TRANSPORTATION IMPACT ASSESSMENT

HANOVER CROSSING
1775 WASHINGTON STREET
HANOVER, MASSACHUSETTS

Prepared for:

PREP Hanover Real Estate, LLC
Cincinnati, Ohio

May 2019

Prepared by:

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Dear Reviewer:

This letter shall certify that this *Transportation Impact Assessment* has been prepared under my direct supervision and responsible charge. I am a Registered Professional Engineer (P.E.) in the Commonwealth of Massachusetts (Massachusetts P.E. No. 38871, Civil) and hold Certification as a Professional Traffic Operations Engineer (PTOE) from the Transportation Professional Certification Board, Inc. (TPCB), an affiliate of the Institute of Transportation Engineers (ITE) (PTOE Certificate No. 993). I am also a Fellow of the Institute of Transportation Engineers (FITE).

Sincerely,

VANASSE & ASSOCIATES, INC.

Jeffrey S. Dirk

Jeffrey S. Dirk, P.E., PTOE, FITE
Partner

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EXECUTIVE SUMMARY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed re-envisioning of the Hanover Mall located at 1775 Washington Street (Route 53) in Hanover, Massachusetts, as a mixed-use, life-style center to be known as Hanover Crossing (hereafter referred to as the "Project"). The Project will include the phased reconstruction of the enclosed mall and associated outparcel buildings to provide 598,535± square feet (sf) of retail, restaurant, grocery and entertainment space centered around an open-air courtyard, with a 297-unit multifamily residential community to be constructed in the eastern portion of the site. At present, the Project site encompasses 833,481± sf of retail, restaurant and entertainment space and associated appurtenances that are supported by 3,509 parking spaces. Accordingly, the Project represents an overall reduction in the amount of retail/restaurant/entertainment space located within the Project site.

The Project will require the issuance of a State Highway Access Permit from the Massachusetts Department of Transportation (MassDOT) for access to Washington Street (Route 53), a State Highway under the jurisdiction of MassDOT.

This assessment was prepared in consultation with MassDOT and the Towns of Hanover and Norwell; was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the scoping determination issued by MassDOT for the preparation of this assessment; and was conducted pursuant to the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)[1] and after adjustment to account for internal trips and pass-by trips, the Project is expected to generate approximately 18,942 primary vehicle trips on an average weekday and 29,116 primary vehicle trips on a Saturday (both two-way, 24-hour volumes), with 587 primary vehicle trips expected during the weekday morning peak-hour, 1,697 primary vehicle trips expected during the weekday evening peak-hour and 2,221 primary vehicle trips expected during the Saturday midday peak-hour;

[1] *Trip Generation*, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

2. In comparison to the existing uses that occupy the Project site, the Project is expected to result in 3,032 additional vehicle trips on an average weekday and 8,022 additional vehicle trips on a Saturday (two-way, 24-hour volumes), with 27 additional vehicle trips expected during the weekday morning peak-hour, 389 additional vehicle trips expected during the weekday evening peak-hour and 337 additional vehicle trips expected during the Saturday midday peak-hour. ***The average weekday daily and Saturday increases exceed the Transportation thresholds of the Massachusetts Environmental Policy Act (MEPA) that would necessitate the filing of an Environmental Notification Form (ENF) and an Environmental Impact Report (EIR) for the Project based on Traffic/Transportation***;

3. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with the majority of the movements at the study area intersections shown to operate at a level-of-service (LOS) of D or better under all analysis conditions, where an LOS of "D" or better is defined as "acceptable" traffic operations;

4. With the exception of the Mill Street/Mill Pond Drive/Hanover Mall Drive intersection, the study area intersections were found to have motor vehicle crash rates that were below the MassDOT average crash rates for a signalized or unsignalized intersection, as appropriate. The Town has advanced safety-related improvements at the Mill Street/ Mill Pond Drive/Hanover Mall Drive intersection that include the implementation of all-way STOP-sign control; and

5. Lines of sight to and from the Project site driveway intersections with Route 53 and Mill Street exceed the recommended minimum distances for the intersections to function in a safe manner.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to maintain safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The improvements that have been recommended as a part of this evaluation, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project site is and will continue to be provided by way of four (4) driveways that intersect the east side of Route 53 (two (2) full access driveways under traffic signal control located opposite the Route 3 southbound ramps and 250-feet south of Woodland Drive, respectively; a full ingress, right-turn only egress driveway located approximately 700 feet south of the Route 3 southbound ramps; and a full access driveway located at the south end of the Project site) and two (2) full access driveways that intersect the north side of Mill Street, with the eastern Mill Street driveway (Hanover Mall Drive) aligned opposite Mill Pond Drive. The following recommendations are offered with respect to Project access and internal circulation:

- The Project site driveways and internal circulating roadways should continue to support the turning and maneuvering requirements of delivery trucks and the largest anticipated responding emergency vehicle as defined by the Hanover Fire Department.

- Vehicles exiting the Project site should continue to operate as presently configured under traffic signal or STOP-sign control.

- All signs and pavement markings to be installed within the Project shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[2]

- A sidewalk should be provided along at least one side of Hanover Mall Drive between the multifamily residential community and Mill Street, where a crosswalk would then be provided to allow pedestrians to walk to/from Mill Pond Drive and the South Shore YMCA.

- A defined pedestrian route should be provided between the multifamily residential community and the commercial area.

- Marked crosswalks and Americans with Disabilities Act (ADA) compliant wheelchair ramps should be provided at pedestrian crossings within the Project site.

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site driveways should be designed and maintained so as not to restrict lines of sight.

- Snow windrows within the sight triangle areas of the Project site driveways shall be promptly removed where such accumulations would impede sight lines.

- A school bus waiting area should be provided for the multifamily residential community at an appropriate location defined in consultation with the Town.

- Consideration should be given to installing electric vehicle charging stations within the Project site and to accommodating the staging of car-sharing vehicles (ZipCar or similar).

Off-Site

Route 53 at Route 123

The addition of Project-related traffic to this signalized intersection was not shown to result in a change in overall intersection operations; however, one or more movements were shown to operate below LOS D. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for the intersection. With the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations will remain at LOS D and all movements will generally operate similar to or will be improved over 2026 No-Build Build conditions. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

[2] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

Route 53 at the Route 3 Northbound Ramps

The addition of Project-related traffic to this signalized intersection was not shown to result in a change in overall intersection operations; however, left-turn/through movements from the Route 3 northbound off-ramp were shown to degrade to LOS F during the Saturday midday peak-hour. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for the intersection. With the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations will remain at LOS C or better, with no movement predicted to operate below LOS D. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Route 53 Traffic Signal System

Overall operating conditions at the three (3) traffic signals that comprise the Washington Street (Route 53) traffic signal system (Route 53/Route 3 southbound ramps/Hanover Mall Drive, Route 53/Hanover Mall center driveway, and Route 53/Mill Street/Frank's Lane) were shown to remain acceptable; however, one or more movements were shown to operate below LOS D. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the three (3) traffic signals that comprise the Washington Street traffic signal system, including the upgrade/replacement of traffic signal equipment and appurtenances as may be necessary to effectuate the recommended changes. In addition and as discussed with the Town of Hanover, the Project proponent will repair and/or replace the emergency vehicle pre-emption system (OPTICOM™) at these intersections. With the implementation of an optimal traffic signal timing, phasing and coordination plan, overall intersection operations will be maintained at LOS C or better during the peak hours, with no movement predicted to operate below LOS D. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Route 53 at Old Washington Street and Pond Street

The addition of Project-related traffic to this signalized intersection was shown to result in a degradation in overall operating conditions during both the weekday evening and Saturday midday peak hours from LOS D to LOS E. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for this intersection. With the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations were shown to improve to LOS D or better and all movements will operate similar to or will be improved over 2026 No-Build Build conditions. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Mill Street/Mill Pond Drive/Hanover Mall Drive

The Mill Street/Mill Pond Drive/Hanover Mall Drive intersection was found to have a motor vehicle crash rate above the MassDOT statewide and District averages for an unsignalized intersection. Improvements were recently completed by the Town at this intersection in an effort to improve safety and included the implementation of all-way STOP-sign control. As such, the Project proponent will participate with the Town and other area stakeholders to facilitate the completion of an "after" study of the intersection in order to determine if the recently completed safety improvements have been effective at reducing the frequency and severity of motor vehicle collisions at the intersection. The "after" study will performed in conjunction with the annual Traffic Monitoring and Reporting Program for the Project (discussion follows).

Mill Street/South Street

All movements at this unsignalized intersection are predicted to operate at LOS C or better during the peak-hours with minimal vehicle queuing (up to two (2) vehicles) with the addition of Project-related traffic. In an effort to assist the Town of Norwell in advancing geometric improvements at the Mill Street/South Street intersection, the Project proponent will prepare a Functional Design Report (FDR) that will assess alternative improvement strategies at the intersection and will include conceptual design plans for each alternative. The FDR and conceptual design plans will be provided to the Town of Norwell prior to the issuance of a Certificate of Occupancy for the residential component of the Project.

Main Street/South Street and Main Street/Prospect Street

The addition of Project-related traffic to the Main Street/South Street and Main Street/ Prospect Street intersections was not shown to result in a significant increase in motorist delays or vehicle queuing over No-Build conditions; however, it was noted that all movements exiting from South Street and Prospect Street are operating at over capacity during the weekday morning and evening peak hours independent of the Project due to the relatively large volume of conflicting traffic on Main Street. In order to assess potential improvement strategies at these intersections, a Traffic Signal Warrant Analysis (TSWA) was performed following the methodology defined in the MUTCD.[3] This analysis indicates that the installation of a traffic control signal is warranted at both intersections under 2019 Existing conditions, again, independent of the Project.

In an effort to assist the Town of Norwell in advancing improvements at the Main Street/ South Street and Main Street/Prospect Street intersections that are warranted as a result of existing conditions unrelated to the Project, the Project proponent will prepare a FDR that will assess alternative improvement strategies at the intersections and will include conceptual design plans for each alternative. The FDR and conceptual design plans will be provided to the Town of Norwell prior to the issuance of the issuance of a Certificate of Occupancy for the residential component of the Project.

Transportation Demand Management

Regularly scheduled public transportation services are not currently provided within the study area or to the Project site. The Town of Hanover is served by the Greater Attleboro-Taunton Regional Transit Authority (GATRA), which provides demand response (Dial-A-Ride) services for people with disabilities and seniors. In addition, the Hanover Council on Aging (COA) provides transportation services by appointment for doctor's appointments, shopping and errands. In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- The owner or property manager will contact MassRIDES to obtain information on facilitating and encouraging healthy transportation options for residents and employees of the Project, and will become a MassRIDES employer partner;
- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to residents and employees;

[3]Ibid.

- A "welcome packet" will be provided to new residents and employees detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES' and their Bay State Commute program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;

- Residents and employees will be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;

- Pedestrian accommodations have been incorporated within the Project site consisting of sidewalks/walkways linking buildings and parking to on-site amenities, and should be expanded to include a sidewalk connection between the multifamily residential community and Mill Street;

- A mail drop will be provided in a central location within the multifamily residential building; and

- Secure bicycle parking will be provided consisting of: i) exterior bicycle parking conveniently located proximate to building entrances; and ii) weather protected bicycle parking located in secure areas.

