimodal Station Access Plan**. The objective of these assessments is to identify the need for any potential infrastructure or operational changes to the local transportation system that improve access to the station and mitigate potential traffic impacts.

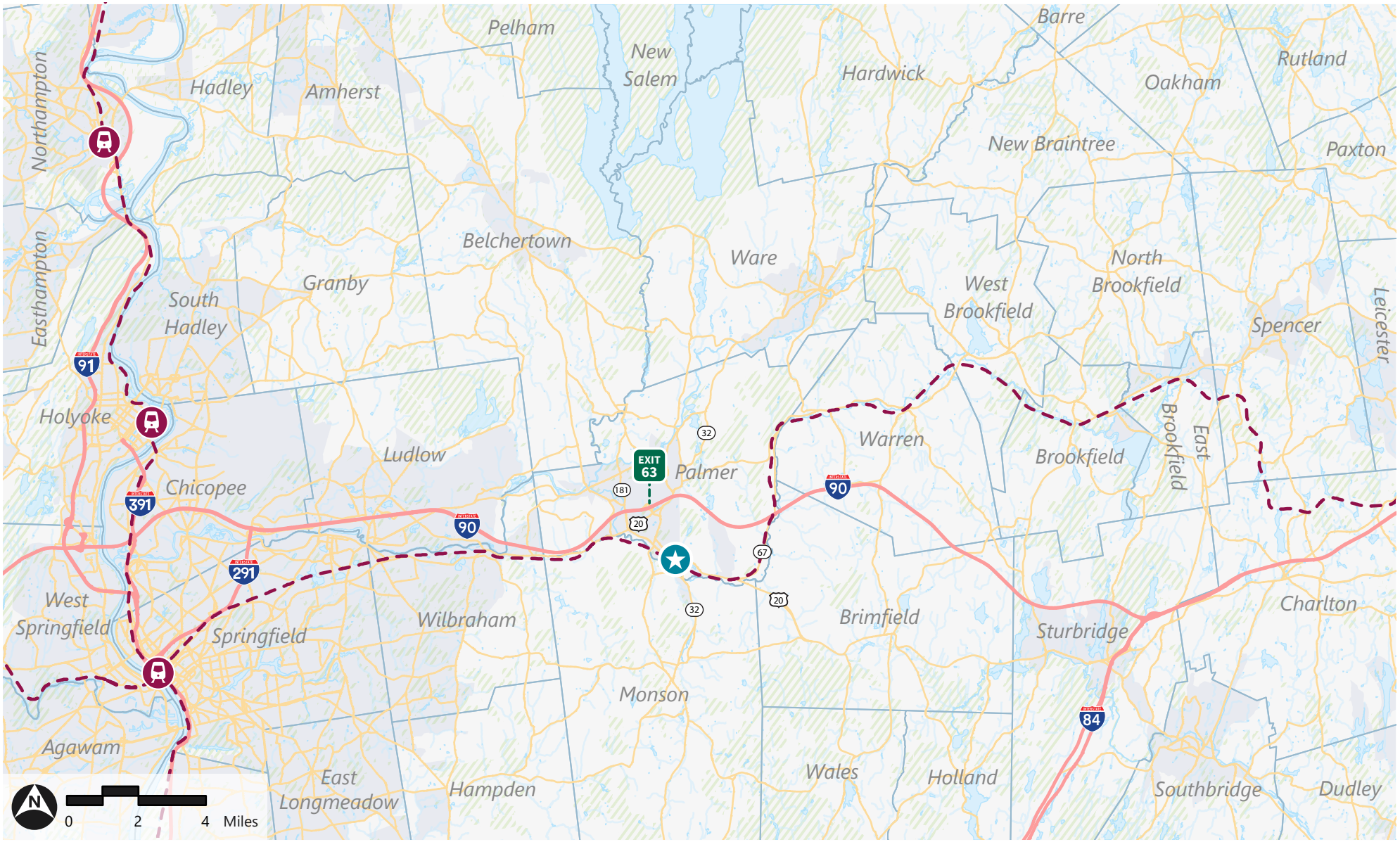
1.1 Project Background

Recent studies conducted by MassDOT considered reintroducing passenger rail service to the Town of Palmer as part of the Compass Rail vision for intercity passenger rail in Massachusetts. Compass Rail is comprised of existing and proposed West-East and North-South services with a hub in Springfield, MA. Future passenger service through Palmer would be part of the proposed West-East Rail routes, including an Inland Route between Boston, MA and New Haven, CT, through Springfield, and a Boston and Albany, NY, route. Both routes would use the Boston & Albany Line owned and operated by CSX Transportation (CSX).

Through a comprehensive analysis of alternative sites, the Palmer Station Planning and Design project identified the south side of CSX's Palmer Yard as the preferred location for a new passenger rail station serving Palmer and its surrounding communities. The proposed site location has access from South Main Street (the "station site"). The station site is just over 0.5 miles from downtown Palmer's Depot Village.

See **Figure 1** for a map of the broader Palmer area and **Figure 2** for a map of the station area.

Figure 1: Greater Region
Palmer Station | Palmer, Massachusetts



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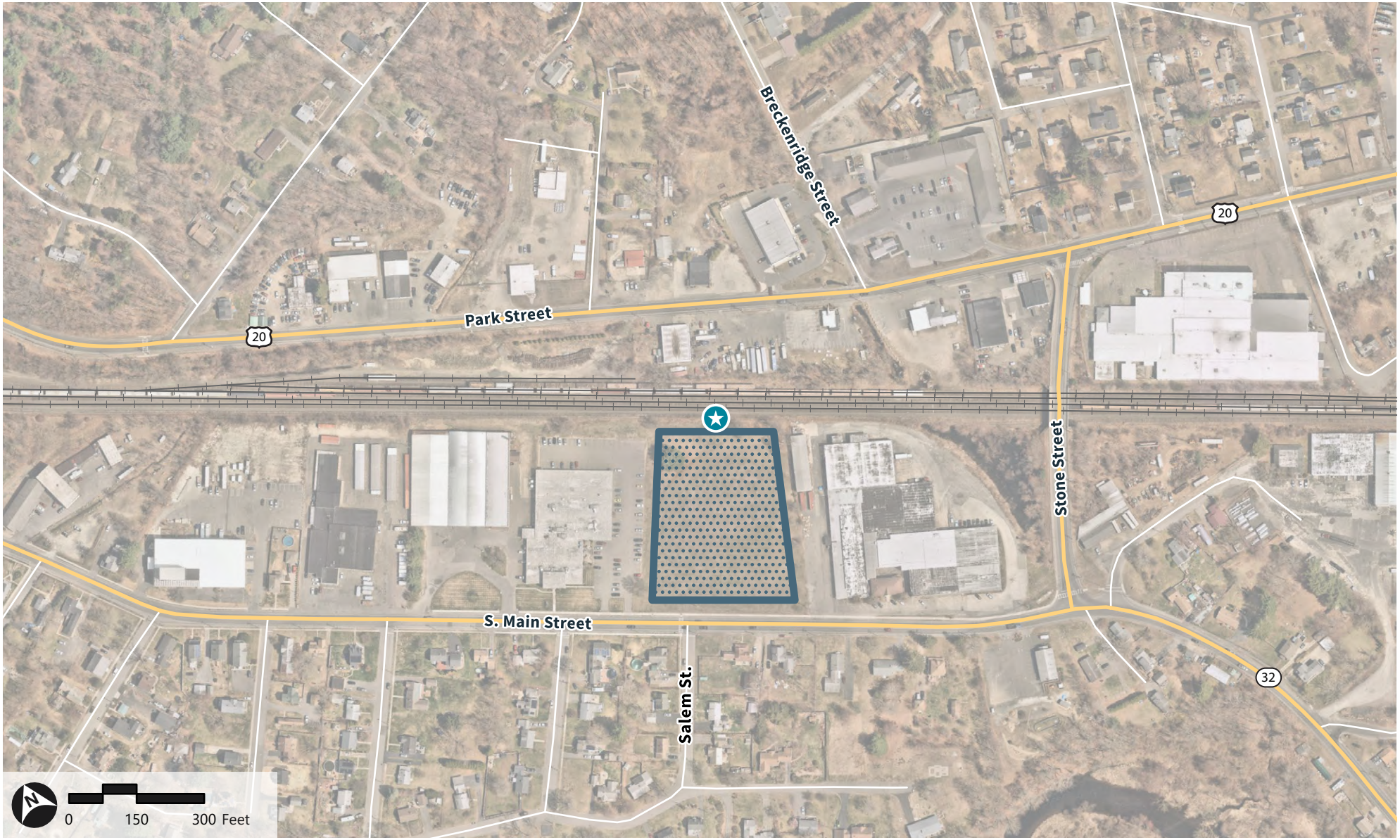
Source: MassGIS, ArcGIS Online

Figure 2: Station Area Map

Palmer Station | Palmer, Massachusetts



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Source: MassGIS, ArcGIS Online

1.2 Study Overview

This TIAS provides an evaluation and summary of the Station's quantified trip activity on the local street network. It includes an analysis of estimated vehicle trip generation (**Chapter 2**) and traffic operations at study area intersections (**Chapter 4**) under existing conditions and future conditions with station activity. **Chapter 3** includes descriptions of existing conditions (physical and operational) related to transportation network. The TIAS concludes with recommended changes to enhance safety, operations, and multimodal access to Palmer Station that could be implemented in connection with the project.

1.3 Key Findings

The TIAS resulted in the following key findings, which are further detailed in the remaining chapters of the report:

- From a traffic generation perspective, **Palmer Station is expected to have a low daily and peak period vehicle trip generation**. Based on MassDOT's and Amtrak's passenger projections on the West-East line, Amtrak traveler characteristics, and the site's access, a typical weekday could generate 62 vehicle trips, roughly split in half during each peak period.
- The addition of **Station site-generated traffic does not significantly impact operations at study area intersections**. In both the AM and PM peak hours, all intersections are expected to experience about the same operations under future conditions as experienced today. At the signalized intersections, when comparing the 2032 No-Build Condition and the 2032 Build Condition (with the station traffic), analysis results indicate that average vehicle delay may have increases of less than 4 seconds and no meaningful change to volume-to-capacity or queue lengths. At the minor approach leg at unsignalized intersections, the addition of station site-generated traffic could increase vehicle delay and queue lengths (by about one car length) as motorists wait for gaps in traffic; these do not warrant signalization or changes to intersection operation. With a limited train schedule, such periods of activity will be of limited duration and may not coincide with peak hour traffic operations.
- The **unsignalized intersections near the Station site do not warrant the installation of a traffic signal**, based on a review of relevant Manual on Uniform Traffic Control Devices (MUTCD) criteria.
- The **sight distance at the Station's driveway on S. Main Street is within safe distances** for motorists exiting the site and for motorists on S. Main Street.
- **Several sidewalks in the station area and its connections to Depot Village are either in poor condition and/or do not achieve recommended Americans with Disabilities Act (ADA) accessible path standards**. Sidewalks in this area would be an important connection between the Station site and Depot Village (0.5 miles or 12- to 15-minute walk).
- **PVTA may provide an opportunity to connect the station to the town's various villages, residential, and commercial areas, and to the region more broadly**. Coordination with PVTA is ongoing related to the potential to incorporate the proposed Palmer Station as a stop on the existing Palmer Shuttle service and other services.

2

Station Activity and Program

The station design related to the site's access/circulation and parking is informed by the expected level of rail passenger activity and guiding principles detailed in Amtrak's *Station Planning and Development Guidelines* and other relevant best practices for the inclusion and design of station access elements. (Additional details of the station program and conceptual design are documented in the Conceptual Design Report.)

This chapter describes the assumptions used to estimate the trip generation activity at the station and the transportation program elements associated with the station (e.g., accommodations for parking, pick-up/drop-off activity, etc.).

2.1 Station Activity

The projection of passenger activity at Palmer Station is used for station planning purposes and for the evaluation of traffic impacts conducted in this study. The projection was developed for MassDOT by Amtrak, which used its travel demand model. Additional assumptions are applied to estimate vehicle trip activity.

2.1.1 Passenger Ridership

Based on Amtrak's projections for passenger rail service on the West-East line for two daily round trips serving Palmer Station and extrapolated by MassDOT to project a future scenario of five daily round trips serving Palmer Station (the highest frequency of service currently contemplated), MassDOT projects an annual ridership (boardings and alightings) at Palmer Station of about 17,480 passengers.

To estimate average daily ridership, the annual value is divided by 312 days (the equivalent of six days a week); this generates an expected typical busy day that is higher than a true average day (by about 16 percent more). The resulting daily activity (boardings and alightings) at Palmer Station is 56 passengers. While this reflects a typical busy day for planning purposes, there may be individual days or periods with higher or lower ridership.

The typical busy day activity is further adjusted, as described next (Section 2.1.2), to estimate the vehicle trip generation expected at the station. Daily passenger activity and other key assumptions related to passenger travel (travel party size, travel duration) inform the vehicle trip generation and parking demands needed to evaluate traffic impacts and parking supply.

2.1.2 Vehicle Trip Generation

This section details the assumptions and adjustments used to arrive at a vehicle trip generation estimate for Palmer Station to apply to the traffic impact assessment.

Daily Trips

Based on Amtrak data[1] (rider per ticket) the average Massachusetts-based intercity travel party size is 1.16 passengers. This metric is used as an assumption of carpooling or average vehicle occupancy (AVO) for vehicle trips to/from the station site. Thus, for 56 passengers, about 48 vehicles are expected to travel to/from the site daily. For the traffic study, we apply a rounded value of 50 vehicle trips, or 25 to the site and 25 from the site. These correspond to vehicle trips carrying a passenger and serve as a preliminary estimate; an additional mode share adjustment to this estimate, described below, is necessary to account for deadhead vehicle trip activity associated with passengers being picked up or dropped off.

Peak-Hour Trips

Because the train schedule for the future service is preliminary and in development, we apply all the expected trips to the peak hour in the AM and the peak hour in the PM, rather than spreading the trips throughout other periods of the day. This also ensures a more "impactful" (conservative) projected use of the station regarding the traffic assessment.

To account for the various trip purposes of a passenger (e.g., commute, business, leisure, etc.), we assume that 65 percent of passenger trips to the station (for departures on the train) will occur in the morning, while 35 percent of passenger trips to the station will occur in the evening; this split is reversed for trips from the station.

Mode Choice Assumptions

Two final assumptions are made for the vehicle trip estimate, both related to travel mode choices: (1) 100 percent access to the station via automobile and (2) 25 percent of vehicle trips are for passenger pick-up or drop-off (PU/DO). PU/DO trips occur in vehicles that do not remain parked at the station for the duration of the passenger travel, and thus, generate a "deadhead" trip to (or from) the station without a train passenger.

We acknowledge that some passengers will arrive in a non-vehicle mode, such as by walking, biking, or using transit/shuttle bus. Nevertheless, for the traffic analysis, we assume that all rail passengers will arrive at (or depart) the station in a vehicle (including vehicles that carry more than one rail passenger).

1 Calculated from Massachusetts-based intercity riders on Amtrak Hartford Line, Valley Flyer, and Vermonter Services (2023). Data includes rider quantity per ticket (one-way and round-trip tickets) and passenger trip duration by ticket.

We also expect that some passengers will be picked up or dropped off by family/friend or a TNC (ride hailing app) vehicle (such as Uber or Lyft). A car that is used for passenger PU/DO arrives and departs the station site within the same peak hour, generating two vehicle trips for each departing (or arriving) train passenger. (A car that is parked on site for the duration of the passenger rail trip only generates one trip in a peak hour.) Thus, the added "deadhead" trip needs to be accounted in the vehicle trip generation estimate that is used for the traffic analysis.

Estimated Vehicle Trips

The resulting number and distribution of peak hour vehicle trips is shown in **Table 1** below. Each peak hour is expected to generate 31 vehicle trips to/from the station.

Table 1 Station Vehicle Trip Generation, Typical Busy Day

	Vehicle Trips (Unadjusted)			Vehicle Trips (Adjusted)		
Trip Direction	AM Peak Hour	PM Peak Hour	Daily	AM Peak Hour	PM Peak Hour	Daily
TO Site	16	9	25	**18**	**13**	31
FROM Site	9	16	25	**13**	**18**	31
Both Directions	25	25	50	31	31	62

Notes: *Unadjusted trips* refers to vehicle trips by rail passengers that do not account for pick-up or drop-off activity. *Adjusted trips* incorporate "deadhead" vehicle trips that arrive or depart the station site without a rail passenger. (The deadhead vehicle trip is added to the opposing direction of the vehicle trip that carries the passenger.)
Numbers are rounded to the nearest whole number.