In addition, the Project proponent will initiate discussions with the Town of Hanover and GATRA concerning the establishment of fixed-route bus service within the Town. In the interim, space will be reserved within the Project site for a bus stop to serve the commercial and residential components of the Project.

Traffic Monitoring and Reporting Program

The Project proponent will conduct a post-development traffic monitoring program in order to validate the trip projections for the Project and to evaluate the success and refine the elements of the TDM program. The monitoring program will include:

i) Obtaining traffic volume information over a continuous seven day, weeklong period at the driveways serving the Project site;

ii) Performing manual turning movement and vehicle classification counts at the Project site driveway intersections during the weekday morning (7:00 to 9:00 AM), weekday evening (4:00 to 6:00 PM) and Saturday midday (11:00 AM to 2:00 PM) peak periods; and

iii) Evaluating motor vehicle crash data at the Project site driveways intersections with Route 53 and Mill Street.

The monitoring program will commence six (6) months after issuance of the first Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Hanover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the Project site driveway intersections; and iii) the elements of the TDM program

that have been implemented and use of alternative modes of transportation to single-occupant vehicles by residents and employees of the Project.

If any of the following conditions are documented as a part of the monitoring program: i) the measured traffic volumes exceed the observed traffic volumes that are presented herein by more than 10 percent on a regular and sustained basis during the monitoring period; ii) there is a material increase in the number of motor vehicle crashes occurring at or in immediate vicinity of the Project site driveway intersections that are attributable to the Project; or iii) the overall directional distribution of Project-related traffic as measured at the Project site driveways varies by more than 10 percent from the direction distribution that form the basis of this assessment; the Project proponent will identify and undertake corrective measures in conjunction with the appropriate parties and subject to receipt of all necessary rights permits and approvals. These measures may include without limitation:

- Traffic signal timing modifications
- Sign and pavement marking improvements
- Wayfinding sign program to encourage regional traffic to use Route 53 (vs. Mill Street and South Street)
- On-site operation and management strategies that are designed to reduce overall and peak traffic volumes and parking demands
- Providing financial incentives for employees to carpool or use alternative modes of transportation to SOVs

The identified corrective measures, if any, will be documented in the transportation monitoring program report, and will identify the appropriate parties responsible for implementation, required approvals, and the timeline for implementation. The status of implementation of the identified improvement measure(s) will be documented in the subsequent monitoring report.

With implementation of the aforementioned recommendations, safe and efficient access will continue to be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

INTRODUCTION

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed re-envisioning of the Hanover Mall located at 1775 Washington Street (Route 53) in Hanover, Massachusetts, as a mixed-use, life-style center to be known as Hanover Crossing (hereafter referred to as the "Project"). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project, along Route 53, Main Street/Webster Street (Route 123), Mill Street and South Street, and at critical intersections located along these roadways through which Project-related traffic will travel.

PROJECT DESCRIPTION

The Project will entail the phased reconstruction of the Hanover Mall and associated outparcel buildings to provide 598,535± square feet (sf) of retail, restaurant, grocery and entertainment space centered around an open-air courtyard, with a 297-unit multifamily residential community to be constructed in the eastern portion of the site. At present, the Project site encompasses 833,481± sf of retail, restaurant and entertainment space and associated appurtenances that are supported by 3,509 parking spaces. Accordingly, the Project represents an overall reduction in the amount of retail/restaurant/entertainment space located within the Project site. The Project site encompasses approximately 106.4± acres of land that is bounded by the Southeast Expressway (Route 3) and commercial properties to the north; Mill Street, commercial properties, areas of open and wooded space, and low-lying wetland areas to the south; Route 3, South Street, and a residential property to the east; and Route 53 and commercial properties to the west. Figure 1 depicts the Project site location in relation to the existing roadway network.

Access to the Project site is and will continue to be provided by way of four (4) driveways that intersect the east side of Route 53 (two (2) full access driveways under traffic signal control located opposite the Route 3 southbound ramps and 250-feet south of Woodland Drive, respectively; a full ingress, right-turn only egress driveway located approximately 700 feet south of the Route 3 southbound ramps; and a full access driveway located at the south end of the Project site) and two (2) full access driveways that intersect the north side of Mill Street, with the eastern Mill Street driveway (Hanover Mall Drive) aligned opposite Mill Pond Drive. The Project will require the issuance of a State Highway Access Permit from the Massachusetts

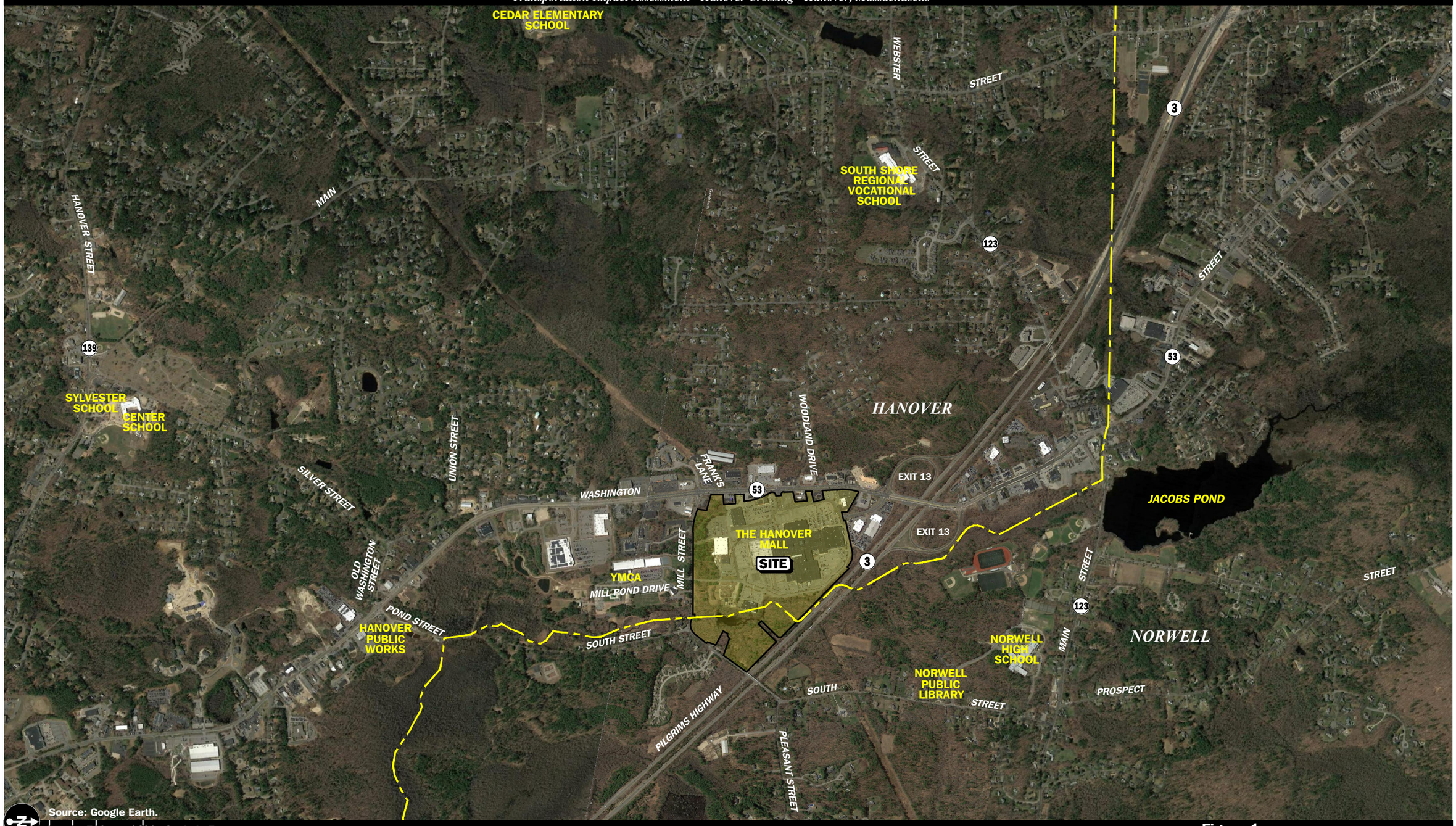

Figure 1

Site Location Map

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Department of Transportation (MassDOT) for access to Route 53, a State Highway under the jurisdiction of MassDOT.

On-site parking will be provided for a total of 3,254 vehicles to support the commercial uses, or a parking ratio of approximately 5.44 spaces per 1,000 sf, and 446 parking spaces will be provided to support the multifamily residential community, or a parking ratio of 1.50 spaces per residential unit. The Project site is located within the Planned Shopping Center District, within which Section 9, *Parking and Loading Requirements*, of the Town of Hanover Zoning Bylaw requires that one (1) parking space per 300 sf of gross floor area (gfa) be provided for commercial uses, or 1,996 parking spaces to support the Project. In addition, Section 9 requires that one (1) parking space per dwelling unit and sufficient off-street parking for visitors and employees be provided for the residential component of the Project. Given that the Project will provide 3,254 parking spaces for the commercial component and 446 parking spaces for the residential component (297 dwelling units), the Project complies with the parking requirements of Section 9 of the Zoning Bylaw and includes sufficient parking to accommodate seasonal parking demand fluctuations.

STUDY METHODOLOGY

This study was prepared in consultation with MassDOT and the Towns of Hanover and Norwell; was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the scoping determination issued by MassDOT for the preparation of this assessment; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; public transportation services; observations of traffic flow; and collection of daily and peak period traffic counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon from the current year was selected for analyses consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in April 2018 and in January, March and April 2019. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; public transportation services; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area for the Project was developed in consultation with MassDOT and the Towns of Hanover and Norwell, and was selected to contain the major roadways providing access to the Project site, Washington Street (Route 53) and Mill Street, as well as the following specific intersections located along these roadways which are also depicted on Figure 2:

1. Webster Street (Route 123) at Main Street
2. Route 53 at Route 123
3. Route 53 at the Route 3 Northbound ramps and Sunoco driveway
4. Route 53 at the Route 3 southbound ramps and Hanover Mall Drive
5. Route 53 at the Hanover Mall north driveway
6. Route 53 at the Hanover Mall center driveway
7. Route 53 at the Hanover Mall south driveway
8. Route 53 at Mill Street and Frank's Lane
9. Route 53 at Old Washington Street and Pond Street
10. Mill Street at the Hanover Mall west driveway
11. Mill Street at Mill Pond Drive and Hanover Mall Drive
12. Mill Street at South Street
13. Main Street (Route 123) at Prospect Street
14. Main Street at South Street
15. South Street and Pleasant Street

The following describes the study area roadways and intersections.

Roadways

Washington Street (Route 53)

- Two to five-lane urban principal arterial roadway under MassDOT jurisdiction
- Traverses study area in a general north-south direction providing access to Route 3 to the north of the Project site (Exit 13)

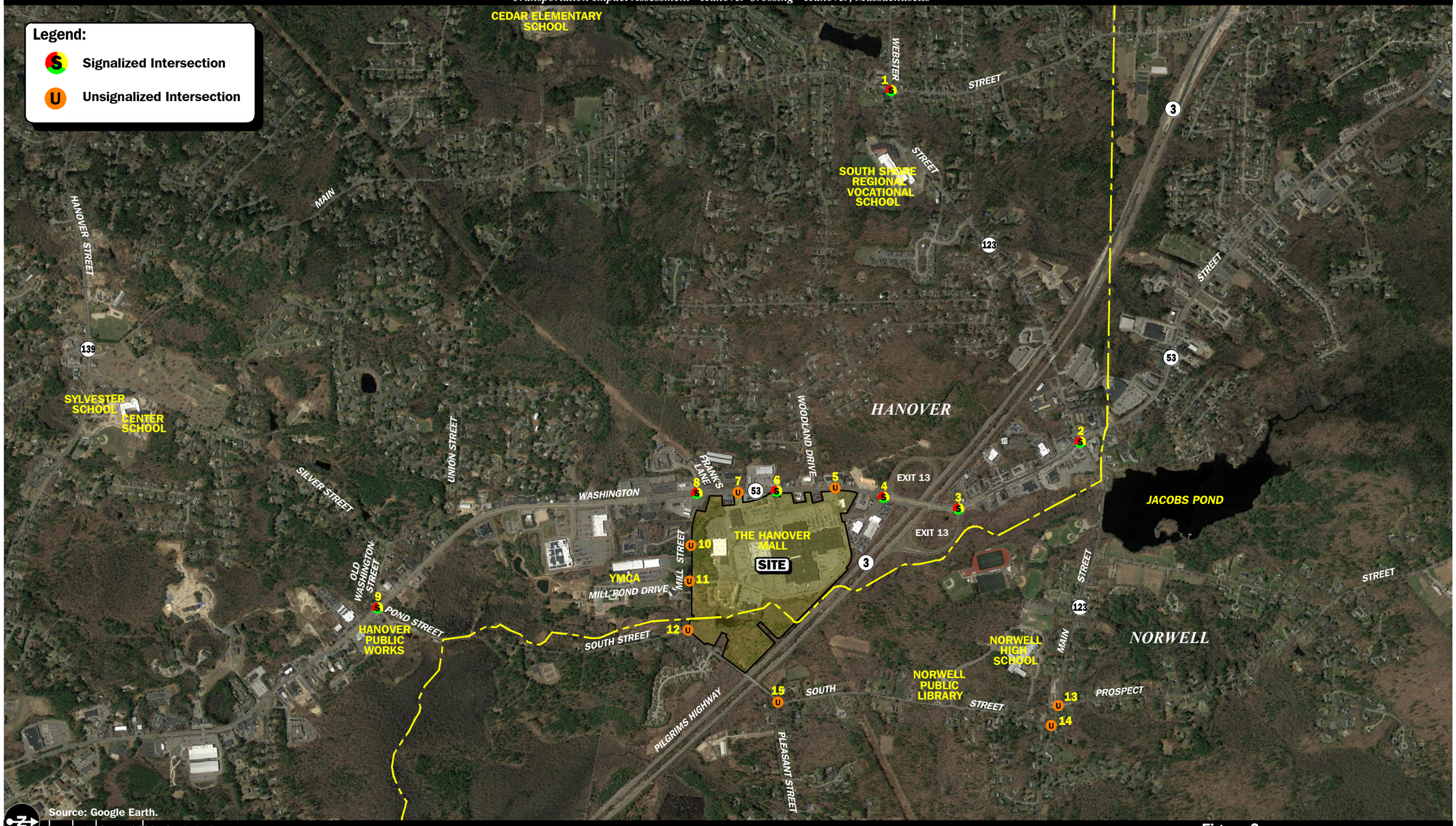

Figure 2

Study Area Map

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- Provides two (2) 12 to 14-foot wide travel lanes per direction within the study area that are separated by a double-yellow centerline, a painted or raised median, or a center turn lane, with 2 to 4-foot wide marked shoulders
- In the immediate proximity of the Project site, sidewalks are provided north of the Route 3 southbound ramps (east side and along both sides north of the Route 3 northbound ramps) continuing for a distance of approximately 500 feet north of the Route 3 northbound ramps
- Illumination is provided by way of street lights mounted on wood poles
- Posted speed limit varies between 30 and 40 miles per hour (mph) within the study area
- Land use consists of the Project site and commercial properties

Mill Street

- Two-lane urban collector roadway under Town jurisdiction
- Traverses study area in a general east-west direction between Route 53 and South Street
- Provides two (2) 10 to 12-foot wide travel lanes separated by a double-yellow centerline with 1-foot wide marked shoulders
- Sidewalks are not provided
- Illumination is provided by way of street lights mounted on wood poles
- A posted speed limit is not provided and, as such, the regulated travel speed pursuant to M.G.L. c. 90 § 17C is 25 mph.[4]
- Land use consists of the Project site, residential and commercial properties, the South Shore YMCA, areas of open and wooded space and low-lying wetland areas

Intersections

Table 1 and Figure 3 summarize existing lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersections as observed in April 2018, January and April 2019.

[4]The Town of Hanover enacted a townwide speed limit of 25 mph within a thickly settled or business district which became effective on February 7, 2019.

Table 1
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 123/ Main St.	TS	2 lanes on Rte. 123 EB with channelized right-turn lane; 1 left-turn lane and 1 through/right lane on Rte. 123 WB; 1 lane on both Main St. approaches	Yes – 1 to 5-feet on Rte. 123 and 1 to 2 feet on Main St.	No	Yes - Shared traveled-way[b]; traffic signal system includes bicycle detection
Rte. 53/Rte.123	TS	1 wide lane that functions as 2 travel lanes on both Rte.123 approaches; 2 general-purpose lanes on Rte.53 NB and 1 left/through lane, 1 through lane and 1 right-turn lane on Rte. 53 SB	Yes – 2-feet on Rte. 53 and 1-foot on Rte. 123	Yes – Sidewalks on both sides of Rte. 53 and south side of Rte. 123; marked crosswalks for crossing all legs; pedestrian traffic signal equipment and phasing (exclusive) provided	Yes - Shared traveled-way; traffic signal system includes bicycle detection
Rte. 53/ Rte. 3 NB Ramps/ Sunoco Dwy.	TS	2 lanes on Rte. 53 NB with channelized right-turn lane; 1 left-turn lane and 2 through lanes on Rte. 53 SB; 1 left-turn/through lane and a channelized right-turn lane on Rte.3 off-ramp; 1 lane on Sunoco dwy.	Yes - 3 to 4-feet on Rte. 53 and 2-feet on Rte. 3 ramps	Yes – Sidewalks along east side of Rte. 53 and along west side north of Sunoco dwy.; marked crosswalks for crossing Rte. 53 north leg and Rte. 3 ramps; pedestrian traffic signal equipment and phasing (exclusive) provided. Sign stating "Pedestrians Prohibited" installed south of Sunoco dwy.	Yes - Shared traveled-way on Rte. 53; traffic signal system includes bicycle detection
Rte. 53/ Rte. 3 SB Ramps/ Hanover Mall Dr.	TS	1 left-turn lane and 2 through lanes on Rte. 53 NB; 2 through lanes on Rte. 53 SB; 1 left-turn lane, 1 through lane and 2 channelized right-turn lanes on Rte. 3 SB off-ramp; 1 through lane and 1 right-turn lane on Hanover Mall Dr. approach; left-turns from Rte. 53 SB and Hanover Mall Dr. are prohibited	Yes - 2 to 4-feet on Rte. 53 and 2-feet on Rte. 3 ramps	Yes – Sidewalk along east side of Rte. 53 north of intersection	Yes - Shared traveled-way on Rte. 53

See notes at end of table

Table 1 (Continued)
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 53/ Hanover Mall North Dwy.	S	2 lanes in both directions on Rte. 53 with center turn lane; 1 lane restricted to right turns only on Hanover Mall dwy.	Yes –2-feet on Rte. 53	No	Yes - Shared traveled-way on Rte. 53
Rte. 53/ Hanover Mall Center Dwy.	TS	2 lanes on Rte. 53 NB; 1 left-turn lane and 2 through lanes on Rte. 53 SB; 1 left-turn lane and 1 right-turn lane on Hanover Mall dwy.	Yes – 2-feet on Rte. 53	Yes – Sidewalk segment along west side of Rte. 53 and north side of Hanover Mall dwy.; crosswalk provided for crossing Rte. 53 north leg; pedestrian traffic signal equipment and phasing (concurrent) provided	Yes - Shared traveled-way on Rte. 53
Rte. 53/ Hanover Mall South Dwy./ Pvt. Dwy.	S	2 lanes in both directions on Rte. 53 with center turn lane; 1 left-turn lane and 1 right-turn lane on Hanover Mall dwy.; 1 lane on Pvt. dwy. that functions as 2 lanes when turning traffic is present	Yes –2-feet on Rte. 53	No	Yes - Shared traveled-way on Rte. 53
Rte. 53/ Mill St./ Frank's Ln.	TS	1 left-turn lane and 2 through lanes on Rte. 53 NB; 1 left-turn lane, 2 through lanes and 1 right-turn lane on Rte. 53 SB; 1 left-turn lane, 1 through lane and a channelized right-turn lane on Mill St.; 1 lane on Frank's Ln.	Yes –2-feet on Rte. 53 and 1 to 2-feet on Mill St.	No	Yes - Shared traveled-way on intersecting roadways

See notes at end of table.

Table 1 (Continued)
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Mill St./ Hanover Mall West Dwy.	S	1 lane on all approaches	Yes – 1-foot on Mill St.	No	No
Mill St./ Mill Pond Dr./ Hanover Mall Dr.	S[c]	1 lane on Mill St. and Hanover Mall Dr. approaches; 1 left-turn/through lane and 1 right-turn lane on Mill Pond Dr.	Yes – 1-foot on Mill St.	Yes – sidewalk along west side of Mill Pond Dr.	No
Mill St./ South St.	S	1 lane on all approaches; South St. south leg provides 2 approaches to Mill St. separates by a raised island	Yes – 1-foot on Mill St. and South St. north of intersection	No	No
Rte. 53/Old Washington St./ Pond St.	TS	1 left-turn lane, 1 through lane and 1 through/right lane on both Rte. 53 approaches ; 1 left/through lane and 1 right-turn lane on Old Washington St.; 1 lane on Pond St.	Yes – 3 to 4-feet on Rte. 53 and 1 to 3-feet on Old Washington St.	Yes – Sidewalk along west side of Rte. 53; crosswalk provided for crossing Old Washington St.; pedestrian traffic signal equipment and phasing (concurrent) provided	Yes - Shared traveled-way on Rte.53 and Old Washington St.
Main St./ Prospect St.	S	1 lane on all approaches	Yes – 1 to 2-feet on Main St. and 1-foot on Prospect St.	Yes – Sidewalk along south side of Main St.	Yes – Shared traveled-way on Main St.
Main St./ South St.	S	1 lane on all approaches	Yes – 1 to 2-feet on Main St. and 1-foot on South St.	Yes – Sidewalks along south side of Main St. and west side of South St.	Yes – Shared traveled-way on Main St.
South St./ Pleasant St.	S	1 lane on all approaches	Yes – 1 to 4-feet on South St. and 1-foot on Pleasant St.	No	Yes – Shared traveled-way on South St. south of intersection and on Pleasant St.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; pvt = private
[a]TS = traffic signal control; S = STOP-sign control; Y = YIELD-sign control; R = rotary/roundabout control; NC = no control present.
[b]Combined shoulder and travel lane width equal to or exceed 14 feet.
[c]This intersection was recently placed under all-way STOP-sign control.