2.2 Station Amenities: Transportation

Amtrak classifies stations into four categories based on annual ridership. Expected station amenities vary depending on the category of station.[2] With projected annual ridership of less than 20,000 riders a year, Palmer Station would classify as a Category 4 Shelter Station. While the projected ridership classifies Palmer Station as a Category 4 Shelter Station, it may include station features that are typically part of a Category 3 Caretaker Station. For example, while a parking lot is not a typical feature of a Category 4 Shelter Station, at sites with available land, a parking lot and other amenities could be considered.

With access anticipated to include park-and-ride passengers, the Palmer Station conceptual design includes a parking lot and amenities that support multimodal transportation access. This includes an area for passenger pick-up/drop-off activity, a curbside area for transit/shuttle bus passenger loading, a sidewalk connecting from the local street (South Main Street), and bicycle parking racks. Details on the site plan and design of these features are provided in the Conceptual Design Report.

2 *Amtrak Station Planning and Development Guidelines*.

3

Existing Conditions: Area Transportation Context

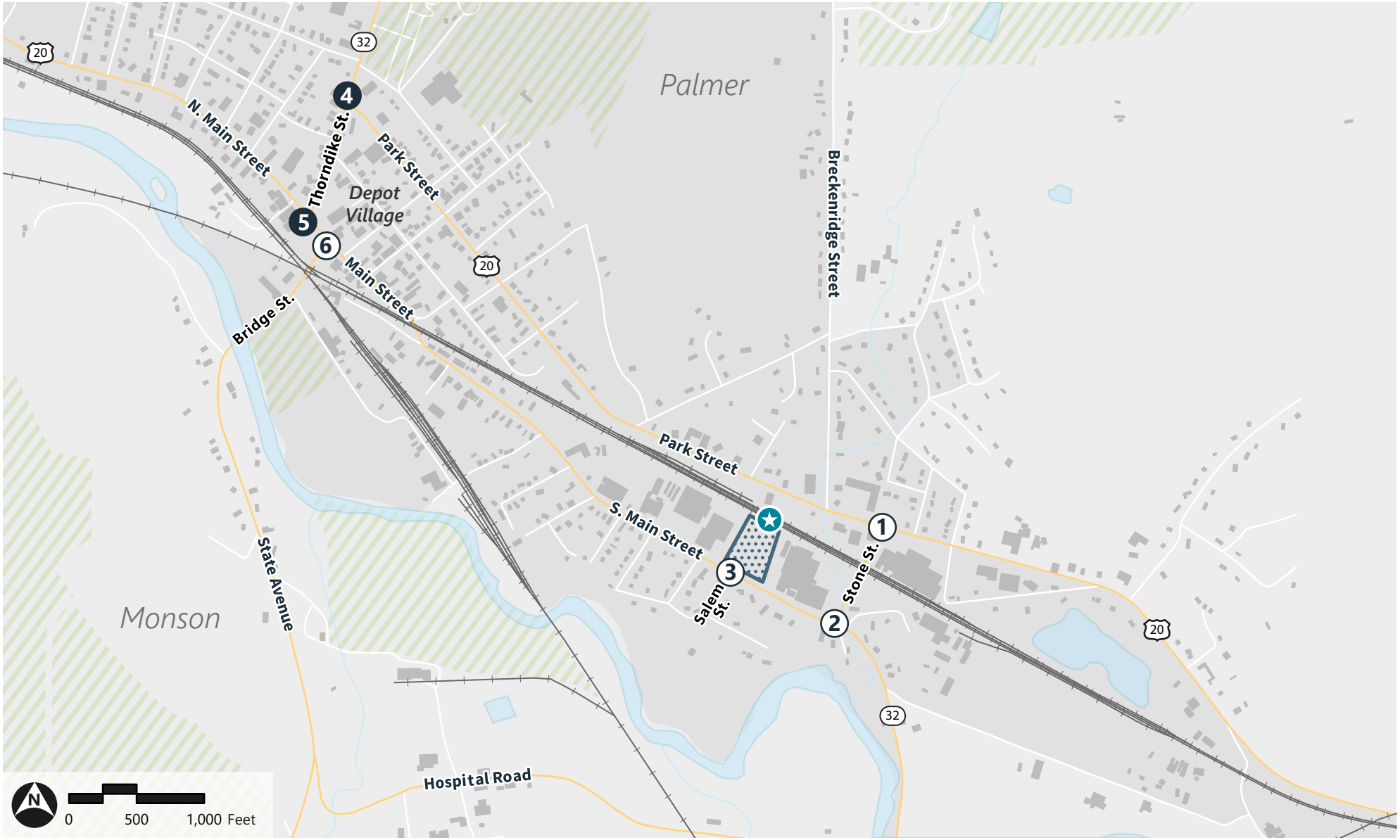
Evaluation of the transportation impacts associated with the Project requires an understanding of the existing transportation conditions in the study area including: an inventory of the traffic control, roadway, driveway, and intersection geometry; the collection of peak hour traffic volumes; a review of existing bicycle and pedestrian accommodations; a summary of public transit options; and a review of recent motor vehicle crash history. Each of these elements is described in detail below.

VHB conducted an inventory of roadway/transportation conditions within the study area in May 2025. The inventory included observations of traffic operations and intersection control (for study area intersections identified in **Figure 3**); presence of sidewalks, crosswalks, and bike lanes; and other related operational and physical elements related to travel through and within the study area.

Notable findings from these observations are presented in **Figure 4** (Existing Conditions Inventory: Study Area) and **Figure 5** (Existing Conditions Inventory: Station Area). Additional details of the transportation network are presented next. **Chapter 5** includes descriptions of opportunities to improve safe and convenient multimodal access to the station.

Figure 3: Study Area Intersections

Palmer Station | Palmer, Massachusetts



Proposed Station
Signalized Intersection
Unsignalized Intersection
Rivers and Streams
Principal Arterial/Minor Arterial/Major Collector/Minor Collector
Local Roads
Rail Lines
Station Site
Urban Areas
Lakes and Ponds
Open Space

Source: MassGIS, ArcGIS Online

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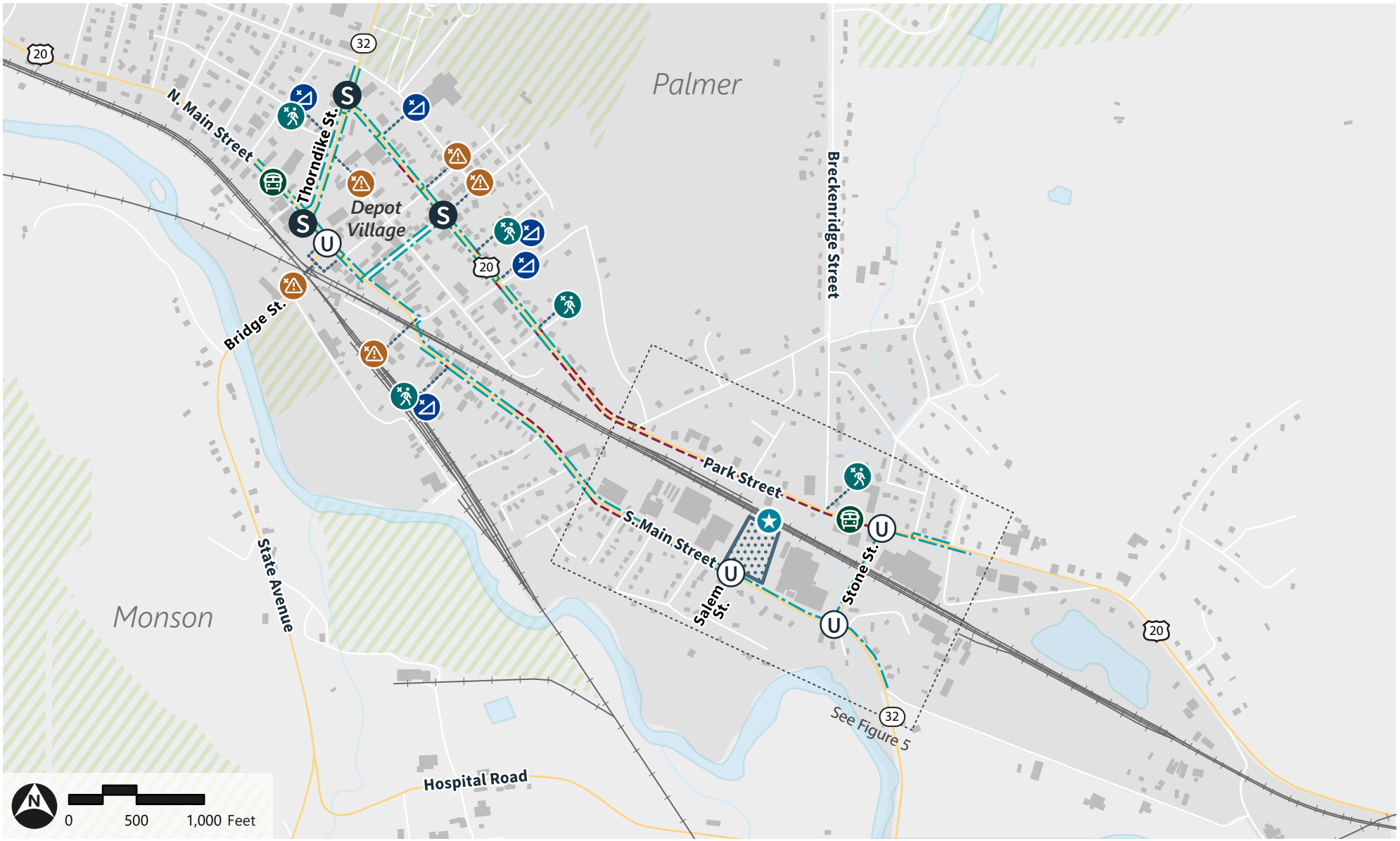
Figure 4: Existing Conditions Inventory (Study Area)

Palmer Station | Palmer, Massachusetts

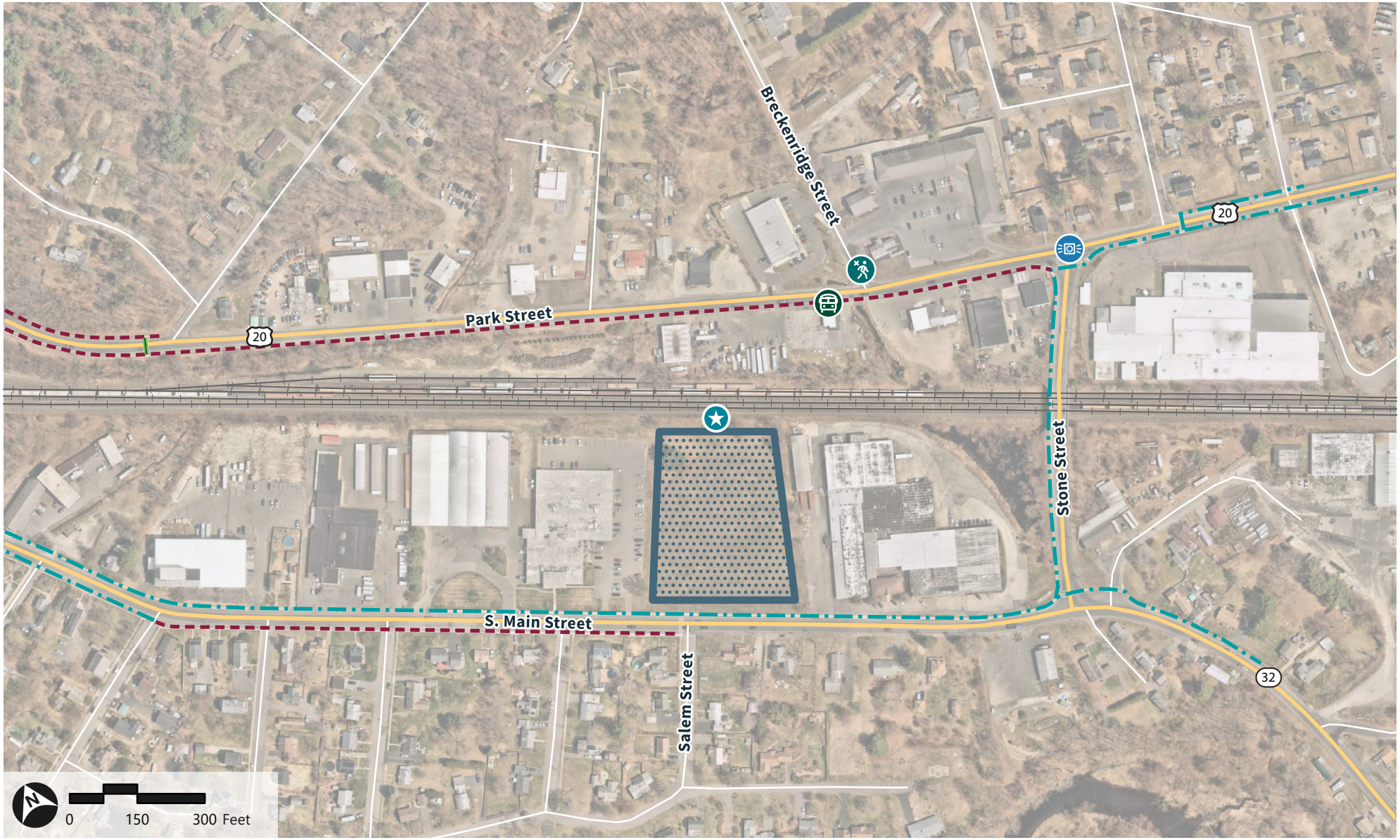


Proposed Station
Signalized Intersection
Unsignalized Intersection
PVTA Bus Stop
No detectable warning panels
No crosswalks
No ramps
Existing Sidewalk—Acceptable Condition
Existing Sidewalk—Section of Concern
Crosswalk
Rivers and Streams
Principal Arterial/Minor Arterial/Major Collector/Minor Collector
Local Roads
Rail Lines
Station Site
Urban Areas
Lakes and Ponds
Open Space

Source: MassGIS, ArcGIS Online

Figure 5: Existing Conditions Inventory (Station Area)

Palmer Station | Palmer, Massachusetts



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Source: MassGIS, ArcGIS Online

3.1 Study Area Roadways

The Station site is directly served by an access point off South Main Street near Salem Street.

MassDOT's Transportation Impact Assessment (TIA) Guidelines suggest including intersections or roadway segments where project site-generated trips increase the peak hour traffic volume by a) five (5) percent or more or b) by more than 100 vehicles per hour.[3] The selected study area includes locations that are the "gateways" into the station area from the greater Palmer area, and thus, the locations most likely to experience new traffic generated by the station. The traffic study (**Chapter 4**) seeks to explore whether the additional station traffic, particularly those vehicle volumes at turning movements, would impact intersection operations.

The study area roadways and intersections (see **Figure 3**) are described next, including descriptions of the existing lane configurations, traffic control at the intersections, and the roadway jurisdiction.

3.1.1 Study Area Roadways

Thorndike Street

Thorndike Street runs northbound and southbound between Main Street and the Massachusetts Turnpike (I-90). It is classified as a principal arterial under local jurisdiction. Thorndike Street consists of one lane of travel in each direction. Sidewalks are provided along the west side of the roadway. On-street parking is prohibited. The posted speed limit is 25 miles per hour (mph).

Park Street (Route 20)

Park Street (Route 20) is a two-way roadway connecting Thorndike Street in Palmer and Boston Road to the east, providing one travel lane per direction. It is classified as a principal arterial roadway with portions under either local or MassDOT jurisdiction. Sidewalks are provided on the south side of the roadway with infrequent pedestrian crosswalks. On-street parking is prohibited. The posted speed limit is 40 mph approaching Stone Street. Land use along Park Street is a mix of residential and commercial.

North Main Street/Main Street

North Main Street is a two-way roadway traveling in eastbound and westbound directions. It intersects Thorndike Street where it turns into Main Street east of the intersection, providing one lane per direction of travel. It is classified as a principal arterial under local jurisdiction. Sidewalks are provided on both sides of the of the road in downtown Palmer, in the study area. On street parking is allowed. The speed limit is 25 mph. Land use along the eastern part of North Main Street is commercial.

3 MassDOT, *Transportation Impact Assessment (TIA) Guidelines* (2014); see section 3.I., page 10. www.mass.gov/doc/transportation-impact-assessment-guidelines/download

Bridge Street

Bridge Street runs in a north/south direction within the study area. Bridge Street intersects Main Street in downtown Palmer (Depot Village); south of the Quaboag River at Fern Hill Rd. the roadway is named State Ave. (and Upper Palmer Road). Bridge Street is under local jurisdiction and is classified as a minor arterial. The roadway consists of one travel lane in each direction. There is a posted speed limit of 30 mph. Sidewalks are provided on the eastern side of the roadway and there are no crosswalks provided along the roadway. On-street parking is not offered. The land use around Bridge Street is mainly commercial.