Legend:

- (S) Signalized Intersection
- (U) Unsignalized Intersection
- Sidewalk
- Crosswalk
- XX' Lane Use and Travel Lane Width
- *XX' Channelized Right-Turn
- Left Turns Prohibited

HANOVER

NORWELL

SITE

EXIT 13

GAS STATION

OLD WASHINGTON STREET

WASHINGTON

FRANK'S LANE

PRIVATE DRIVEWAY

STREET

WEBSTER STREET

MAIN

MILL

POND STREET

MILL POND DRIVE

SOUTH STREET

PLEASANT STREET

PROSPECT STREET

53

3

123

Figure 3

Existing Intersection Lane Use, Travel Lane Width and Pedestrian Facilities

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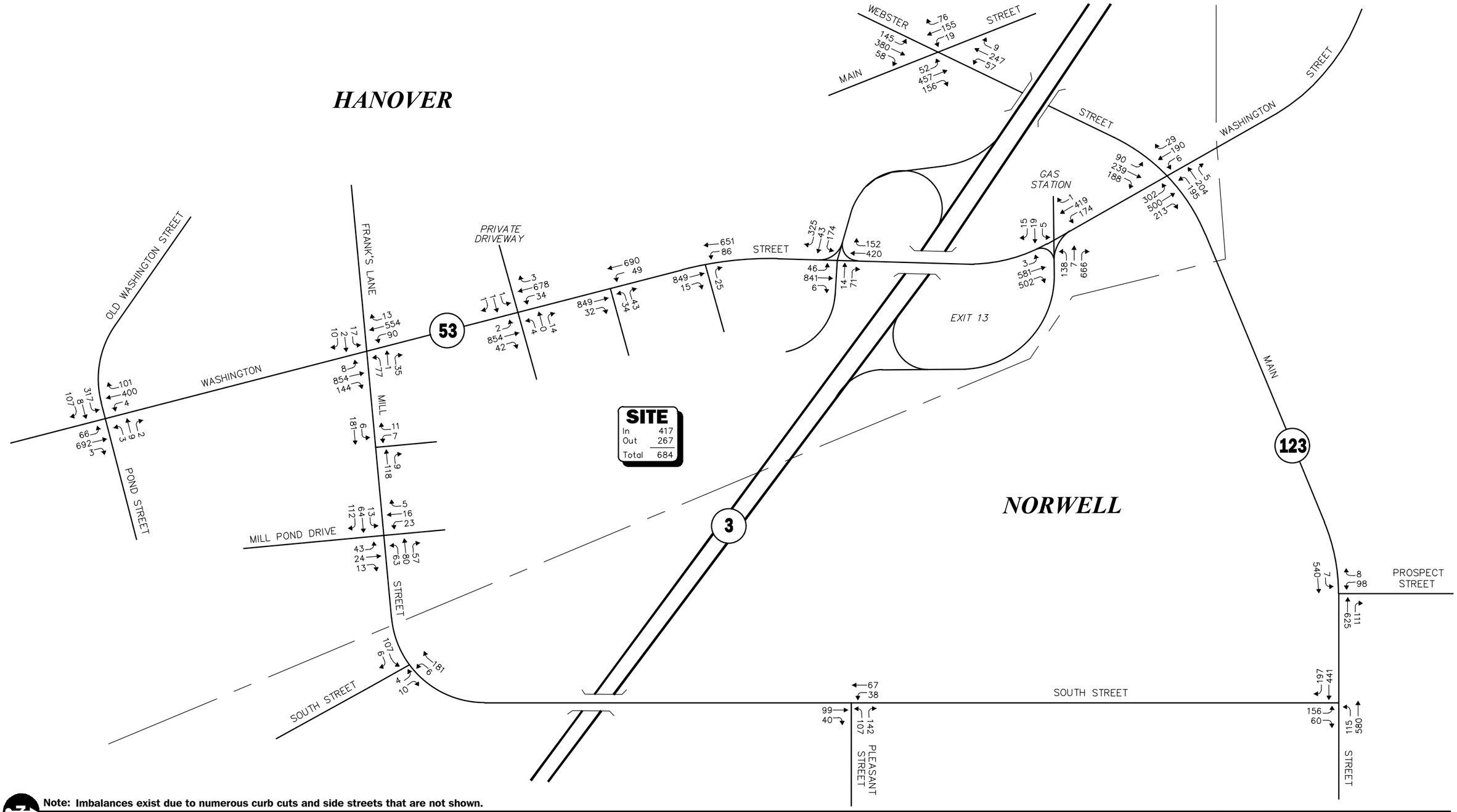
EXISTING TRAFFIC VOLUMES

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts, manual turning movement counts (TMCs) and vehicle classification counts were completed in April 2018 and in January, March and April 2019 while public schools were in regular session. The ATR counts were conducted on Mill Street over a continuous 72-hour period in order to record weekday daily traffic conditions over an extended period, with weekday morning (7:00 to 9:00 AM), weekday evening (4:00 to 6:00 PM) and Saturday midday (11:00 AM to 2:00 PM) peak period manual TMCs performed at the study intersections. In addition, weekday 12-hour (7:00 AM to 7:00 PM) TMCs were conducted at the intersections of Main Street at Prospect Street and Main Street at South Street in order to perform a Traffic Signal Warrant Analysis (TSWA) and an extended weekday afternoon (2:00 to 6:00 PM) TMC was conducted at the intersection of South Street at Pleasant Street given the proximity of Norwell High School to the intersection. These time periods were selected for analysis purposes as they are representative of the peak traffic volume hours for both the Project and the adjacent roadway network.

Traffic Volume Adjustments

In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, traffic volume data from MassDOT Continuous Count Station No. 36 located on Route 3 south of River Street in Norwell were reviewed.[5] Based on a review of this data, it was determined that traffic volumes for the months of January, March and April are approximately 15.3, 2.9 and 1.6 percent below average month conditions, respectively. As such, the raw traffic count data that forms the basis of the assessment was adjusted upward accordingly to represent average-month conditions. The traffic volume data collected in April 2018 was adjusted to 2019 conditions by applying a general background traffic growth rate of 0.5 percent (discussed in further detail in the *General Background Traffic Growth* section of this report). The 2019 Existing traffic volumes are summarized in Table 2, with the weekday morning, weekday evening and Saturday midday peak-hour traffic volumes graphically depicted on Figures 4, 5 and 6, respectively. Note that the peak-hour traffic volumes presented in Table 2 were obtained from the aforementioned figures.

[5]MassDOT Traffic Volumes for the Commonwealth of Massachusetts; 2019.



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 4

2019 Existing
Weekday Morning
Peak Hour Traffic Volumes

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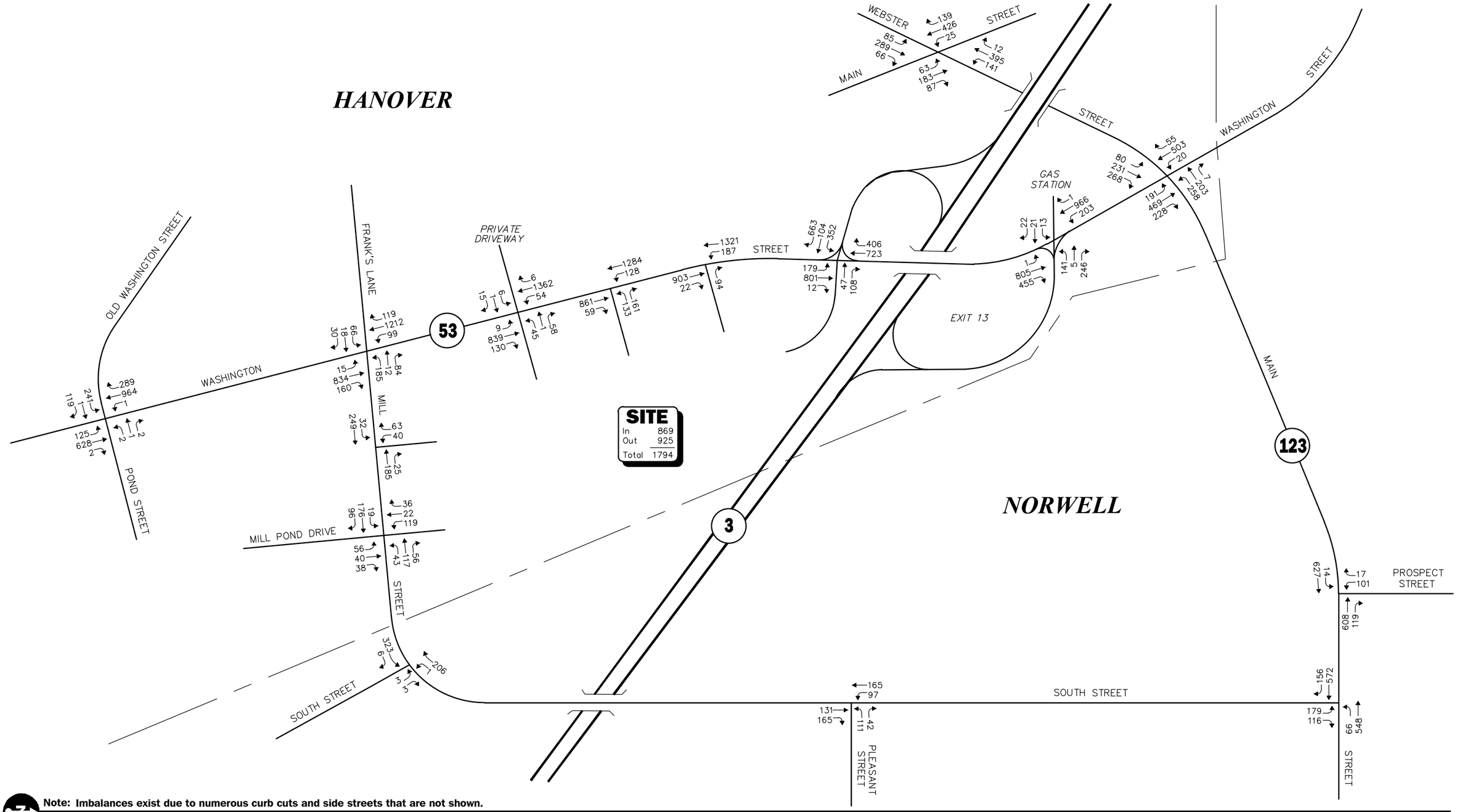

Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 5

2019 Existing
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
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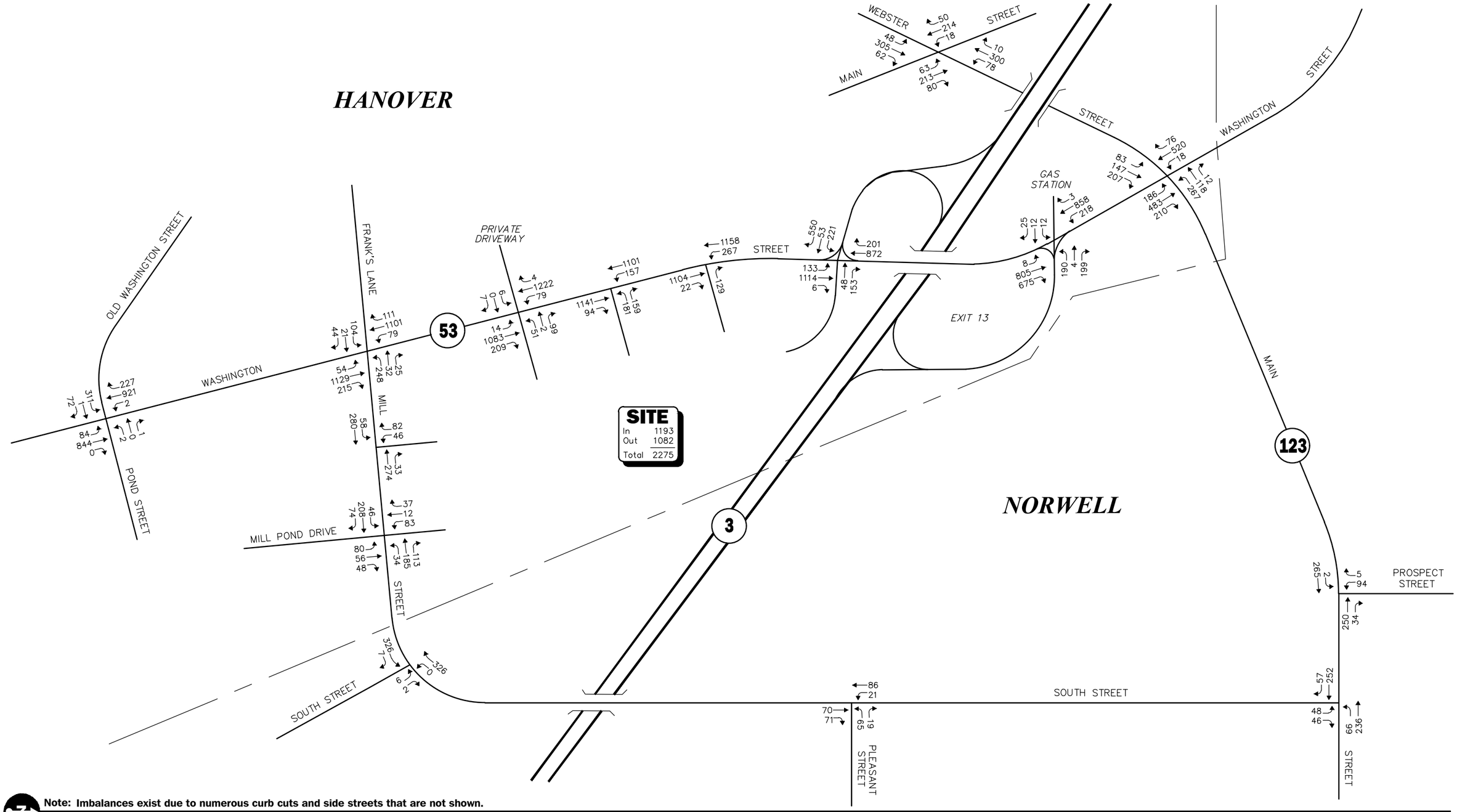

Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 6

2019 Existing
Saturday Midday
Peak Hour Traffic Volumes

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Table 2
2019 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT[a]	Saturday[b]	VPH[c]	K Factor[d]	Directional Distribution[e]
Route 53*, south of the Hanover Mall*					
North Driveway:	26,670[f]	28,735[f]	--	--	--
Weekday Morning (8:00 – 9:00 AM)	--	--	1,581	5.9	56.8% NB
Weekday Evening (4:30 – 5:30 PM)	--	--	2,400	9.0	59.3% SB
Saturday Midday (11:00 AM – 12:00 PM)	--	--	2,586	9.0	50.5% NB
Mill Street, east of the Hanover Mall					
West Driveway:	6,325	6,400	--	--	--
Weekday Morning (8:00 – 9:00 AM)	--	--	315	5.0	59.7% EB
Weekday Evening (4:30 – 5:30 PM)	--	--	499	7.9	57.9% EB
Saturday Midday (11:00 AM – 12:00 PM)	--	--	633	9.9	51.5% EB

[a]Average weekday traffic in vehicles per day.
[b]Vehicles.
[c]Vehicles per hour.
[d]Percent of daily traffic occurring during the peak hour.
[e]Percent traveling in peak direction.
[f]Estimated.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

As can be seen in Table 2, Route 53 in the vicinity of the Project site was estimated to accommodate approximately 26,670 vehicles on an average weekday and 28,735 vehicles on a Saturday (both two-way, 24-hour volumes), with approximately 1,581 vehicles per hour (vph) during the weekday morning peak-hour, 2,400 vph during the weekday evening peak-hour and 2,586 vph during the Saturday midday peak-hour.

Mill Street in the vicinity of the Project site was found to accommodate approximately 6,325 vehicles on an average weekday and 6,400 vehicles on a Saturday, with approximately 315 vph during the weekday morning peak-hour, 499 vph during the weekday evening peak-hour and 633 vph during the Saturday midday peak-hour.

SPOT SPEED MEASUREMENTS

Vehicle travel speed measurements were performed on Mill Street in the vicinity of the Project site over a continuous 72-hour period in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	Mill Street	
	Eastbound	Westbound
Mean Travel Speed (mph)	33	32
85th Percentile Speed (mph)	37	36
Regulated Speed (mph)[a]	25	25

mph = miles per hour.
[a]Pursuant to MGL c. 90 §17C and as enacted by the Town on February 7, 2019.

As can be seen in Table 3, the mean vehicle travel speed along Mill Street in the vicinity of the Project site was found to be approximately 33 mph in the eastbound direction and 32 mph westbound. The average measured 85th percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled at or below, was found to be approximately 37 mph in the eastbound direction and 36 mph westbound, which is 11 to 12 mph above the regulated travel speed along Mill Street (25 mph). The 85th percentile speed is used as the basis of engineering design and in the evaluation of sight distances, and is often used in establishing posted speed limits.

PEDESTRIAN AND BICYCLE FACILITIES

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in April 2018 and in January and April 2019. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersections, as well as the location of existing and planned future bicycle facilities. As detailed on Figure 3, a sidewalk is provided along the east side of Route 53 north of Hanover Mall Drive, along the west side north of the Sunoco driveway to Route 123 and along the west side north and south of Old Washington Street; along the south side of Main Street east of the Hanover/Norwell town line; and along the west side of South Street from Main Street to the Norwell High School. Marked crosswalks are provided for crossing the Route 53/Route 123; Route 53/Route 3 northbound ramps/Sunoco driveway; Route 53/Hanover Mall center driveway; and Route 53/Old Washington Street/Pond Street intersections (sidewalk segments are provided at this intersection); all of which include pedestrian traffic signal equipment and phasing.

Formal bicycle facilities are not provided within the study area; however, Route 53 and Route 123 provide sufficient width (combined travel lane and paved shoulder) to support bicycle travel in a shared traveled-way configuration.[6] In addition, the traffic signal systems at the signalized study area intersections include bicycle detection.

[6]A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

PUBLIC TRANSPORTATION

Regularly scheduled public transportation services are not currently provided within the study area or to the Project site. The Town of Hanover is served by the Greater Attleboro-Taunton Regional Transit Authority (GATRA), which provides demand response (Dial-A-Ride) services for people with disabilities and seniors. In addition, the Hanover Council on Aging (COA) provides transportation services by appointment for doctor's appointments, shopping and errands.

MOTOR VEHICLE CRASH DATA

Motor vehicle crash information for the study area intersections was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2012 through 2016, inclusive) in order to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, roadway and weather conditions, and day of occurrence, and presented in Table 4.

As can be seen in Table 4, the study intersections experienced an average of approximately six (6) or fewer reported motor vehicle crashes per year over the five-year review period and, with the exception of the Mill Street/Mill Pond Drive/Hanover Mall Drive intersection, were found to have a motor vehicle crash rate below both the MassDOT statewide and District averages for a signalized or unsignalized intersection, as appropriate, for the MassDOT Highway Division District in which the intersections are located (District 5).

The Mill Street/Mill Pond Drive/Hanover Mall Drive intersection was found to have experienced a total of 17 reported motor vehicle crashes over the five-year review period, with eight (8) crashes occurring on a weekday, eight (8) occurring on a Saturday and one (1) on a Sunday. The majority of the crashes occurred under clear weather conditions, during daylight, and were reported as angle type collisions that resulted in personal injury. The intersection was found to have a motor vehicle crash rate that was above both the statewide and MassDOT District 5 average crash rates for an unsignalized intersection. The Town recently advanced safety-related improvements at the intersection that include the implementation of all-way STOP-sign control.

A review of the MassDOT statewide High Crash Location List indicated that there are no locations within the study area that are included on MassDOT's Highway Safety Improvement Program (HSIP) listing as high crash locations. In addition, no fatal motor vehicle crashes were reported to have occurred at the study area intersections over the five-year review period. The detailed MassDOT Crash Rate Worksheets and High Crash Location mapping are provided in the Appendix.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	Hanover Locations												Norwell Locations		
	Route 53/ Route 3 NB Ramps	Route 53/ Route 3 SB Ramps/ Hanover Mall Dr.	Route 53/ North Mall Driveway	Route 53/ Center Mall Driveway	Route 53/ South Mall Driveway	Route 53/ Mill Street/ Frank's Lane	Mill Street/ West Mall Driveway	Mill Street/ Mill Pond Drive/ Hanover Mall Drive	Mill Street/ South Street	Route 53/ Route 123	Route 123/ Main Street	Route 53/ Old Washington Street/ Pond Street	Main Street/ Prospect Street	Main Street / South Street	South Street/ Pleasant Street
Traffic Control Type:[b]	TS	TS	U	TS	U	TS	U	U	U	TS	TS	TS	U	U	U
Year:															
2012	5	8	1	0	0	2	0	1	0	4	2	1	1	1	0
2013	9	3	1	0	0	2	1	5	0	2	2	1	2	2	0
2014	3	4	1	1	3	2	0	0	0	2	6	1	2	1	0
2015	7	8	0	0	0	4	3	5	0	5	4	5	0	0	2
2016	5	6	1	2	1	6	0	6	0	3	5	3	0	3	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2
Average	5.80	5.80	0.80	0.60	0.80	3.20	0.80	3.40	0.00	3.20	3.80	2.20	1.00	1.40	0.40
Rate[c]	0.50	0.40	0.08	0.06	0.08	0.28	0.33	1.01	0.0	0.31	0.49	0.23	0.25	0.21	0.14
MassDOT Crash Rate:[d]	0.78/0.75	0.78/0.75	0.57/0.57	0.78/0.75	0.57/0.57	0.78/0.75	0.57/0.57	0.57/0.57	0.57/0.57	0.78/0.75	0.78/0.75	0.78/0.75	0.57/0.57	0.57/1.57	0.57/0.57
Significant?[e]	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
Type:															
Angle	4	3	2	2	3	9	4	16	0	9	9	6	2	3	2
Rear-End	21	18	1	1	0	6	0	0	0	4	7	4	1	4	0
Head-On	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0
Sideswipe	0	4	1	0	0	1	0	1	0	2	0	0	2	0	0
Fixed Object	2	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Pedestrian/Bicycle	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Unknown/Other	1	3	0	0	1	0	0	0	0	0	0	0	0	0	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2
Day of Week:															
Monday through Friday	19	27	3	2	4	11	4	8	0	13	15	9	3	7	0
Saturday	4	2	1	0	0	3	0	8	0	3	3	0	2	0	2
Sunday	6	0	0	1	0	2	0	1	0	0	1	2	0	0	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2
Severity:															
Property Damage Only	20	21	1	1	3	7	4	7	0	14	6	2	5	7	2
Personal Injury	9	8	3	2	1	9	0	10	0	2	10	9	0	0	0
Fatality	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2
Conditions:															
Clear	21	23	1	3	3	10	4	10	0	11	13	9	4	6	1
Cloudy	5	5	2	0	0	3	0	4	0	2	2	2	0	0	1
Rain	1	0	1	0	1	2	0	3	0	3	4	0	1	1	0
Snow/Ice	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2
Lighting:															
Daylight	22	21	4	3	1	13	3	14	0	13	8	9	5	7	2
Dawn/Dusk	1	1	0	0	1	0	0	1	0	0	1	0	0	0	0
Dark (Road Lit)	6	4	0	0	2	3	1	2	0	3	10	2	0	0	0
Dark (Road Unlit)	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	29	29	4	3	4	16	4	17	0	16	19	11	5	7	2

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2012 through 2016.
[b]Traffic Control Type: U = unsignalized; TS = traffic signal.
[c]Crash rate per million vehicles entering the intersection.
[d]Statewide/District crash rate.
[e]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 5).