South Main Street

South Main Street runs eastbound and westbound starting in the west from downtown Palmer where it continues from Main Street to the east where it crosses the river and turns into Palmer Rd. It is classified as a major collector under MassDOT jurisdiction at and south of the Station site. South Main Street consists of one lane of travel in each direction. Sidewalks are provided along both sides of the roadway west of the site (at Salem Street) and only on the north side of the roadway east of the site. There are infrequent pedestrian crosswalks along the roadway (two crosswalks in the 4,000-foot segment between Main Street in the Depot Village area and Stone Street near the station site). On-street parking is prohibited near the Project Site. The posted speed limit is 30 mph.

Stone Street

Stone Street runs northbound and southbound and connects Park Street to South Main Street. It is classified as a principal arterial under MassDOT jurisdiction. Stone Street consists of one lane of travel in each direction and it includes a bridge over the Boston & Albany rail corridor. Sidewalks are provided along the west side of the roadway. On-street parking is prohibited near the Station site. The posted speed limit is 20 mph.

3.1.2 Study Area Intersections

The study area intersections (**Figure 3**) are:

1. Park Street (Route 20) at Stone Street
2. South Main Street at Stone Street
3. South Main Street at Salem Street (vicinity of the Station site driveway)
4. Thorndike Street at Park Street
5. Thorndike Street at Main Street (Route 20)
6. Main Street at Bridge Street

1: Park Street at Stone Street (unsignalized)

Park Street (Route 20) and Stone Street form a three-way unsignalized intersection with a flashing beacon facing each direction. Park Street runs east/west and Stone Street intersects from the south. Each approach to the intersection consists of a single general-purpose lane.

The northbound approach operates under a red flashing beacon STOP control while the eastbound and westbound Park Street approaches are free flowing with a warning yellow flashing beacon. Sidewalks are only provided on the western leg of Stone Street and the southern side of Park Street. A crosswalk is provided across Stone Street at the intersection. The land use around the intersection is a mix of residential and commercial.

2: South Main Street at Stone Street (unsignalized)

South Main Street at Stone Street forms a three-way unsignalized intersection. South Main Street runs east/west and Stone Street intersects from the north. Each approach to the intersection consists of a single general-purpose lane. Close to this intersection are two minor roads that function as driveways intersecting South Main Street: Fenton Street from the northeast and Packard Street from the south; these approaches are excluded from the operational evaluation of the intersection.

The southbound approach operates under STOP control while the eastbound and westbound approaches are freely flowing. Fenton Street is assumed to operate under YIELD control due to the absence of STOP sign. Sidewalks are provided on the north side of South Main Street and the western side of Stone Street intersection. A crosswalk is provided across Stone Street, connecting all sidewalks. Land use around the intersection is a mix of commercial and residential.

3: South Main Street at Salem Street/Station Site Driveway (unsignalized)

South Main Street at Salem Street form a three-way unsignalized intersection. South Main Street runs east/west and Salem Street intersects from the south. Each approach to the intersection consists of a single general-purpose lane. The potential driveway to the station could intersect here or nearby.

The northbound approach of Salem Street operates under STOP control while the eastbound and westbound approaches are freely flowing. Sidewalks are provided on the north side of South Main Street and the south side of South Main west of the intersection. A crosswalk is provided across the eastbound approach of South Main Street. The land use around the intersection is a mix of commercial (north side) and residential (south side).

4: Thorndike Street at Park Street (signalized)

Thorndike Street at Park Street form a three-way signalized intersection. Thorndike Street runs north/south and Park Street intersects from a westbound approach. Each approach to the intersection consists of a single general-purpose lane.

All approaches operate under signal control. Sidewalks and crosswalks are provided on all sides of the roadways. Land use around the intersection is a mix of residential and commercial.

5: Thorndike Street at Main Street (signalized)

Thorndike Street at Main Street form a three-way signalized intersection. Main Street, called North Main Street west of the intersection, runs east/west, and Thorndike Street intersects from the north. The eastbound Main Street approach to the intersection provides a through and left turn lane while the westbound approach has a through and right turn lane. The southbound approach consists of a left and right turn lane.

Every approach operates under signal control. Sidewalks and crosswalks are provided on every leg of the intersection.

6: Main Street at Bridge Street (unsignalized)

Main Street at Bridge Street forms a three-way unsignalized intersection. Main Street runs east/west and Bridge Street intersects from the south. Each approach to the intersection consists of a single general-purpose lane.

The northbound approach operates under STOP control while the eastbound and westbound approaches are free flowing. Sidewalks are provided on all legs of the intersection. Crosswalks are provided along the eastbound and northbound approaches. There is diagonal on-street parking on the northern side of Main Street at this intersection. The land use around the intersection is commercial.

3.2 Active Transportation Infrastructure

3.2.1 Pedestrian Environment

Varying levels of pedestrian accommodation are provided throughout the study area (**Figure 4**) and station area (**Figure 5**) and are representative of the level of pedestrian accommodation throughout Palmer. Sidewalks exist on most roadways featured in the study area.

A few notable observations on walking conditions are:

- Across from the Station site, the sidewalk on the south side of South Main Street terminates at a crosswalk across Salem Street.
- There is no sidewalk present on the south side of South Main Street between Salem Street and Stone Street. Sidewalks are also missing along the east side of Stone Street and the north side of Park Street near the site.
- The sidewalk on the south side of South Main Street west of Salem Street is narrow.
- The sidewalk on the south side of Park Street is in poor condition and is narrow.

In the Depot Village area, signalized intersections with pedestrian accommodation provide pedestrian signals for all crosswalks. Crosswalk ramps are provided for some crosswalk approaches, and tactical warning strips are provided on some, but not all, crosswalk ramps.

Enhancements to the pedestrian network within the study area were proposed by the Town of Palmer Master Plan,[4] including improvements slated as part of the town's 2018 Complete Streets Prioritization Plan. The Town is slated to implement some improvements to segments and intersections in the Depot Village area in 2026; these are discussed in Chapter 5.

3.2.2 Bicycle Amenities

Existing dedicated bicycle facilities in the study area are not present in any meaningful way. Bicyclists can use the shoulder or the roadway itself to travel, although no signage is present to designate shared bike lanes. MassDOT designates this area of Palmer near the proposed station as having a "medium" potential for walking and bicycling, according to PVPC's recent update to the *Regional Bicycle and Pedestrian Plan*.[5]

Improvements to the bicycle network within the study area were proposed by the Town of Palmer Master Plan.

"North Main Street (Depot Village)

- *Consider adding bicycle signage along the street, such as 'Bicyclists may use full lane.' This will increase motorists' awareness of cyclists and increase safety on the roadway.*
- *Consider temporary placemaking pilot programs to activate vacant storefronts and create a more walkable and bikeable downtown.*
- *Consider adding bicycle racks (potentially designed by local artists) along the street to accommodate and encourage bicycling.*

Thorndike Street (Depot Village)

- *Consider implementing Shared-Use Arrows ("Sharrows") on the pavement for bicyclists. Also, consider adding bicycle signage along the street.*
- *Consider widening the median separating traffic at the intersection with North Main Street. This will decrease motor vehicle speeds and improve the safety of the intersection.*

Main Street (Depot Village)

- *Consider undertaking placemaking initiatives on the street. Encourage public usage of the park on Main Street, consider turning around benches on Main Street to face hillside.*
- *Consider adding an additional crosswalk where sidewalk ends on the southeastern end Main Street."*

A comprehensive implementation plan is not published on the Town's website (as of November 2025).

4 Town of Palmer, Massachusetts. *Palmer Master Plan*. July 2021. *PalmerMP_Final_07292021.pdf.* Available at www.townofpalmer.com/planning. Accessed July 14, 2025.

5 Pioneer Valley Planning Commission, "Regional Bicycle and Pedestrian Plan," December 2025. Available at https://pvpc.org/wp-content/uploads/2025/12/Regional-Bicycle-and-Pedestrian-Plan-2025-Update-Final-Report.pdf. Refer to page 45 for a discussion on MassDOT's modeling analysis exercise to categorize roadways by their potential for everyday biking,

3.3 Public Transportation

The Pioneer Valley Transit Authority (PVTA) offers public transportation (transit) services in Palmer and surrounding area. Detailed maps and schedules are provided in the Appendix. Only the PVTA's Palmer Shuttle currently has a route that travels past the Station site, but it does not currently stop within the station area. (Opportunities to provide transit service to the station are discussed in **Chapter 5**.)

Palmer Shuttle

The PVTA Palmer Shuttle (PS) provides weekday and weekend service between local Palmer destinations (including Three Rivers, Bondsville, and Thorndike neighborhoods).[6] The shuttle route also provides connections to Ware (via the Palmer Big Y stop) and to Springfield's Union Station where riders can access additional bus, train, and Amtrak services. The Palmer Shuttle route operates as a one-way loop that takes about 36 minutes to complete.

The nearest stop to the Station site is on Park Street at the intersection with Breckenridge Street, about 0.4 miles (or a 10-minute walk) from the site. The transit route travels past the Station site on South Main Street. The route has a stop within Depot Village at the Palmer Library on N. Main Street, just west of Thorndike Street.

The local shuttle service runs every 45 minutes during the day except during peak morning and evening periods when the additional Springfield and Ware routes occur.

Ware Shuttle

The PVTA Ware Shuttle (WS) service connects neighboring communities of Ware and Wilbraham via Palmer, with stops in Palmer including the Library stop at Palmer's Depot Village and the Palmer Big Y stop. The route travels on N. Main Street and Thorndike Street through Depot Village.

Quaboag Connector

The Quaboag Valley Community Development Corporation (QVCDC) and the Town of Ware established the Quaboag Connector, a demand-response shuttle service. The service area includes the Town of Palmer and eight other area communities. It operates Monday through Saturday.

6 www.pvta.com/schedules/PalmerShuttle.pdf

3.4 Traffic Volumes

VHB conducted traffic counts on Thursday, May 1, 2025, including turning movement counts (TMCs) inclusive of vehicle, bicycle, and pedestrian volumes. The 2025 existing condition weekday morning and evening peak hour vehicle volume networks are presented in **Figure 6** and **Figure 7**, respectively (Pedestrian and Bicycle Volumes are presented in **Figure 8** through **Figure 11**). Detailed traffic count worksheets are provided in the Appendix.

The TMCs are used to establish the Project Study Area network peak hour volumes for a baseline conditions analysis. The weekday morning peak hour was determined to be 7:00 AM to 8:00 AM and the weekday evening peak hour from 4:15 PM to 5:15 PM. The TMCs are provided in the Appendix for reference.

Over the course of three days, continuous 24-hour automatic traffic recorder (ATR) counts were conducted along South Main Street, east of Salem Street (Thursday, May 1, 2025, through Saturday, May 3, 2025). The collected data include traffic volumes and vehicle classification. **Table 2** presents a summary of the weekday traffic data.

MassDOT 2024 Seasonal Adjustment Rates (see Appendix) were reviewed; however, no seasonal adjustments were applied because the counts in May represent a typical high-volume condition. Therefore, the counts conducted as part of this study are used to represent the 2025 Existing Condition.

Table 2 South Main Street, east of Salem Street: Weekday Traffic Volumes

	Weekday Daily	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
Location	**Volume (two-way)**	**Volume**	**K Factor[a]**	**Directional Flow[b]**	**Volume**	**K Factor**	**Directional Flow**
South Main Street, east of Salem Street	7,300	460	6.3%	68% WB	610	8.4%	59% EB

Source: ATR data, May 1-2, 2025

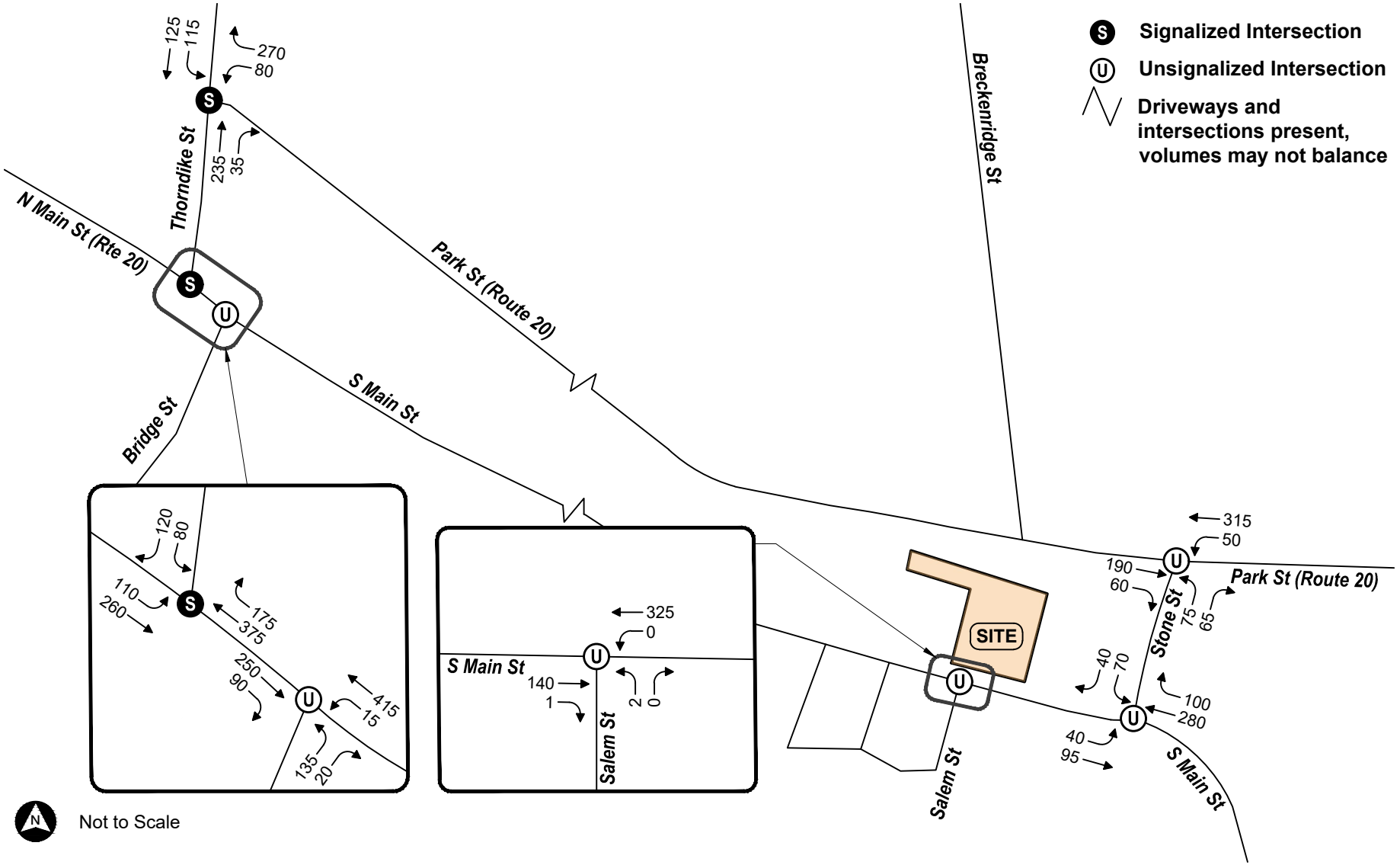
a Percentage of daily volume that occurs during the peak hour