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2026, which reflects a seven-year planning horizon from the current year consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. Independent of the Project, traffic volumes on the roadway network in the year 2026 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2026 No-Build traffic volumes reflect 2026 Build traffic volume conditions with the Project.

FUTURE TRAFFIC GROWTH

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic; however, potential population growth and development external to the study area would not be accounted for in the resulting traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Development by Others

The Planning Department in the Towns of Hanover and Norwell were contacted in order to determine if there were any projects planned within the study area that would have an impact on future traffic volumes at the study intersections. Based on this discussion, the following projects were identified for inclusion in this assessment:

- ***Previte's Marketplace, Hanover, Massachusetts.*** This project will entail the construction of approximately 25,290 sf of retail/restaurant space to be located at

283 Columbia Road (Route 53/139) and 283 Broadway. The property located at 283 Columbia Road was formerly occupied by the Sylvester Company lumber yard.

- ***Merchant's Row, Hanover, Massachusetts.*** This project is currently under construction and will entail the redevelopment of the former 65,000 sf commercial building located at 2053 Washington Street with 62,000 sf of retail and restaurant space.

- ***Chick-Fil-A Restaurant, Hanover, Massachusetts.*** This project will entail the redevelopment of the existing Burger King Restaurant located at 1877 Washington Street to accommodate a 4,858 sf Chick-fil-A Restaurant with drive-through facility.

- ***Simon Hill Residential Development, Norwell, Massachusetts.*** This project consists of the construction of a 150-unit multifamily residential community located off Prospect Street.

- ***Schooner Estates, Norwell, Massachusetts.*** This project consists of the construction of a 9-unit residential community located off Stetson Road. Traffic volumes associated with this project are expected to be relatively minor and would be reflected in the general background traffic growth rate.

- ***Old Oaken Bucket Estates, Norwell, Massachusetts.*** This project will entail the construction of a 26-unit residential community to be located off Old Oaken Bucket Road.

- ***Circuit Street Residential Development, Norwell, Massachusetts.*** This proposed project will entail the construction of a 7-unit residential community to be located off Circuit Street. Traffic volumes associated with this project are expected to be relatively minor and would also be reflected in the general background traffic growth rate.

Traffic volumes associated with the aforementioned specific development projects by others were obtained from the traffic study prepared in support of the project[7] or using trip-generation information available from the Institute of Transportation Engineers (ITE)[8] for the appropriate land use, and were assigned onto the study area roadway network based on existing traffic patterns where no other information was available. No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general background traffic growth rate.

In addition to the aforementioned specific development projects by others, it was assumed that the vacant space within the Hanover Mall (143,884 ± sf) would be reoccupied.

General Background Traffic Growth

Traffic-volume data compiled by MassDOT from Continuous Count Station No. 36 located on Route 3 south of River Street in Norwell were reviewed. Based on a review of this data and the background traffic growth rate used in other recently completed studies within the Town,[9] a 0.5 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

[7] *Environmental Notification Form*, Previte's Marketplace Retail Development, 283 Columbia Road and 237 Broadway, Hanover, Massachusetts; VHB; April 30, 2018.

[8] Ibid 1.

[9] Ibid 6.

Roadway Improvement Projects

MassDOT and the Towns of Hanover and Norwell were consulted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2026. Based on these discussions, the following roadway improvement was identified:

- ***Route 3 Bridge Replacement Project, Hanover and Norwell (606553), Massachusetts.*** This project is currently under construction by MassDOT and entails the replacement of the existing bridges over Webster Street (Route 123) in Hanover and High Street in Norwell to include accommodations for the future widening of Route 3. This project is expected to be completed in 2020.

No other roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

No-Build Traffic Volumes

The 2026 No-Build condition peak-hour traffic-volumes were developed by applying the 0.5 percent per year compounded annual background traffic growth rate to the 2019 Existing peak-hour traffic volumes and then adding the peak-hour traffic volumes associated with the identified specific development projects by others. The resulting 2026 No-Build weekday morning, weekday evening and Saturday midday peak-hour traffic volumes are shown on Figures 7, 8 and 9, respectively.

PROJECT-GENERATED TRAFFIC

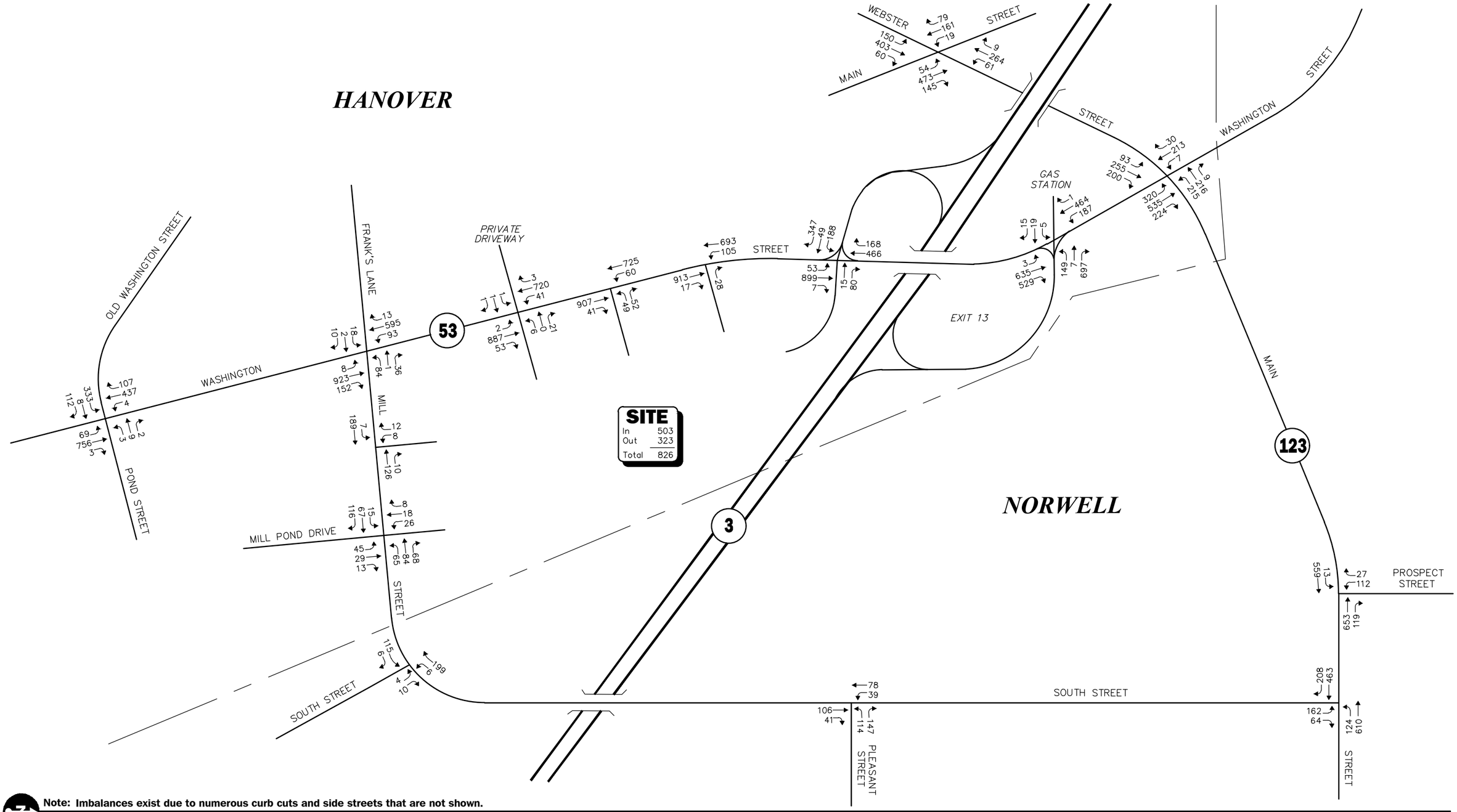
Design year (2026) Build traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

As proposed, the Project will entail the phased construction of 598,535± sf of retail, restaurant, grocery and entertainment space, and a 297-unit multifamily residential community. In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE[10] for similar land uses as those proposed were used. ITE Land Use Codes (LUCs) 221, *Multifamily Housing (Mid-Rise)*; 820, *Shopping Center*; and 850, *Supermarket*; were used to establish the base traffic characteristics of the Project.

Internal Trips

A portion of the trips expected to be generated by the Project will consist of internal or dual-purpose trips. An internal trip consists of a resident, customer and/or employee that patronizes more than one of the uses planned within a development and is common in mixed-use projects with appropriate accommodations to facilitate trips between uses. By way of example, a resident of the Project may also patronize the retail space or the grocery store that is to be located within

[10]Ibid 1.

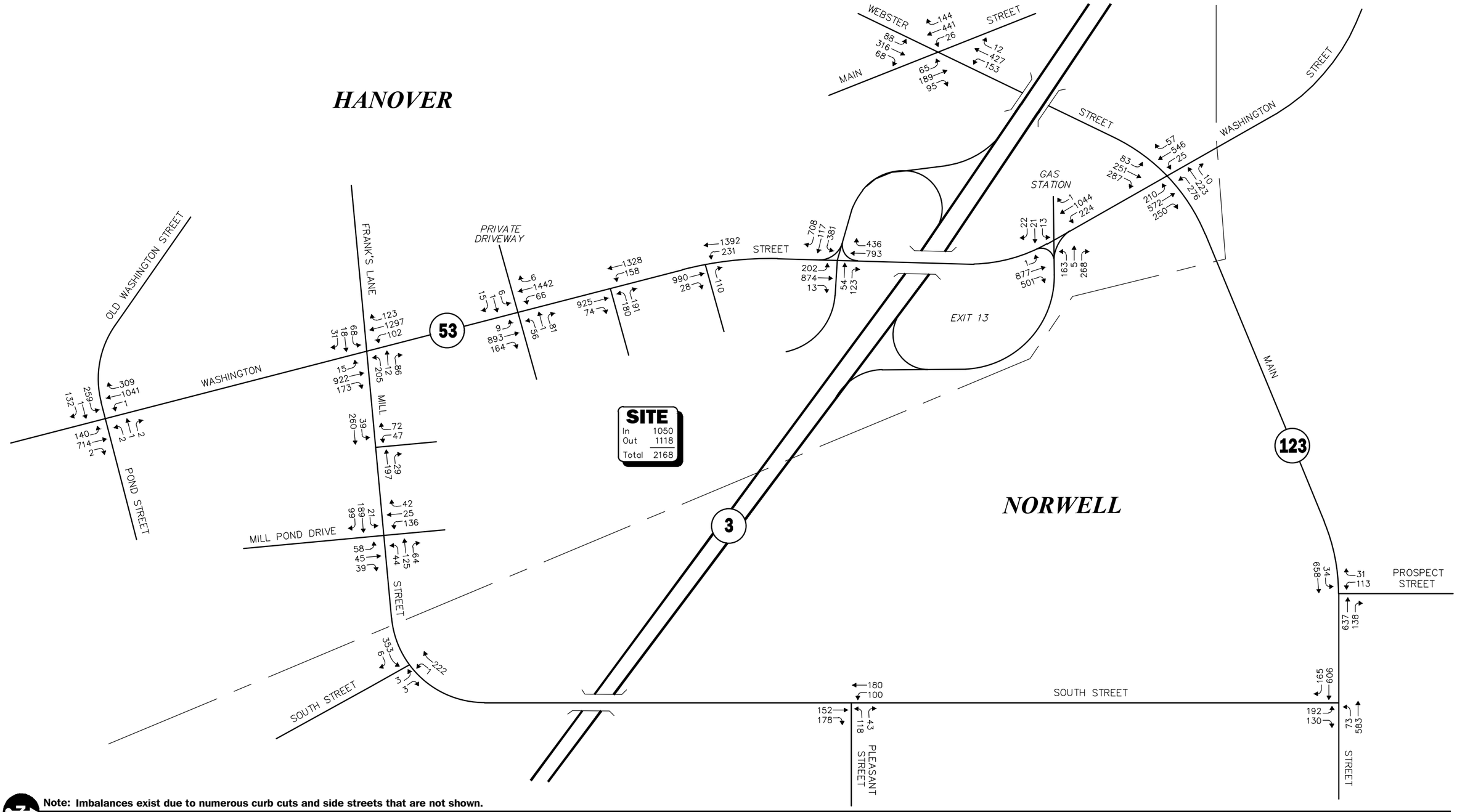


Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 7

2026 No-Build
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 8

2026 No-Build
Weekday Evening
Peak Hour Traffic Volumes

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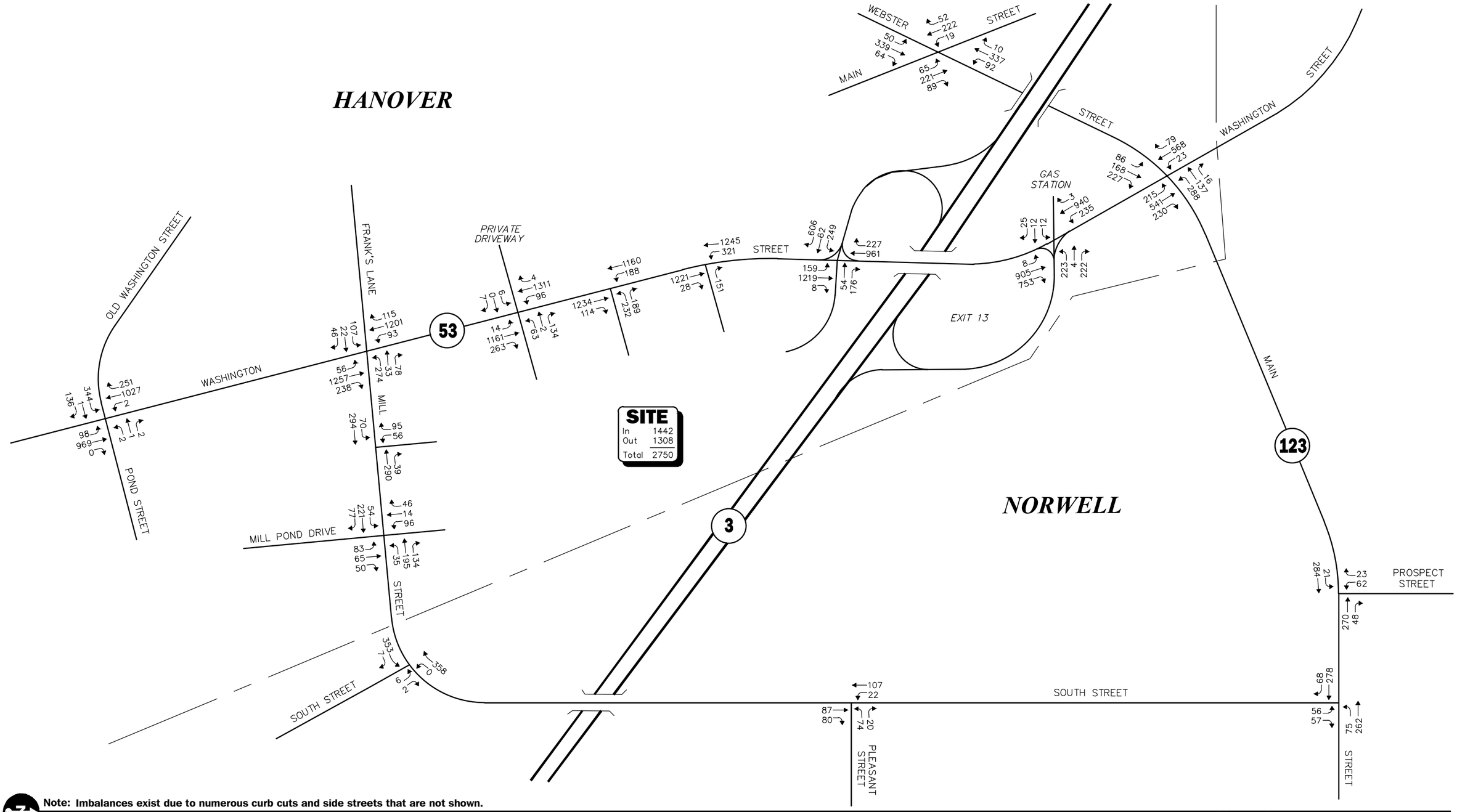

Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 9

2026 No-Build
Saturday Midday
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
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the Project site. In order to account for this interaction, the multi-use trip-generation calculation methodology promulgated by the ITE[11] was applied to the base ITE trip-generation calculations.

Pass-By Trips

Not all of the trips expected to be generated by the retail, restaurant, grocery and entertainment components of the Project will be new trips on the roadway network. A significant portion of these trips will consist of pass-by trips or vehicles already traveling along the study area roadways for other purposes that will patronize the Project in conjunction with their trip and then continue to their original destination. These trips are not new trips on the roadway network as a result of the Project. Statistics published by the ITE[12] indicate that an average of up to 34 percent of the trips generated by the retail/restaurant/entertainment components (shopping center) and up to 36 percent of trips generated by the grocery component may consist of pass-by trips. In accordance with MassDOT guidelines which limits pass-by trips to the lesser of: i) 15 percent of the adjacent roadway traffic volume; or ii) the ITE pass-by trip rate for the specific use; the ITE published pass-by trips rates were applied to the trip-generation calculations for the retail, restaurant, grocery and entertainment space components of the Project after the internal trip reduction was applied.

Table 5 summarizes the anticipated trip characteristics of the Project using the aforementioned methodology.

[11] *Trip Generation Handbook*, 3rd Edition, A Recommended Practice of the Institute of Transportation Engineers; Institute of Transportation Engineers; Washington, D.C.; September 2017.

[12] Ibid.

Table 5
TRIP GENERATION SUMMARY

Time Period/Direction	Grocery Component					Retail/Restaurant/Entertainment Component					Residential Component			
	(A) Supermarket (92,500 sf)[a]	(B) Internal Trips[b]	(C = A - B) Net Trips	(D) Pass-By Trips[c]	(E = C - D) Primary Trips	(F) Shopping Center (506,035 sf)[d]	(G) Internal Trips[e]	(H = F - G) Net Trips	(I) Pass-By Trips[f]	(J = H - I) Primary Trips	(K) Residential Housing (297 units)[g]	(L) Internal Trips[h]	(M = K– L) Primary Trips	(N = E+J+M) Total Primary Trips
Average Weekday Daily														
Entering	4,939	101	4,838	1,742	3,096	9,054	186	8,868	3,015	5,853	809	287	522	9,471
Exiting	4,939	101	4,838	1,742	3,096	9,054	186	8,868	3,015	5,853	809	287	522	9,471
Total	9,878	202	9,676	3,484	6,192	18,108	372	17,736	6,030	11,706	1,618	574	1,044	18,942
Weekday Morning Peak Hour														
Entering	212	0	212	64	148	251	1	250	69	181	26	1	25	354
Exiting	141	0	141	64	77	154	1	153	69	84	73	1	72	233
Total	353	0	353	128	225	405	2	403	138	265	99	2	97	587
Weekday Evening Peak Hour														
Entering	377	8	369	130	239	866	20	846	300	546	77	28	49	834
Exiting	362	8	354	130	224	938	20	918	300	618	49	28	21	863
Total	739	16	723	260	463	1,804	40	1,764	600	1,164	126	56	70	1,697
Saturday														
Entering	8,215	104	8,111	2,920	5,191	12,178	155	12,023	3,126	8,897	729	259	470	14,558
Exiting	8,215	104	8,111	2,920	5,191	12,178	155	12,023	3,126	8,897	729	259	470	14,558
Total	16,430	208	16,222	5,840	10,382	24,356	310	24,046	6,252	17,794	1,458	518	940	29,116
Saturday Midday Peak Hour														
Entering	428	8	420	148	272	1,159	20	1,139	285	854	64	28	36	1,162
Exiting	412	8	404	148	256	1,069	20	1,049	285	764	67	28	39	1,059
Total	840	16	824	296	528	2,228	40	2,188	570	1,618	131	56	75	2,221

[a]Based on ITE LUC 850, *Supermarket*, applied to 92,500 sf.
[b]Internal trips: weekday daily – 2.0 percent; weekday morning peak-hour– 0.0 percent; weekday evening peak hour – 2.2 percent; Saturday daily – 1.3 percent; and Saturday midday peak hour – 1.9 percent.
[c]Pass-by trip rate – 36 percent.
[d]Based on ITE LUC 820, *Shopping Center,* applied to 506,035 sf.
[e] Internal trips: weekday daily – 2.1 percent; weekday morning peak-hour– 0.5 percent; weekday evening peak hour – 2.2 percent; Saturday daily – 1.3 percent; and Saturday midday peak hour – 1.8 percent.
[f]A pass-by trip rate was applied to the traffic volumes associated with the retail/restaurant/entertainment uses as follows: average weekday daily, weekday morning and evening peak hours - 34 percent; and Saturday daily and Saturday midday peak-hour – 26 percent.
[g]Based on ITE LUC 221, *Multifamily Housing (Mid-Rise),* applied to 297 units.
[h]Internal trips: weekday daily – 35.5 percent; weekday morning peak-hour – 2.0 percent; weekday evening peak-hour – 44.4 percent; Saturday daily – 35.5 percent; and Saturday midday peak-hour – 42.7 percent.

Project-Generated Trip Summary

As can be seen in Table 5, using the aforementioned methodology and after adjustment (reduction) to account for both internal and pass-by trips, the Project is expected to generate approximately 18,942 primary vehicle trips on an average weekday and 29,116 primary vehicle trips on a Saturday (both two-way, 24-hour volumes), with 587 primary vehicle trips (354 vehicles entering and 233 exiting) expected during the weekday morning peak-hour, 1,697 primary vehicle trips (834 vehicles entering and 863 exiting) expected during the weekday evening peak-hour and 2,221 primary vehicle trips (1,162 vehicles entering and 1,059 exiting) expected during the Saturday midday peak-hour.