b Percentage of vehicles traveling in one direction during the peak hour

Figure 6: 2025 Existing Conditions Vehicle Volumes - Weekday AM Peak Hour

Palmer Station | Palmer, MA

08/06/2025



Not to Scale

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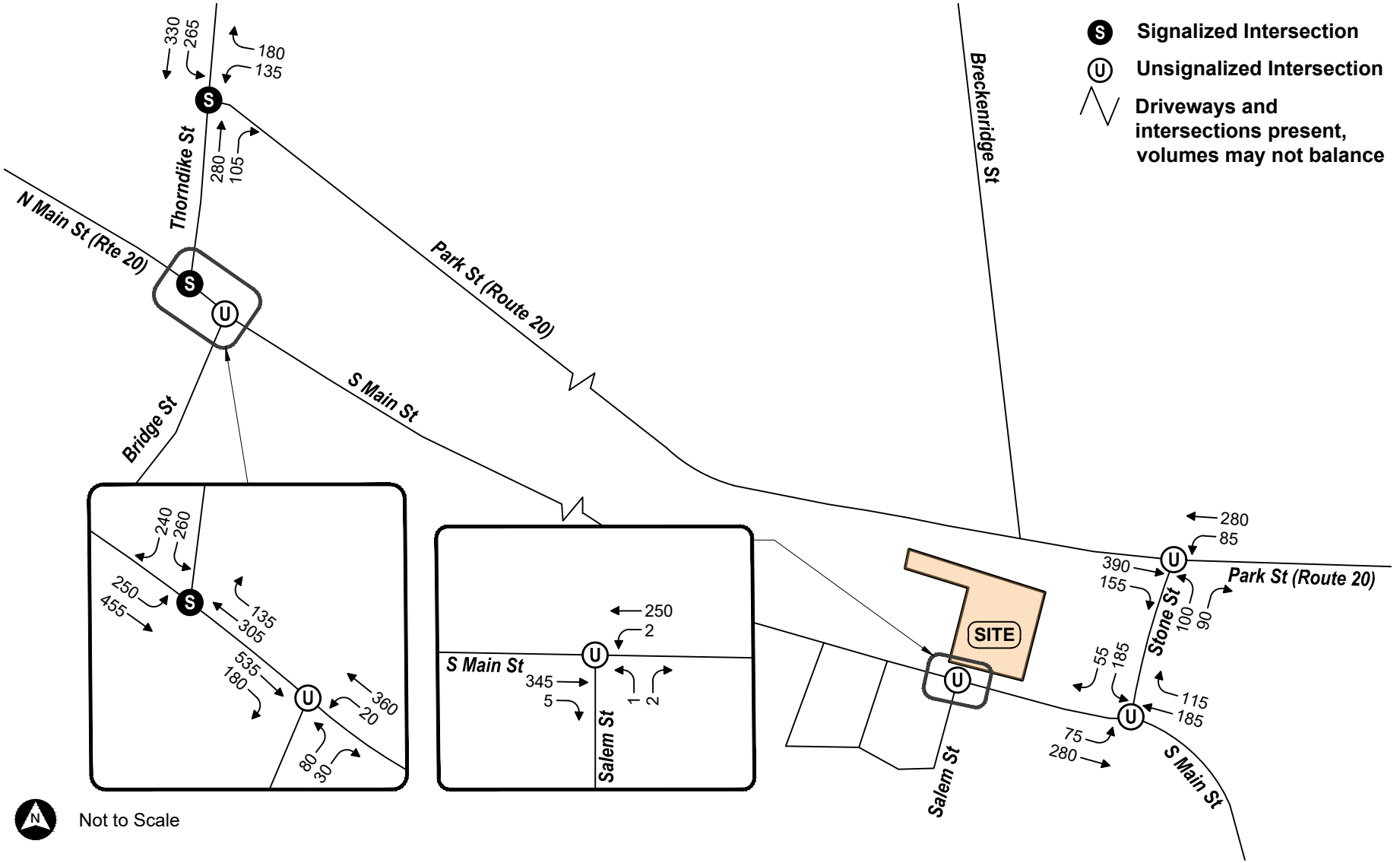
Figure 7: 2025 Existing Conditions Vehicle Volumes - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025



Not to Scale

Figure 8: 2025 Existing Conditions Pedestrian Volumes - Weekday AM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

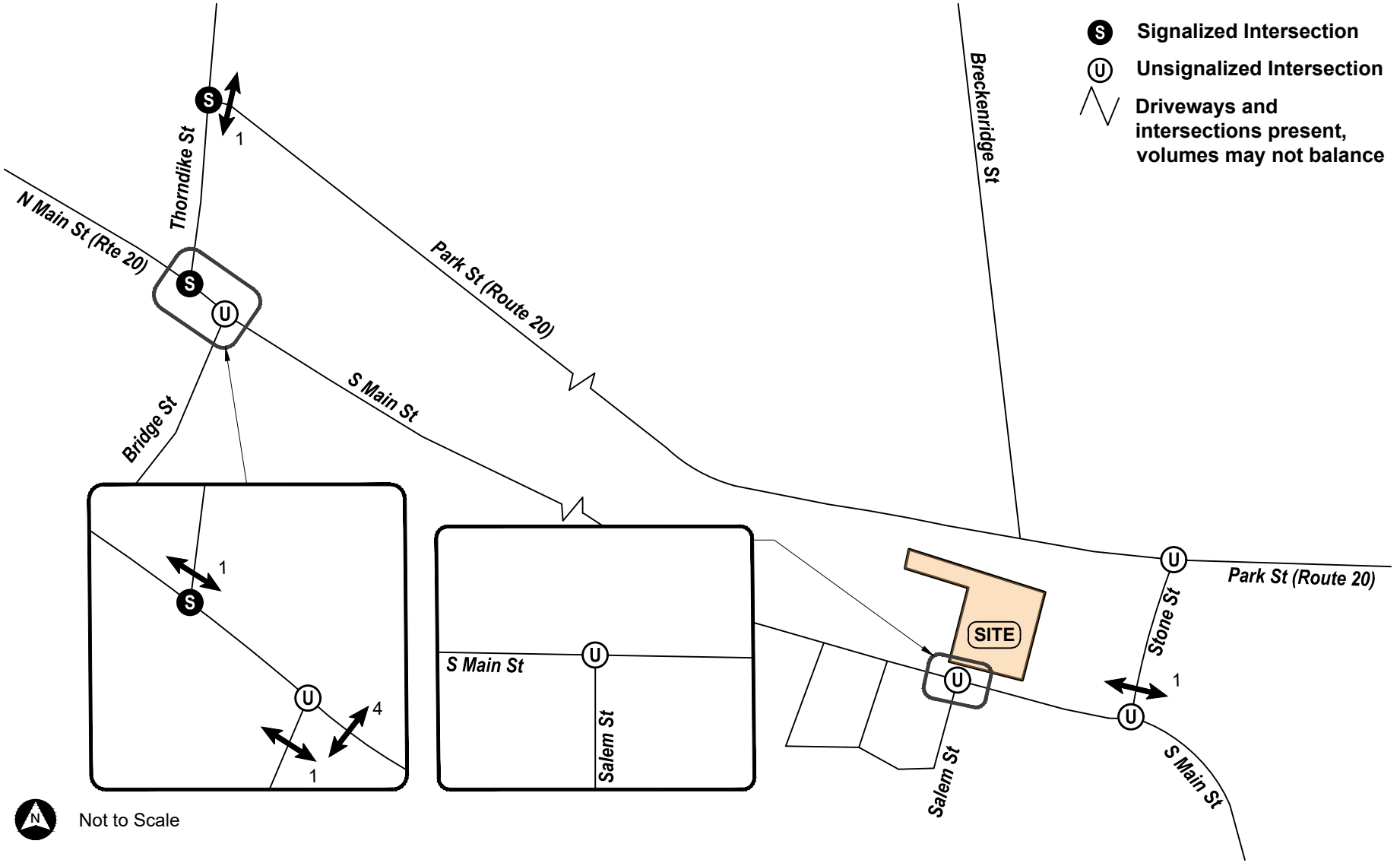


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Figure 9: 2025 Existing Conditions Pedestrian Volumes - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

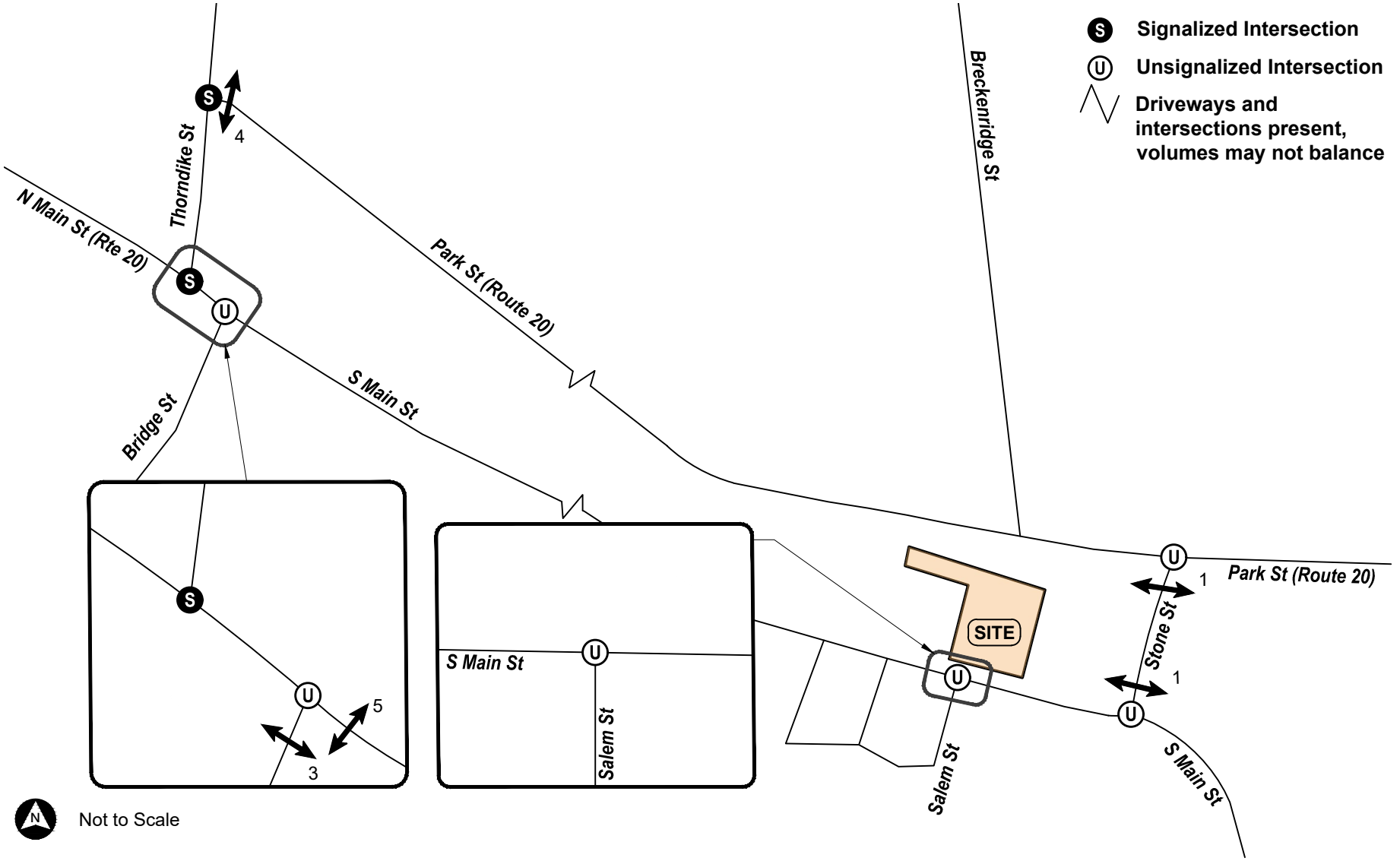

Figure 10: 2025 Existing Conditions Bicycle Volumes - Weekday AM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

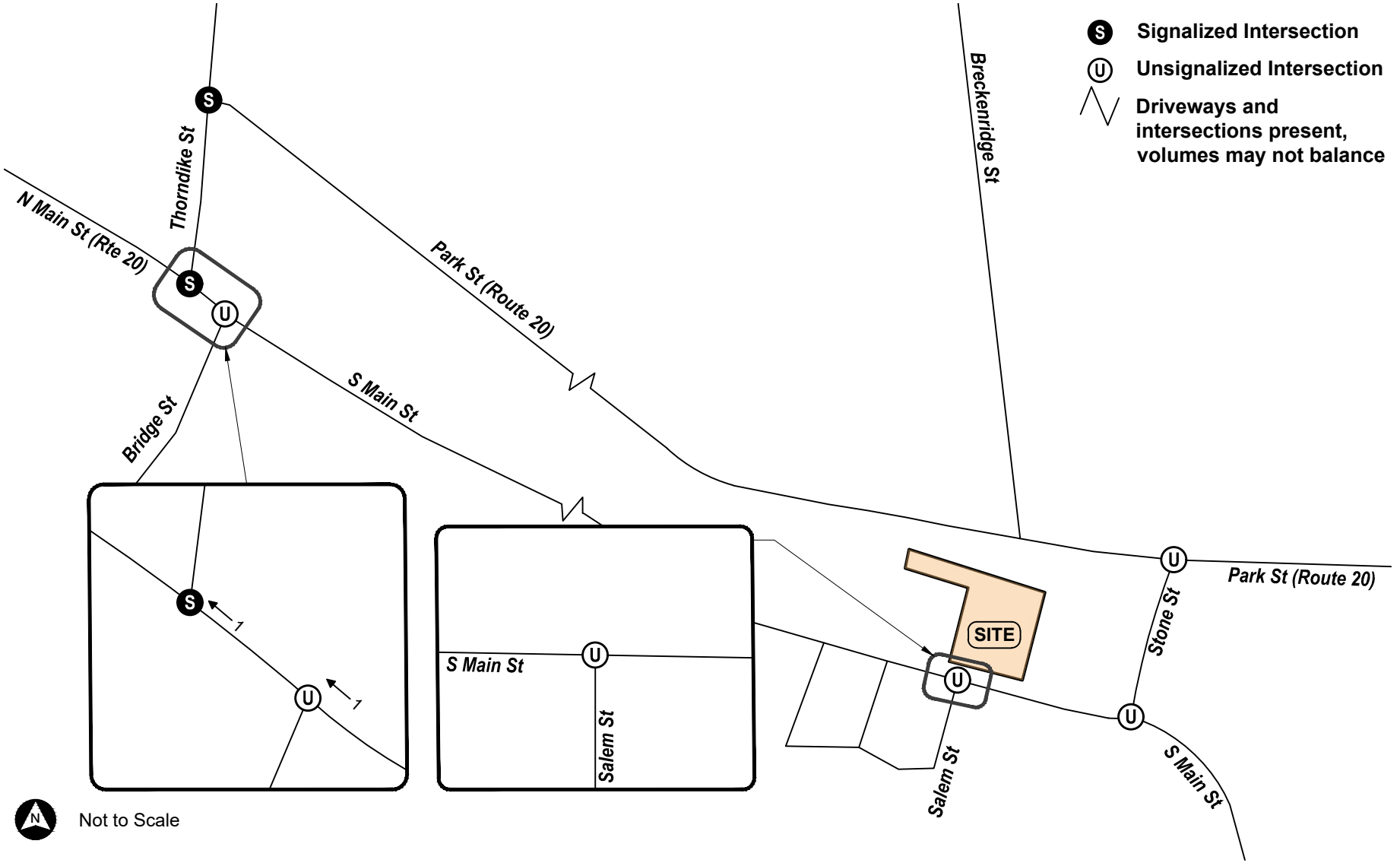

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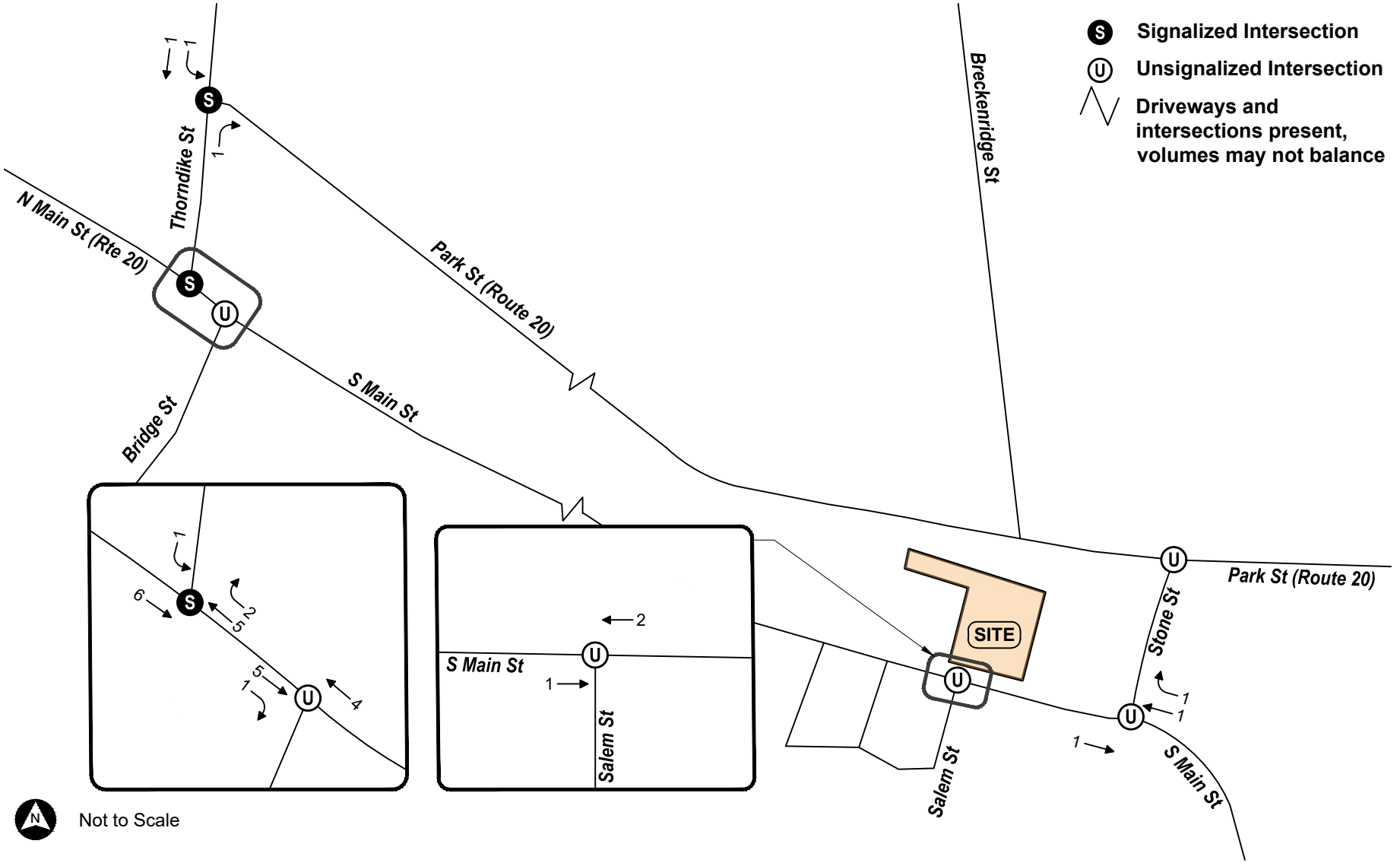
Figure 11: 2025 Existing Conditions Bicycle Volumes - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025



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3.5 Crash Inventory

A crash inventory was conducted to identify potential vehicle crash incident trends in the traffic study area.

3.5.1 Crash Data Source

The MassDOT roadway crash database is comprised of crash data from the RMV primarily for use in traffic studies and safety evaluations. Some crash incidents may not be available in the database due to individual crashes not being reported or the city (local) crash records are not provided in an RMV-compatible format.

The vehicle crash data for the traffic study area was obtained from MassDOT (RMV) for the years 2019 to 2024. A summary of vehicle crash history at the study area intersections is included in **Table 3** and the detailed crash data is provided in the Appendix.

3.5.2 Crash Rates

Crash rates are calculated based on the number of crashes at an intersection and the volume of traffic travelling through that intersection daily. Rates that exceed MassDOT's average for crashes at intersections in the district in which the town or city is located could indicate safety or geometric issues for an intersection.

The study area in Palmer falls within District 2. The MassDOT average crash rate for District 2 is 0.89 for signalized intersections and 0.62 for unsignalized intersections. The crash rates represent the number of reported crashes for every million vehicles that pass through an intersection. Thus, on average, 0.89 crashes occurred per million entering vehicles at signalized intersections throughout the district and 0.62 crashes occurred per million entering vehicles at unsignalized intersections.

The review of the crash data finds that within the study area, five out of six intersections exhibit crash rates lower than the MassDOT District 2 average crash rates. These rates are summarized in **Table 3**. At the intersection of Park Street at Stone Street, incidents correspond to a crash rate of 0.90, which is significantly above the average for unsignalized intersections within District 2. The predominant types of collisions within the study area in recent years are angle, rear-end, and single vehicle crashes.

3.5.3 Highway Safety Improvement Program

A review of MassDOT's Highway Safety Improvement Program (HSIP) database finds that none of the study area intersections are potential HSIP-eligible clusters, based on the most recently available data. An HSIP-eligible cluster is one in which the total number of "equivalent property damage only" crashes in the area falls within the top 5 percent of all crash clusters in that region. Being HSIP-eligible makes the location eligible for FHWA and MassDOT funds to address the identified safety issues at these locations.

Table 3 2019-2024 Vehicle Crash Summary

	Park Street at Stone Street	South Main Street at Stone Street	South Main Street at Salem Street	Thorndike Street at Park Street	Thorndike Street at Main Street	Main Street at Bridge Street
Signalized?	No	No	No	Yes	Yes	No
MassDOT D2 Average Crash Rate	0.62	0.62	0.62	0.89	0.89	0.62
Calculated Crash Rate[2]	0.90	0.33	0.00	0.88	0.75	0.29
Exceeds District Average	Yes	No	No	No	No	No
Year						
2019	4	2	0	4	6	1
2020	*1*	*0*	*0*	*0*	*0*	*0*
2021	6	2	0	9	7	1
2022	4	1	0	5	7	1
2023	3	1	0	2	2	3
2024	3	0	0	3	3	1
Total	21	6	0	23	25	7
Collision Type						
Angle	8	0	0	4	8	3
Head-on	0	0	0	2	1	0
Rear-end	5	3	0	9	8	0
Rear-to-rear	0	0	0	0	0	0
Sideswipe, opposite direction	1	0	0	3	0	1
Sideswipe, same direction	0	0	0	3	5	1
Single Vehicle Crash	7	3	0	2	3	2
Unknown	0	0	0	0	0	0
Severity						
Fatal Injury	0	0	0	0	0	0
Non-Fatal Injury	3	1	0	3	7	3
Property Damage Only (none injured)	17	5	0	19	18	4
Not Reported	1	0	0	1	0	0
Time of day						
Weekday ,7:00 AM – 9:00 AM	1	1	0	3	2	0
Weekday, 4:00 PM – 6:00 PM	4	2	0	5	2	0
Saturday 11:00 AM – 1:00 PM	0	0	0	1	0	0
Weekday, other time	11	2	0	8	17	5
Weekend, other time	5	1	0	6	4	2
Pavement Conditions						
Dry	15	5	0	20	22	7
Wet	6	1	0	3	3	0
Snow/Ice/Slush	0	0	0	0	0	0
Non-Motorist (Bike, Pedestrian)	0	0	0	0	0	2

Source: MassDOT RMV Crash Database

1. Because of Covid-19 pandemic travel disruptions, Year 2020 crash data from MassDOT is noted but excluded in any calculations including totals and intersection crash rate.
2. Calculated Crash Rate is based on data from 2016–2021 – with 2020 data excluded.

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4

Traffic Operations Analyses

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess the quality of flow, roadway capacity analyses were conducted with respect to Existing and projected No-Build and Build traffic volumes for both weekday morning and weekday evening peak hours. Capacity analyses provide an indication of how well the roadway facilities can serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service.

4.1 Future Traffic Conditions

4.1.1 Future No-Build Condition Traffic Volumes

Traffic volumes in the study area were projected to the year 2032, reflecting MassDOT's recommended seven-year planning horizon.[7] Traffic volumes on the roadway network under year 2032 No-Build Condition include existing traffic and new traffic (growth) resulting from general background land development. For the No-Build condition analysis, no traffic is added for any specific proposed development project in the area, which allows for evaluating a condition that only introduces the station-related traffic.

Background Traffic Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. Often, an annual percentage increase (growth rate) is applied to increase a study area's traffic volumes.

7 MassDOT, *Transportation Impact Assessment (TIA) Guidelines* (2014), page 34; www.mass.gov/doc/transportation-impact-assessment-guidelines/download

The 2032 No-Build traffic volumes were developed by only applying a growth rate of 0.16 percent per year only based on a review of historic traffic growth and the Town of Palmer's Master Plan.[8]

The resulting 2032 No-Build weekday morning and weekday evening peak hour traffic volume networks are illustrated in **Figure 12** and **Figure 13**, respectively.

4.1.2 Future No-Build Conditions: Roadway Improvement Projects

To properly assess future traffic conditions, a traffic study should consider planned and recently completed roadway improvements within the study area. No known significant transportation improvement projects were identified that may affect traffic operations within the seven-year planning horizon.

8 "Palmer's Demographic Conditions." Housing. *Palmer Master Plan*, July 2021; Pg. 37.

Figure 12: 2032 No Build Conditions Vehicle Volumes - Weekday AM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

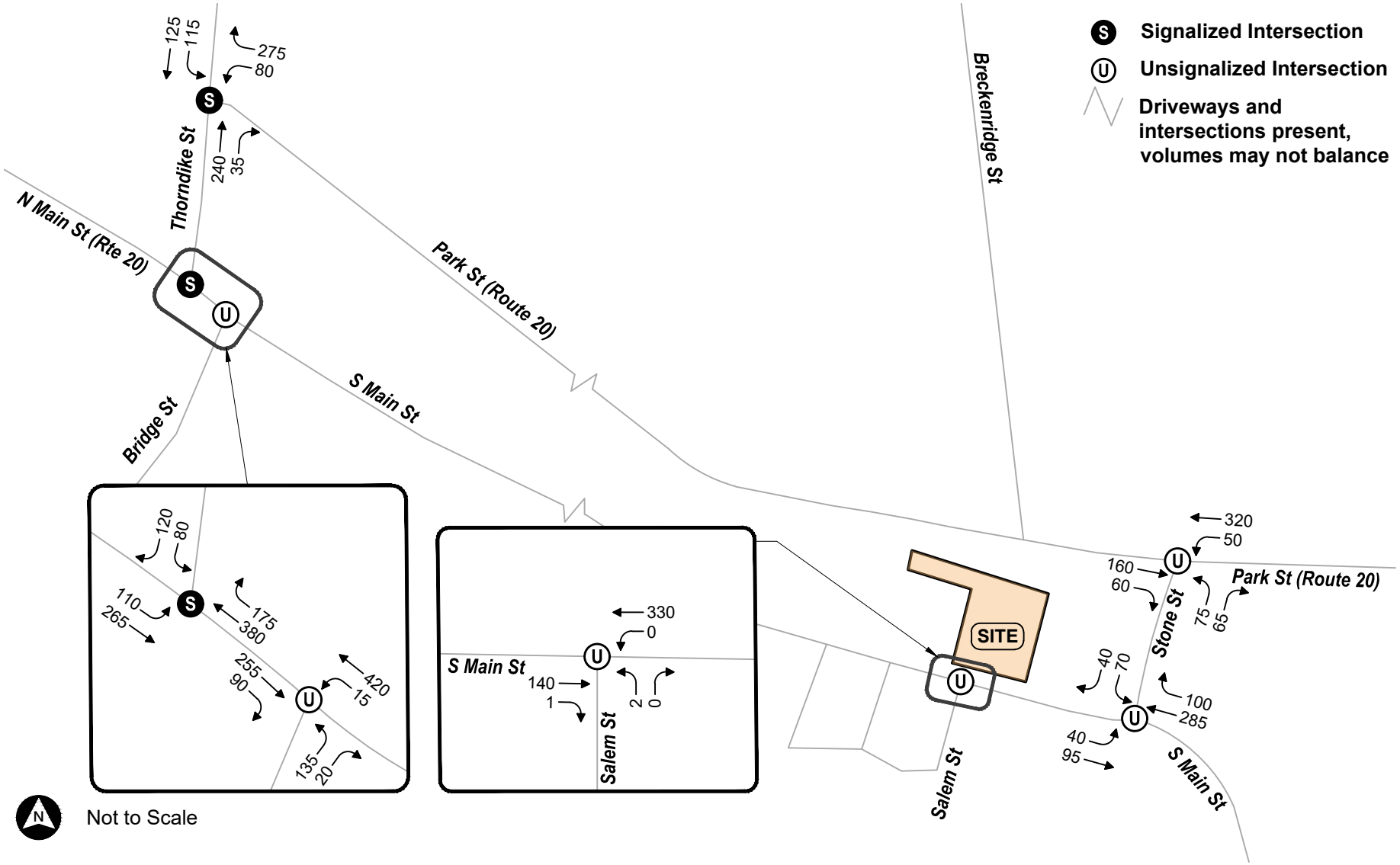

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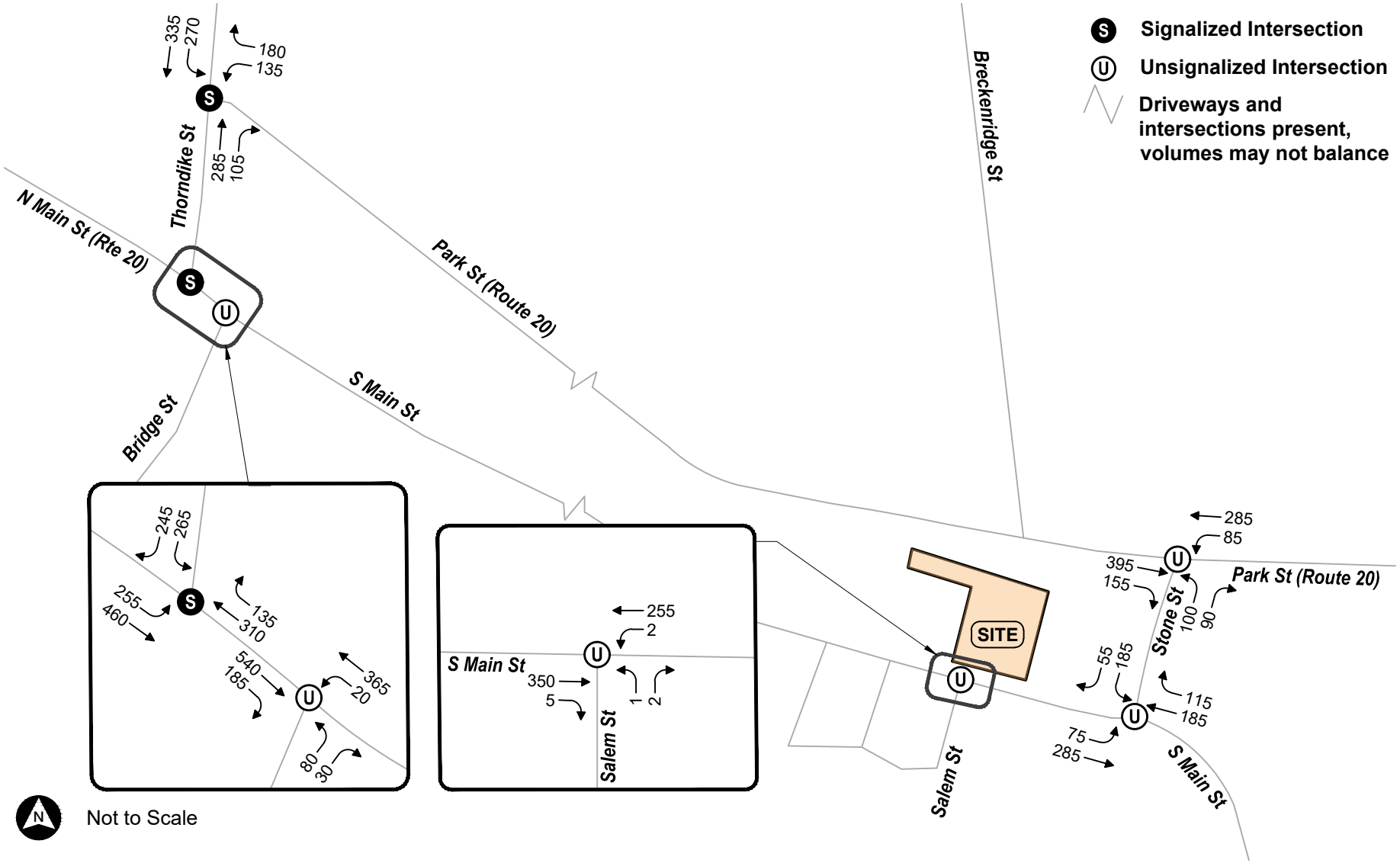
Figure 13: 2032 No Build Conditions Vehicle Volumes - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025



4.1.3 Future Build Condition Traffic Volumes

As detailed in **Chapter 2.1.2**, Palmer Station is projected to generate about 31 vehicle trips each peak hour during a typical weekday, as shown in **Table 4**.

Table 4 Station Vehicle Trip Generation, Typical Busy Weekday

	Vehicle Trips	
	Weekday Morning (AM Peak Hour)	**Weekday Evening (PM Peak Hour)**
Enter	18	13
Exit	13	18
Total	**31**	**31**

See inputs and assumptions in **Chapter 2.1.2**.

Vehicle Trip Distribution and Assignment

Vehicle trips to and from the Station site will travel through the local study area, adding traffic to certain intersections and movements. To represent the relative activity of this traffic, we apply a proportional distribution of the trips according to the existing traffic volumes entering and exiting the study area. This local pattern serves as an indication of the relative use of the downtown Palmer (and station) area roadways.

The Station-related traffic volumes for the Build Condition are assigned to the study area roadway network (intersection approaches and movements) based on the vehicle trip distribution patterns shown in **Table 5** and illustrated in **Figure 14**. The Station-generated vehicle trips on the local street network for the weekday morning and weekday evening peak hour are shown in **Figure 15** and **Figure 16**.

The assigned traffic volumes are added to the 2032 No-Build peak hour traffic volume networks to develop the 2032 Build Condition for the weekday morning and evening peak hour traffic volume networks, as shown in **Figure 17** and **Figure 18**, respectively.

Table 5 Trip Distribution Summary

Travel Route	Direction	Share of Trips
N. Main Street	From West/ Northwest	25%
Thorndike Street	From North/I-90	22%
Park Street	From East	23%
S. Main Street	From Southeast	10%
Bridge Street	From Southwest	20%
Total		100%

Source: Based on the study area's 2025 turning movement counts.

Figure 14: Station Vehicle Trip Distribution

Palmer Station | Palmer, MA

08/06/2025

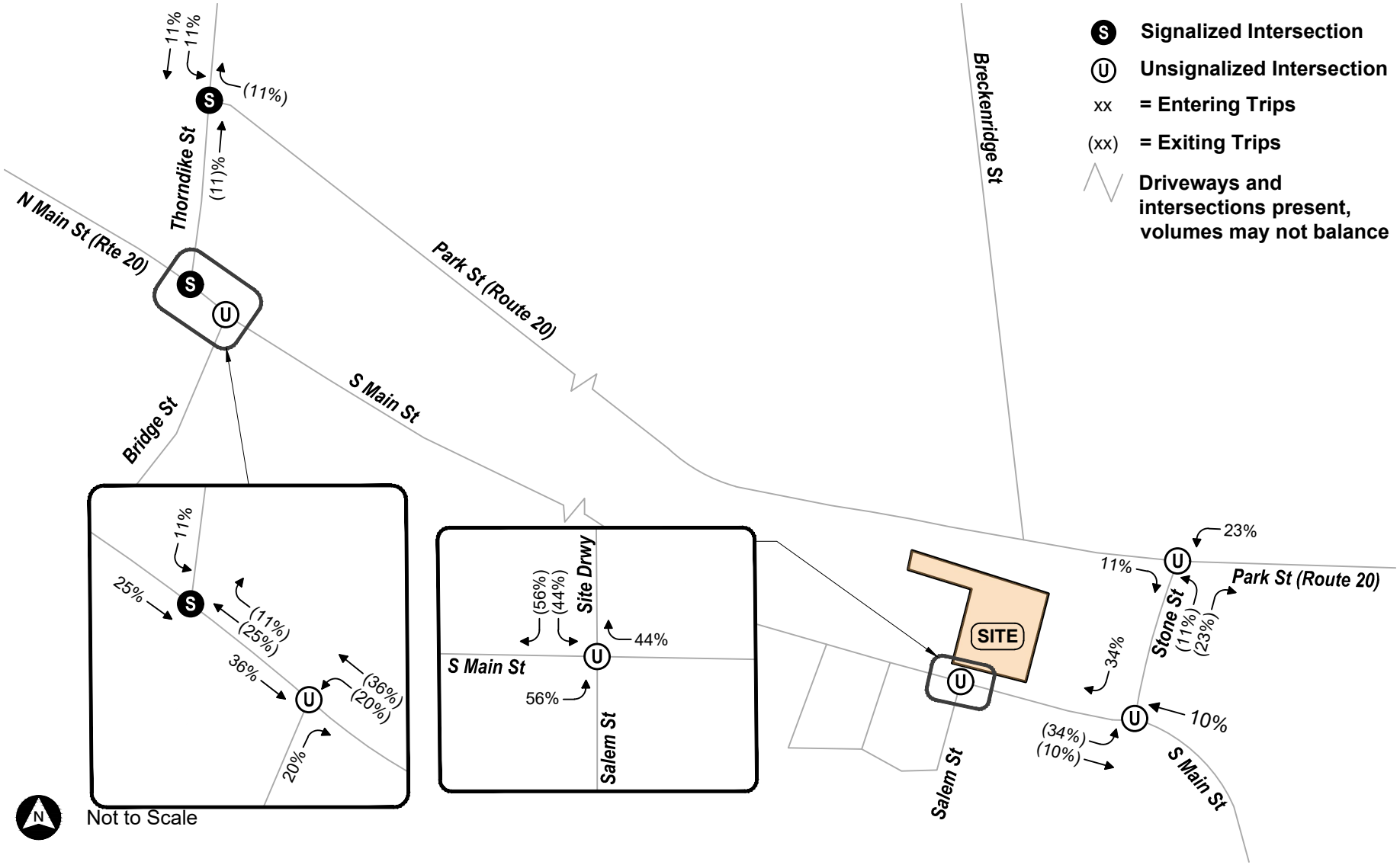


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Figure 15: Station-Generated Vehicle Trips - Weekday AM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

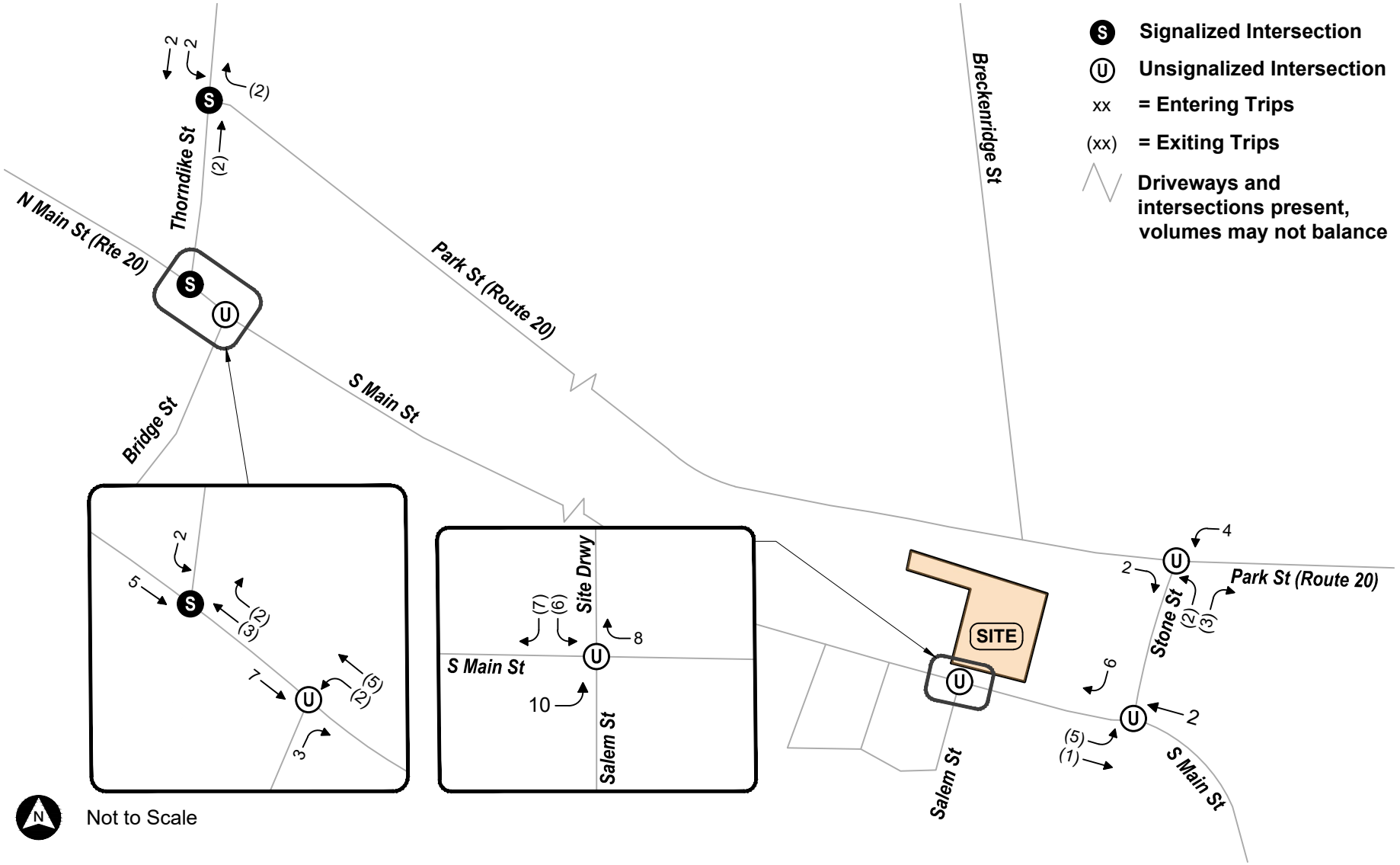

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Figure 16: Station-Generated Vehicle Trips - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025

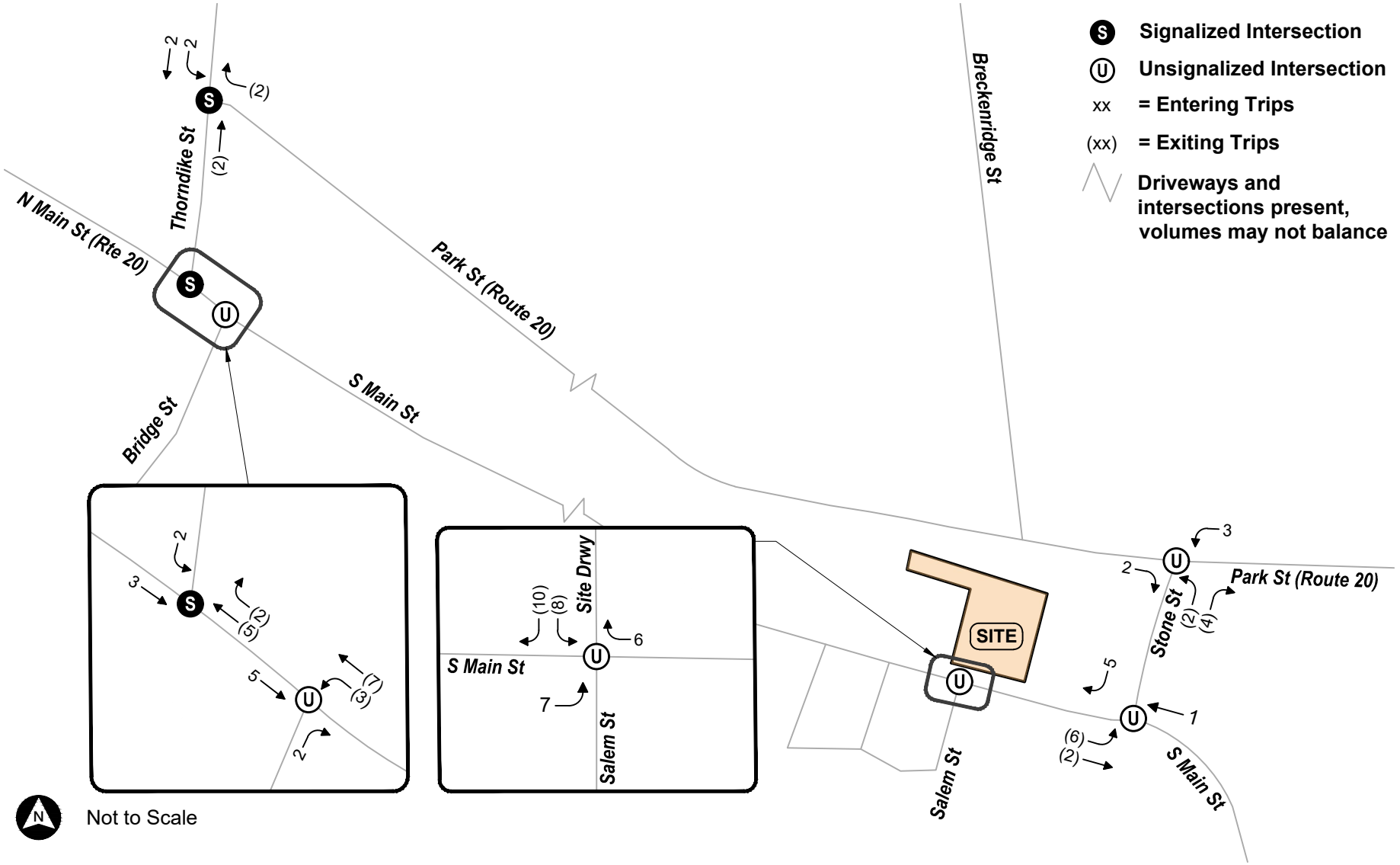

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Figure 17: 2032 Build Conditions Vehicle Volumes - Weekday AM Peak Hour

Palmer Station | Palmer, MA

11/11/2025

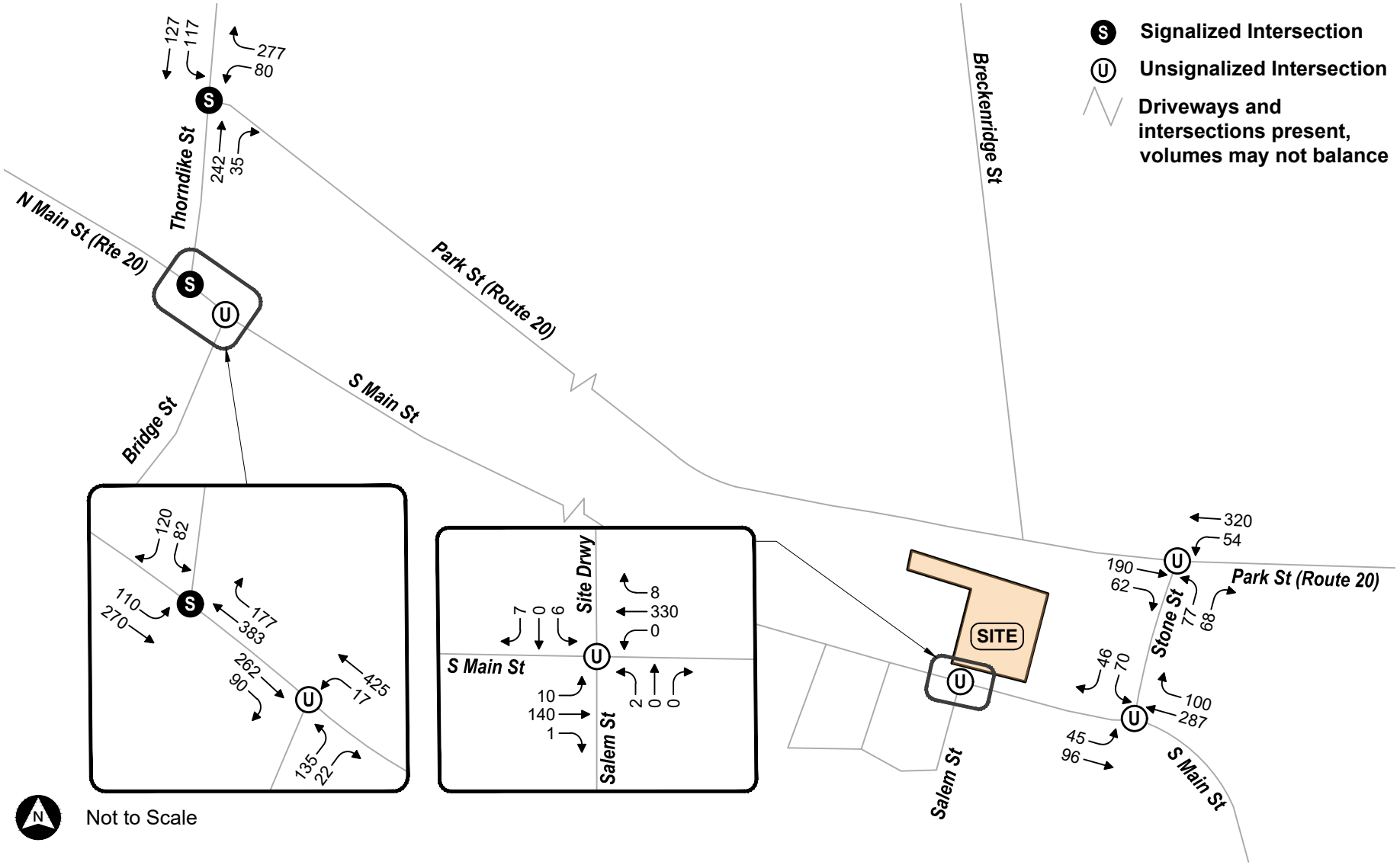

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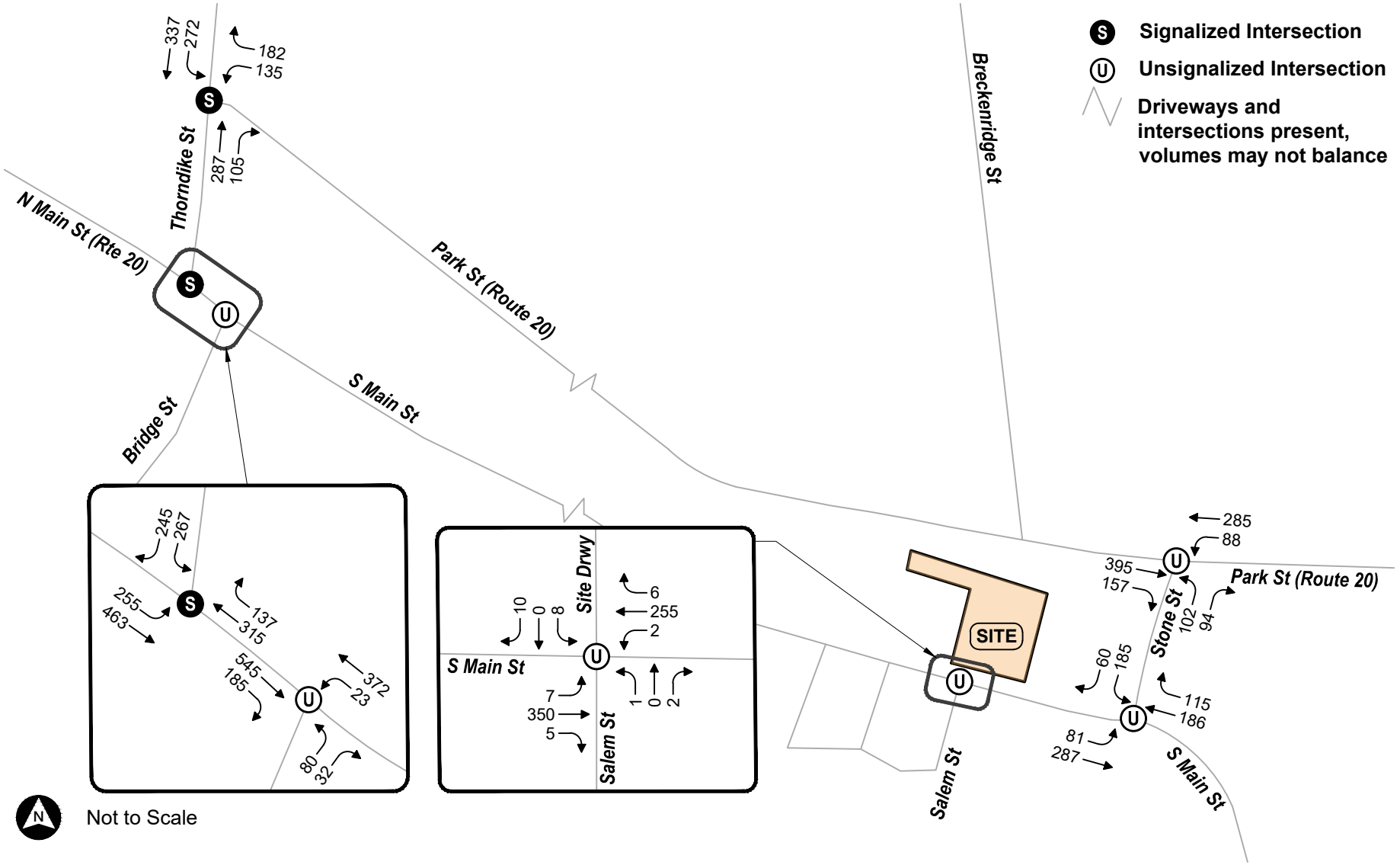
Figure 18: 2032 Build Conditions Vehicle Volumes - Weekday PM Peak Hour

Palmer Station | Palmer, MA

08/06/2025



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4.2 Intersection Capacity Analyses

Synchro 11 software was used to model traffic operations at the Study Area intersections. Both signalized and unsignalized intersection capacity analyses were conducted under 2025 Existing, 2032 No-Build, and 2032 Build conditions.

The evaluation criteria used to analyze area intersections in this traffic study are based on the Highway Capacity Manual (HCM).[9]

Two measures of effectiveness are typically used to quantify the traffic operations at intersections: *volume-to-capacity ratio* (v/c) and *average vehicle delay* (expressed in seconds per vehicle). For example, a v/c ratio of 0.90 for an intersection indicates that the intersection is operating at 90 percent of its available capacity to process the traffic volumes. A delay of 15 seconds for a particular vehicular movement or approach indicates that vehicles on that movement or approach will experience an average additional travel time of 15 seconds.

For unsignalized intersections, the critical movements that are often assessed are those for vehicles exiting from the side street and for a conflicting movement on the mainline, or main roadway, which is generally the left turn from the mainline into a side street or driveway. The analysis assumes that traffic on the mainline (without traffic control) is not affected by traffic on the side streets.

Cautious judgment should be exercised when interpreting the capacity analysis results at unsignalized intersections. The analytical methodology for unsignalized intersections applies conservative analysis parameters, such as long critical gaps in traffic flows. Actual field observations indicate that drivers on minor streets generally accept shorter gaps in traffic than those used in the analysis procedures, and therefore, experience less delay than reported by the analysis software. The analysis methodologies also do not fully account for the beneficial grouping effects (vehicle platooning) often caused by nearby signalized intersections. The net effect of these analysis procedures is the over-estimation of calculated delays at unsignalized intersections.

4.2.1 Signalized Intersection Capacity Analyses

Table 66 summarizes the intersection capacity analyses for the signalized study area intersections; the capacity analysis worksheets are included in the Appendix.

In both the AM and PM peak hours, all intersections are expected to experience similar conditions under the 2032 No-Build Condition and the 2032 Build Condition, with average vehicle delay increases of less than 4 seconds and no meaningful change to volume-to-capacity or queue lengths. The addition of Station site-generated traffic does not impact traffic operations at these intersections in any significant way.

Due to the large number of vehicles entering the Depot Village area from the north in the evening, the southbound approach of Thorndike Street at Park Street experiences a significantly higher delay and average queue than the intersection's other approaches.

Potential opportunities to improve intersection operations are discussed in **Chapter 5**.

9 Transportation Research Board, *Highway Capacity Manual*, 6th Edition, Washington, D.C., 2016.

4.2.2 Unsignalized Intersection Capacity Analyses

Table 77 summarizes the intersection capacity analyses for the unsignalized study area intersections; the capacity analysis worksheets are included in the Appendix.

The addition of Station site-generated traffic could increase vehicle delay and queue lengths (by about one car length) at certain intersection approaches. As noted above, cautious judgment should be exercised when interpreting the capacity analysis results at unsignalized intersections because the analytical methodology applies conservative analysis parameters that results in an over-estimation of calculated delays at unsignalized intersections.

Stone Street NB at Park Street and Stone Street SB at S. Main Street each could experience in the PM peak hour an increase in delay and queue lengths. Stone Street is expected to have added Station traffic and the Station may also add traffic to the mainline streets at these intersections. Under Existing Conditions these minor street approach movements already exhibit relatively high average delay in the PM peak hour.

At the approach of Bridge Street NB to Main Street, during each the AM and PM peak hour, the movement operates with relatively high average delay in each period under Existing Conditions; under the Future Build Condition with additional vehicles, both average delay and queue length (about one car length) could increase.

Potential opportunities to improve intersection operations are discussed in **Chapter 5**.

Site Driveway Operations

On the unsignalized Station site driveway (vicinity of Salem Street), operations are expected to operate at acceptable conditions during both Weekday AM and PM peak hours. Under the Future Build Condition, the Salem Street approach is expected to operate at a similar level.

Table 6 Signalized Intersection Capacity Analysis Summary

	2025 Existing Condition				2032 No-Build Condition				2032 Build Condition				Difference Build vs. No-Build Condition		
Location / Movement	**v/c [a]**	**Del [b]**	**50 Q [c]**	**95 Q [d]**	**v/c**	**Del**	**50 Q**	**95 Q**	**v/c**	**Del**	**50 Q**	**95 Q**	**Δ v/c**	**Δ Del**	**Δ 50 Q**
Thorndike Street at Park Street															
Weekday Morning															
Park Street WB L	0.31	37.5	50	94	0.31	37.5	50	94	0.31	37.5	51	93	0.00	0.0	1
Park Street WB R*	0.43	3.5	0	25	0.44	3.6	0	25	0.44	3.6	0	25	0.00	0.0	0
Thorndike Street NB T/R	0.68	42.0	173	260	0.70	42.6	178	266	0.70	42.7	179	268	0.00	0.1	1
Thorndike Street SB L*	0.46	26.0	52	94	0.47	26.2	52	94	0.50	27.3	56	96	0.03	1.1	4
Thorndike Street SB T	0.22	21.0	56	100	0.22	21.0	56	100	0.23	21.1	60	102	0.01	0.1	4
Overall		**30.2**				**24.5**				**24.7**				**0.2**	
Weekday Evening															
Park Street WB L	0.50	41.9	87	149	0.50	41.9	87	149	0.51	42.3	89	148	0.01	0.4	2
Park Street WB R*	0.31	3.2	0	23	0.31	3.2	0	23	0.32	3.3	0	21	0.01	0.1	0
Thorndike Street NB T/R	0.91	60.7	262	#429	0.92	62.5	266	#438	0.94	64.3	270	#444	0.02	1.8	4
Thorndike Street SB L*	1.32	197.8	~197	#363	1.35	208.8	~205	#372	1.36	212.5	~207	#376	0.01	3.7	2
Thorndike Street SB T	0.54	26.6	174	263	0.55	26.8	176	267	0.55	27.0	180	273	0.00	0.2	4
Overall		**69.8**				**72.9**				**73.7**				**0.8**	

* Modeled these lanes according to observed driver behavior, which create separation of turning movements within the wide approach lanes.

a v/c = Volume to capacity ratio

b Del = Average control delay, in seconds per vehicle

c 50Q = 50th percentile queue, in feet

d 95Q = 95th percentile queue, in feet

~ Volume exceeds capacity; queue is theoretically infinite

95th percentile volume exceeds capacity; queue length may be longer

Location / Movement	2025 Existing Condition				2032 No-Build Condition				2032 Build Condition				Difference Build vs. No-Build Condition		
	v/c [a]	Del [b]	50 Q [c]	95 Q [d]	v/c	Del	50 Q	95 Q	v/c	Del	50 Q	95 Q	Δ v/c	Δ Del	Δ 50 Q
Thorndike Street at N. Main Street/Main Street															
Weekday Morning															
N Main Street EB L	0.37	15.3	45	72	0.38	15.4	45	72	0.39	15.6	46	73	0.01	0.2	1
N Main Street EB R	0.35	14.9	120	167	0.36	15.0	123	170	0.37	15.3	130	173	0.01	0.3	7
Main Street WB T	0.67	35.0	279	360	0.68	35.4	284	367	0.70	36.0	292	371	0.02	0.6	8
Main Street WB R	0.32	7.2	20	58	0.32	7.5	21	60	0.33	7.8	23	59	0.01	0.3	2
Thorndike Street SB L	0.24	42.2	57	104	0.24	42.2	57	104	0.26	42.6	61	109	0.02	0.4	4
Thorndike Street SB R	0.32	9.1	0	52	0.32	9.1	0	52	0.32	9.1	0	52	0.00	0.0	0
Overall		**21.8**				**22.1**				**22.4**				**0.3**	
Weekday Evening															
N Main Street EB L	0.65	21.9	107	164	0.67	22.8	109	167	0.67	23.0	108	164	0.00	0.2	-1
N Main Street EB R	0.53	18.0	225	321	0.53	18.1	228	325	0.54	18.4	234	333	0.01	0.3	6
Main Street WB T	0.52	29.8	214	272	0.53	30.0	219	277	0.54	30.4	227	281	0.01	0.4	8
Main Street WB R	0.23	4.8	4	35	0.23	5.0	5	36	0.24	5.3	7	34	0.01	0.3	2
Thorndike Street SB L	0.82	64.6	227	#340	0.83	66.2	233	#350	0.84	66.8	235	#353	0.01	0.6	2
Thorndike Street SB R	0.51	8.3	0	60	0.52	8.3	0	60	0.52	8.3	0	63	0.00	0.0	0
Overall		**25.7**				**26.3**				**26.5**				**0.2**	

a v/c = Volume to capacity ratio
b Del = Average control delay, in seconds per vehicle
c 50Q = 50th percentile queue, in feet
d 95Q = 95th percentile queue, in feet
~ Volume exceeds capacity; queue is theoretically infinite
# 95th percentile volume exceeds capacity; queue length may be longer

Table 7 Unsignalized Intersection Capacity Analysis Summary

Location / Movement	2025 Existing Condition			2032 No-Build Condition			2032 Build Condition			Difference Build vs. No-Build Condition		
	v/c [a]	Del [b]	95 Q [c]	v/c	Del	95 Q	v/c	Del	95 Q	Δ v/c	Δ Del	Δ 95 Q
Park Street at Stone Street												
Weekday Morning												
Stone Street NB L/R	0.32	15.3	35	0.33	15.4	35	0.37	16.4	43	0.04	1.0	8
Weekday Evening												
Stone Street NB L/R	0.70	37.1	125	0.71	38.4	128	0.79	47.4	158	0.08	9.0	30
S Main Street at Stone Street												
Weekday Morning												
Stone Street SB L/R	0.33	16.4	35	0.33	16.6	35	0.39	17.8	45	0.06	1.2	10
Weekday Evening												
Stone Street SB L/R	0.75	38.9	148	0.75	39.8	150	0.85	53.6	193	0.10	13.8	43
S Main Street at Salem Street/Station Site Driveway												
Weekday Morning												
Salem Street NB L/T/R	0.02	13.7	3	0.02	13.8	3	0.02	15.7	3	0.00	1.9	0
Site Driveway SB L/T/R	-	-	-	-	-	-	0.08	13.3	8	0.08	13.3	8
Weekday Evening												
Salem Street NB L/T/R	0.00	8.2	0	0.01	12.5	0	0.01	13.1	0	0.00	0.6	0
Site Driveway SB L/T/R	-	-	-	-	-	-	0.12	14.2	10	0.12	14.2	10
Main Street at Bridge Street												
Weekday Morning												
Bridge Street NB L/R	0.62	31.9	98	0.63	32.8	100	0.71	40.6	128	0.09	7.8	28
Weekday Evening												
Bridge Street NB L/R	0.54	36.3	73	0.55	37.3	75	0.64	46.3	95	0.09	9.0	20

a v/c = Volume to capacity ratio
b Del = Average total delay, in seconds per vehicle
c 95Q = 95th percentile queue, in feet

4.3 Signal Warrant Analysis

A preliminary signal warrant analysis was performed for the three intersections near the proposed station: Park Street at Stone Street; South Main Street at Stone Street; and South Main Street at Salem Street/Station Driveway. The warrant analysis under Warrant 3 (Peak Hour) was prioritized, because the station will generate traffic at concentrated periods, rather than at regular volumes throughout the day.

The estimates of future traffic into and out of the intersections surrounding the Station site do not exceed the peak hour traffic signal warrant threshold. Thus, the installation of a traffic control signal at the intersection is not warranted under this condition (or any of the conditions reviewed). The analysis worksheets are included in the Appendix.

Context

Per Massachusetts General Law, Chapter 85, Section 2, municipalities are required to adhere to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) regarding the criteria that shall be satisfied before considering signalizing an intersection.

To provide a baseline for comparison to the analysis that will be presented in the post-occupancy traffic signal warrant analysis, a preliminary warrant analysis has been conducted using currently available traffic data and site-generated traffic estimates. The analysis methodology and findings are presented below.

4.3.1 Data Collection

To support the traffic signal warrant analysis, both TMCs and volume/speed counts were collected. TMC data was collected at the intersection of South Main Street at Salem Street (vicinity of the proposed Station driveway) on Thursday, May 1, 2025, from 7 AM to 9 AM and 4 PM to 6 PM. Continuous counts (including vehicle volume, classification, and speeds) via ATR were conducted along South Main Street, east of Salem Street, on Thursday, May 1, 2025, through Saturday, May 3, 2025.

4.3.2 Signal Warrant Evaluation Process

The MUTCD includes nine warrants, including three vehicular traffic volume-based warrants, to justify the installation of a traffic signal system. While the satisfaction of any or several of the warranting conditions does not, in and of itself, require the installation of a traffic signal, satisfaction of the warrants indicates that traffic signal control may be considered further as part of an engineering study. More importantly, if none of the traffic signal warrants outlined by the MUTCD are satisfied, traffic signal control shall not be considered.

- **Warrant 1 (Eight-Hour Vehicular Volume):** Warrant 1 is satisfied if either Condition A or B is met. In addition, Warrant 1 can be satisfied by 80 percent satisfaction of both Condition A and Condition B.
  - **Condition A (Minimum Vehicular Volume):** Satisfied when the volume of intersecting traffic (major and minor streets) exceeds MUTCD thresholds for eight or more hours.

- **Condition B (Interruption of Continuous Traffic):** Satisfied when the volume of major street traffic is so heavy that minor street traffic suffers excessive delay in entering or crossing the major street for eight or more hours.

› **Warrant 2 (Four-Hour Vehicular Volume):** Satisfied when volumes (major and minor streets) exceed MUTCD thresholds for four or more hours.

› **Warrant 3 (Peak Hour):** Satisfied when for the peak hour of a typical day, major and minor street traffic exceeds MUTCD thresholds.

› **Warrant 4 (Pedestrian)**: Based on pedestrian volumes for a peak hour or a four-hour period. The minimum threshold for Warrant 4 is 107 pedestrian crossings at an intersection per hour.

› **Warrant 5 (School Crossing)**: Based on the proximity of an intersection to a school crossing. *This warrant is not applicable, as there are no established school crossings near the site.*

› **Warrant 6 (Coordinated Signal System):** Based on the spacing of traffic signals for a coordinated signal system. *This warrant is not applicable as the intersections are not part of a coordinated signal system.*

› **Warrant 7 (Crash Experience):** Satisfied when five collisions correctable by signalization occur over the most recent 12 months.

› **Warrant 8 (Roadway Network):** Applicable when the two roadways are the common intersection of two major routes with a total volume at least 1,000 vehicles per hour entering the intersection during peak hour. At least one of Warrants 1, 2, or 3 must also have been met.

› **Warrant 9 (Intersection Near a Grade Crossing):** Applicable when the intersection is located near an at-grade railroad crossing. *This warrant is not applicable as there are no active at-grade crossings near the site.*

The applicable warrants were evaluated to determine whether the projected future traffic at nearby unsignalized intersections would cross signal warrant thresholds (see Table 8). The installation of a traffic control signal at the intersection is not warranted under any of the vehicle volume warrant conditions. Furthermore, a review of the study's traffic data indicates that neither (a) the pedestrian activity at an intersection nor (b) the crash experience would justify implementing traffic signal control based on the warrant criteria.

Once the station is open, MassDOT or the Town of Palmer may consider reviewing traffic activity to confirm whether the observed volumes and traffic patterns warrant signalizing the intersection of Stone Street at South Main Street (Route 32) and/or the intersection of Stone Street and Park Street (Route 20).

Table 8 Signal Warrant Analysis Summary, 2025 Build Conditions

Location	Warrant 1 (8-Hour) Met?	Warrant 2 (4-Hour) Met?	Warrant 3 (Peak Hour) Met?	Warrant 4 (Pedestrian) Met?	Warrant 7 (Crash Exp.) Met?	Warrant 8 (Network) Met?
Park Street at Stone Street	No	No	No	No	No	No
South Main Street at Stone Street	No	No	No	No	No	No
South Main Street at Salem Street/ Station Driveway	No	No	No	No	No	No

4.4 Sight Distance Evaluation

VHB conducted a sight distance evaluation at the potential Station site driveway location. The objective is to identify whether the driveway location provides adequate, safe visibility for motorists exiting the station onto South Main Street.

Stopping sight distance (SSD) is the distance required for a motorist approaching an intersection from either direction to perceive, react, and come to a complete stop to avoid colliding with an object in the road (such as a vehicle exiting a driveway). In this respect, SSD can be considered as the minimum visibility criterion for the safe operation of an unsignalized intersection.

Intersection sight distance (ISD) is based on the time required for a motorist to perceive, react, and complete a desired critical exiting maneuver (typically, a left turn) once the driver on a minor street approach (or a driveway) decides to execute the maneuver. Calculations for ISD include the time to (1) turn left and clear the near half of the intersection without conflicting with the vehicles approaching from the left; and (2) upon turning left, to accelerate to the operating speed on the roadway without causing approaching vehicles on the main road to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection.

VHB collected field observations in May 2025, taking measurements to evaluate SSD and ISD in accordance with American Association of State Highway and Transportation Officials (AASHTO) guidelines and sight distance criteria; these are provided in the Appendix.

Table 9 presents a summary of the SSD and ISD analysis. The analysis at the South Main Street driveway is based on the observed 85th percentile traffic speed of 39 mph traveling eastbound and 41 mph traveling westbound along South Main Street.

The available SSD at each intersection approach exceeds (meets) the AASHTO requirements. At the Site driveway on South Main Street at Salem Street, the desirable ISD is also exceeded (met).

Table 9 Sight Distance Evaluation Summary: S. Main Street at Potential Site Driveway

	Stopping Sight Distance (feet)		Intersection Sight Distance (feet)		85th Percentile Speed (mph)
Location	**Required [a]**	**Measured**	**Desirable [a]**	**Measured**	
S. Main Street at Site Driveway					
Eastbound	290	650	455	650	41
Westbound	315	1100	395	1100	39

a Based on guidelines established in *A Policy on the Geometric Design of Highways and Streets*, 7th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2018.

5

Opportunities for Multimodal Transportation Access Improvements

For consideration, this chapter highlights opportunities to improve the existing infrastructure to increase operational efficiency, increase safety, and improve multimodal travel conditions to and from the station site. The opportunities described in this chapter are not required to support the project but would further supplement and improve multimodal access to the station.

The station site is just over 0.5 miles (about a 12- to 15-minute walk) from Palmer's Depot Village. The sidewalks along Main Street, S. Main Street, and Park Street—and those on side streets that connect to them—are important connections between the station and the area's homes and businesses.

Described next and highlighted in **Figure 19** and **Figure 20** are several potential opportunities for improvements to the existing street network that would enhance access, safety, and convenience in user travel to/from the station. While these opportunities would support improved connectivity to the station site, they are not due to impacts caused by the station trip activity.

One framework applied to the review of transportation infrastructure improvements is to apply a "Complete Streets" approach, which aims to accommodate all users of a street—including those walking and biking and with different abilities.[10] Well-designed streets can encourage low-carbon and sustainable transportation options like bicycling, walking, or use of mass transit. Complete Streets measures help create a safer travel environment, broaden transportation access options, and increase mobility. The Town of Palmer has adopted a Complete Streets Policy (2016) and Complete Streets Prioritization Plan (2018)[11] which are further reiterated in its Master Plan.[12]

10 Pioneer Valley Planning Commission, *Understanding Complete Streets Policy*. https://www.pvpc.org/sites/default/files/files/PVPC-Complete%20Streets%20Policy.pdf.

11 *Town of Palmer Complete Streets* (January 2018). Available at www.townofpalmer.com/vertical/sites/%7B034F9CAE-5196-4551-90C2-FBFD76374BDB%7D/uploads/Palmer_Complete_Streets_2018-01-02(1).pdf

12 Town of Palmer, Massachusetts. *Palmer Master Plan*. July 2021, page 143.

5.1 Opportunities to Improve Intersections

The following roadway safety and operational improvements could be considered:

1. *I-1. Park Street at Stone Street:* Formalize (via pavement markings and signs) the northbound right and left turn lane. Restrict parking on the south side of Park Street just west of Stone Street to improve sight distance; site observations noted obstructed views when vehicles and trucks parked near the intersection.
2. *I-2. Thorndike Street and Park Street:* Formalize (via pavement markings and signs) both the southbound through and left turn lanes and westbound left and right turn lanes. Doing so may limit the potential for crashes by spatially separating vehicle movements. Additionally, increasing protected green time for the southbound approach during the evening peak hour may increase intersection efficiency by lowering vehicle delay and queue length.
3. *I-3. Thorndike Street and Main Street:* Consider adding curb extensions on the corners of the intersection to reduce intersection size, provide tighter curb radii, and shorten pedestrian crossing distances. Also consider adding lane line extensions through the intersection to clarify driver movement. (The Town of Palmer's *Master Plan* (2021; p. 142) also noted measures to narrow vehicle lanes to slow down vehicle speeds.)

5.2 Opportunities to Improve Sidewalks and Crosswalks

Several sidewalks in the station area and its connections to downtown Palmer (Depot Village) are either in poor condition and/or do not achieve recommended ADA accessible path standards.[13] At certain locations, crosswalks are missing or lack standard wheelchair ramps or detectable warning strips. To ensure safe and comfortable walking paths between Depot Village, area bus stops, and the station, the following improvements are recommended:

1. *P-1. S. Main Street, between Vail Street and Strong Street:* Upgrade sidewalks on the north side to meet minimum recommended ADA paths: 4' minimum, 5' preferred. (The north side is most likely used for travel to/from Depot Village.) Across wide driveways, consider installing detectable warning panels and crosswalk striping or dashed guidelines.
2. *P-2. Park Street, between Pearl Street and Stone Street:* Upgrade sidewalks on the south side to meet minimum recommended ADA paths: 4' minimum, 5' preferred. (The south side is most likely used for travel to/from Depot Village.) Across wide driveways, consider installing detectable warning panels and crosswalk striping or dashed guidelines.
3. *P-3. Park Street at Breckenridge Street:* Add crosswalks at this intersection across all approaches in conjunction with adding sidewalks on Breckenridge Street (between Park Street and Geraldine Street) and on Park Street (between Breckenridge Street and Winthrop Street).
4. *P-4. Stone Street, between Park Street and S. Main Street:* Perform maintenance of the sidewalk on the west side to repair cracks and eliminate vegetation.
5. *P-5. Church Street at S. Main Street:* Modify the intersection geometry to reduce the crossing widths across Church Street. Install detectable warning panels and restripe crosswalks.

13 U.S. Access Board, *Accessible Public Rights-of-Way Planning and Design for Alterations*—A Public Rights-of-Way Access Advisory Committee (PROWAAC) Special Report, Chapter 5 – Model Sidewalks. www.access-board.gov/prowag/proposed/planning-and-design-for-alterations/

6. *P-6. Depot Village area (several locations):* add detectable warning strips and crosswalk markings along main streets. *Note: In 2026, the Town of Palmer is scheduled to implement improvements such as these at a few locations in the Depot Village area. The scope of most of the work entails updating/replacing pedestrian crossings, including new ADA/wheelchair ramps and restriping crosswalks. Planned locations include Park Street at the town green near the Walgreens shopping plaza, Park Street at Central Street, Pleasant Street at Walnut Street, North Main Street at the library, and North Main Street at Thorndike Street.*

5.3 Opportunities to Improve Bicycle Access

No formal bike lanes or related infrastructure are present in the study area. This presents an opportunity to introduce bike lanes, as a minimum measure to formalize biking paths to the station site:

1. *B-1. South Main Street:* Formalize on-street, buffered bike lanes in each direction generally from Central Street (Depot Village area) to the Station site; this can take the place of the current roadway shoulder.
2. *B-2. Stone Street:* On the bridge over the railroad tracks, bike lanes can take the place of the roadway shoulder, with a striped buffered added. Add "No Parking" signs along the bridge to further reinforce that vehicles cannot stop on the paved shoulder. Add the associated bike lane pavement markings at the intersections with Park Street and at South Main Street.

In the Depot Village area, the Town of Palmer's *Master Plan* (2021; p. 142) recommends signs and pavement markings to increase motorist awareness of bicyclists in the area.

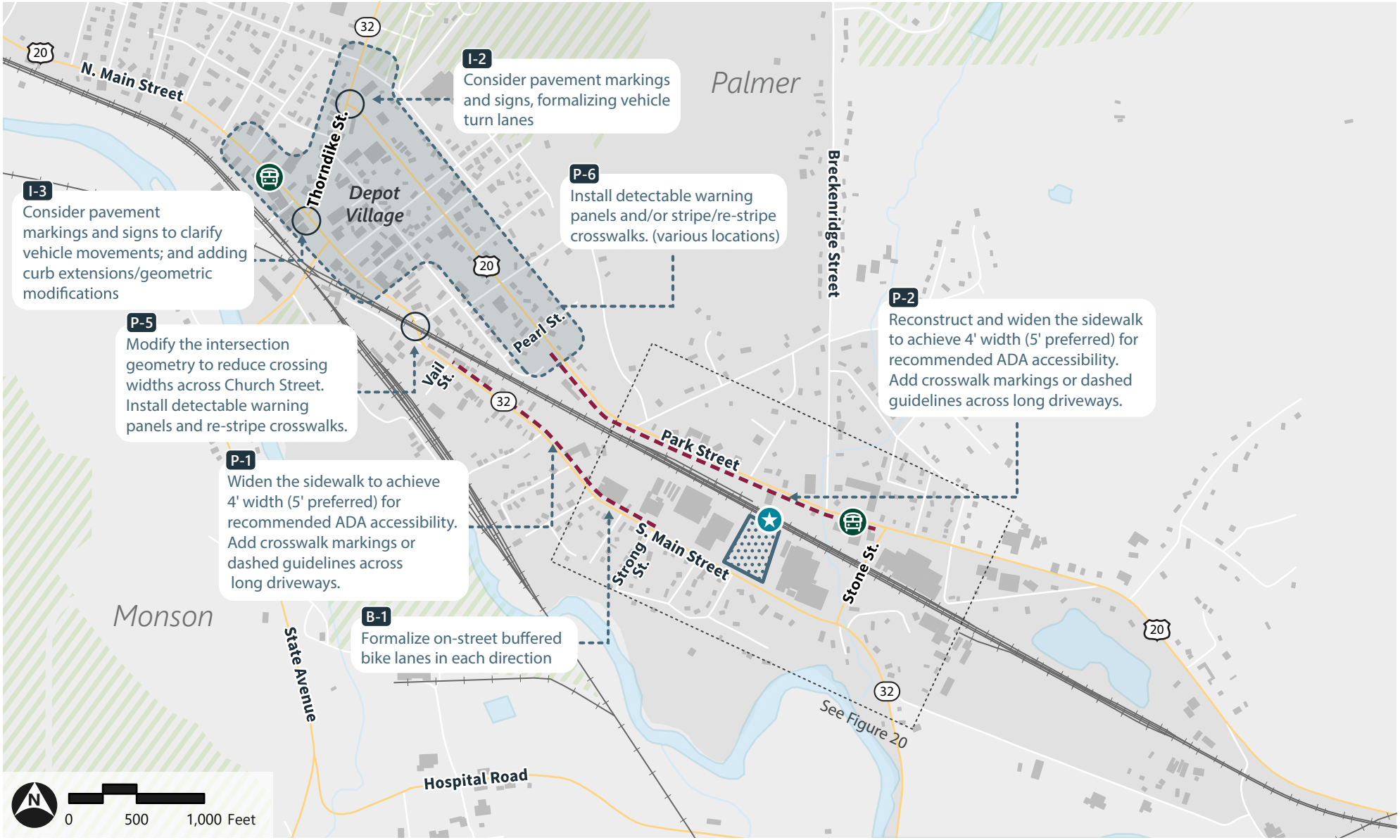
5.4 Opportunities to Improve Transit Access

The station is expected to be served by transit services offered by PVTA, which already operates in Palmer and around the station area. It may also be served by the Quaboag Connector Service, operated by the Quaboag Valley Community Development Corporation (QVCDC) and the Town of Ware.

MassDOT has coordinated with PVTA and the Quaboag Connector and anticipates that both operators may provide opportunities to connect the station to Palmer and the surrounding communities. The Conceptual Design Report describes how the proposed station would support transit access.

Figure 19: Transportation Improvement Opportunities in Study Area

Palmer Station | Palmer, Massachusetts



Source: MassGIS, ArcGIS Online

Figure 20: Transportation Improvement Opportunities in Station Area

Palmer Station | Palmer, Massachusetts

Path: \\vhb.com\gis\proj\Boston\15790.02 TO2-Palmer Station Desgn\Project\Palmer.aprx (zconner, 7/8/2025)

- Proposed Station
- PVTA Bus Stop
- Opportunities Identified in Report
- Existing Sidewalk—Section of Concern
- Add New Sidewalk
- Local Roads
- Principal Arterial/Minor Arterial/ Major Collector/Minor Collector
- Station Site

Source: MassGIS, ArcGIS Online

Appendix

Provided Upon Request

Transit Routes and Schedules (PVTA)

Palmer Shuttle

Ware Shuttle

Crash Data

Traffic Counts

Trip Generation Data

Synchro Reports

Sight Distance Analysis

Traffic Signal Warrant Analysis