Table 6 compares the traffic volumes associated with the Project to those of the existing uses that occupy the Project site. Note that pass-by trips are <u>included</u> in the subject traffic volumes, which represent the <u>total</u> volume of traffic entering and exiting the Project site.

Table 6
TRAFFIC VOLUME COMPARISON

	Vehicle Trips		
Time Period/Direction	(A) Hanover Crossing[a]	(B) Existing Uses[b]	(A-B) Difference
Average Weekday Daily:	28,456	25,424[c]	3,032
Weekday Morning Peak Hour:	853	826[d]	27
Weekday Evening Peak Hour:	2,557	2,168[d]	389
Saturday:	41,208	33,186[c]	8,022
Saturday Midday Peak Hour:	3,087	2,750[d]	337

[a]Based on ITE LUC 820, *Shopping Center*, LUC 850, *Supermarket*, and LUC 221, *Multifamily Housing (Mid-Rise)*.
[b]Assumes full occupancy of the Hanover Mall.
[c]Based on ITE LUC 820, *Shopping Center*.
[d]As counted on Thursday April 26, 2018 and Saturday, April 28, 2018, and adjusted proportionally to reflect occupancy of the current vacant space.

Traffic Volume Comparison

As can be seen in Table 6, in comparison to the existing uses that occupy the Project site, the Project site is expected to accommodate 3,032 additional vehicle trips on an average weekday and 8,022 additional vehicle trips on a Saturday (two-way, 24-hour volumes), with 27 additional vehicle trips expected during the weekday morning peak-hour, 389 additional vehicle trips expected during the weekday evening peak-hour and 337 additional vehicle trips expected during the Saturday midday peak-hour. ***The average weekday daily and Saturday traffic volume increases <u>exceed</u> the Transportation thresholds of the Massachusetts Environmental Policy Act (MEPA) that would necessitate the filing of an Environmental Notification Form (ENF) and an Environmental Impact Report (EIR) for the Project based on Traffic/Transportation.***

TRIP DISTRIBUTION AND ASSIGNMENT

Separate trip-distribution patterns were developed for the residential and commercial (retail, restaurant, grocery and entertainment space) components of the Project given the differing nature and purpose of the trips associated with these uses. For the residential component of the Project, the directional distribution was determined based on a review of Journey-to-Work data obtained from the U.S. Census for persons residing in the Town of Hanover and then refined based on a review of existing traffic patterns within the study area during the peak periods. For the commercial component of the Project, the directional distribution was determined based on a review of existing traffic patterns at the Project site driveways and the refined based on a review of existing traffic patterns within the study area. The general trip distribution for the commercial and residential components for the Project are graphically depicted on Figures 10 and 11, respectively. Traffic volumes expected to be generated by the Project were assigned onto the study area roadway network as shown on Figures 12, 13 and 14 for the respective peak hours.

FUTURE TRAFFIC VOLUMES - BUILD CONDITION

The 2026 Build condition traffic volumes consist of the 2026 No-Build traffic volumes with: i) the removal of the traffic associated with the existing uses that occupy the Project site; and ii) the addition of the traffic expected to be generated by the Project. The resulting 2026 Build weekday morning, weekday evening and Saturday midday peak-hour traffic-volumes are graphically depicted on Figures 15, 16 and 17, respectively.

A summary of peak-hour projected traffic-volume changes outside of the study area that is the subject of this assessment is shown in Table 7. These changes are expected as a result of the construction of the Project.

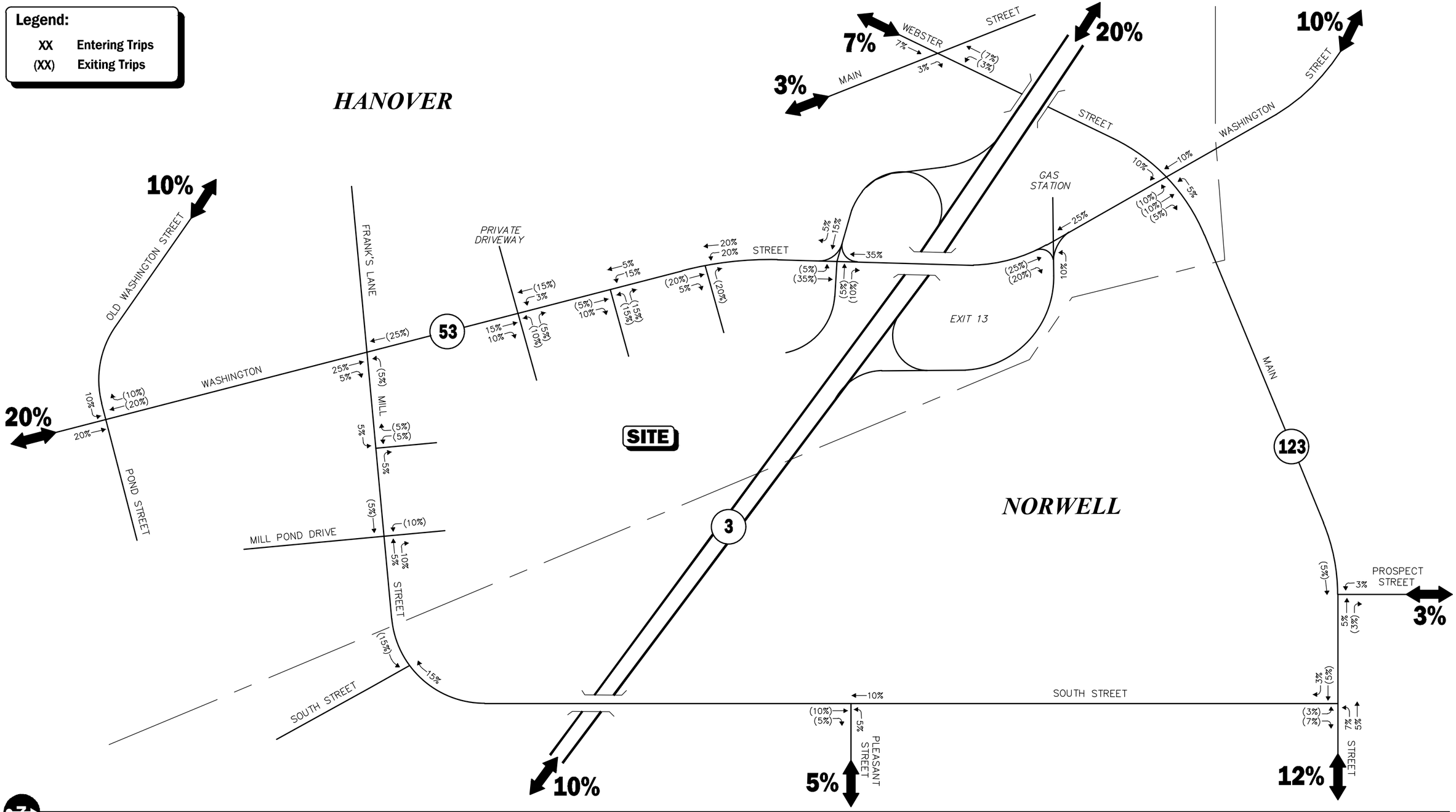


Figure 10

Trip Distribution Map
Commercial Component

Vanasse & Associates, Inc.
Transportation Engineers & Planners

Legend:

XX	Entering Trips
(XX)	Exiting Trips

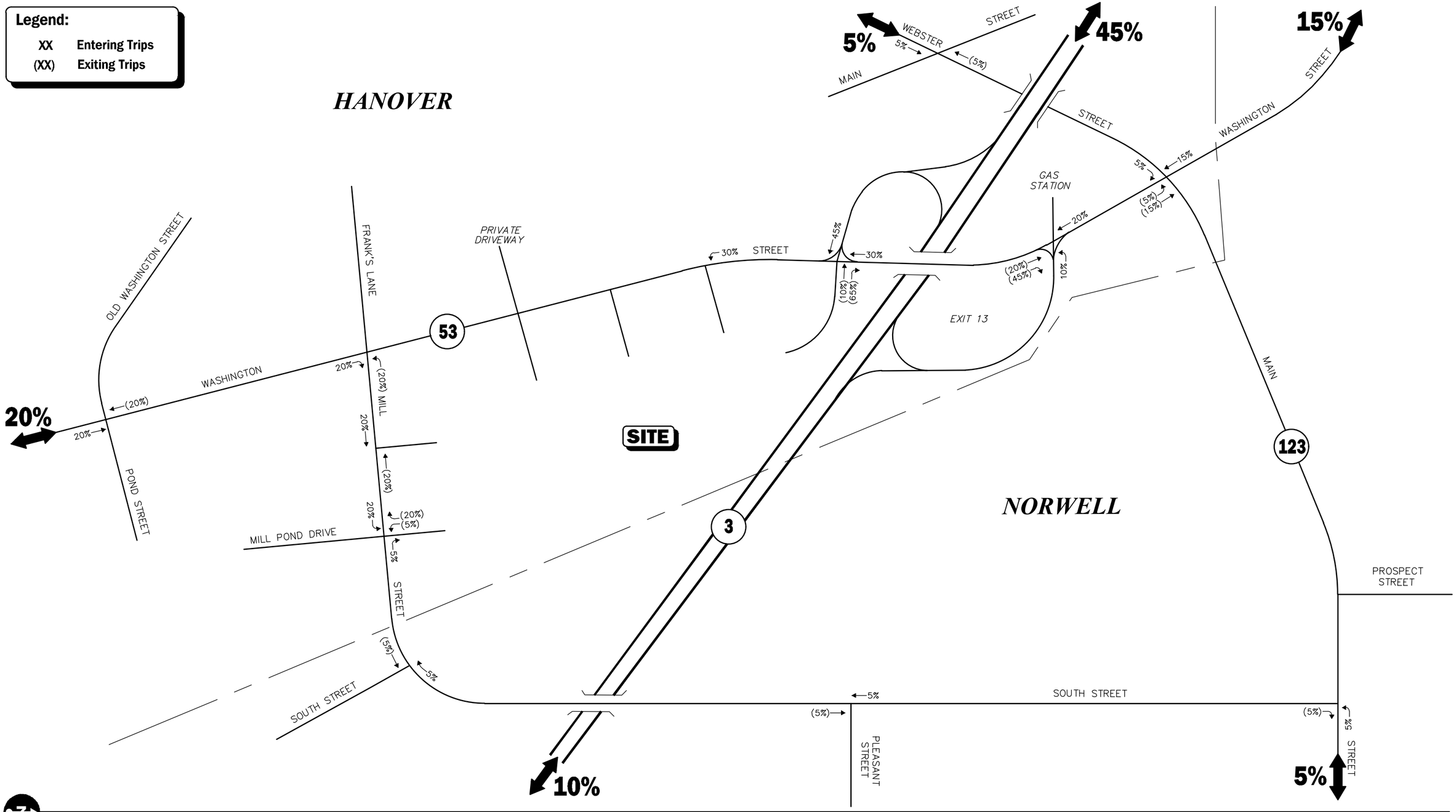


Figure 11

Trip Distribution Map
Residential Component

Vanasse & Associates, Inc.
Transportation Engineers & Planners

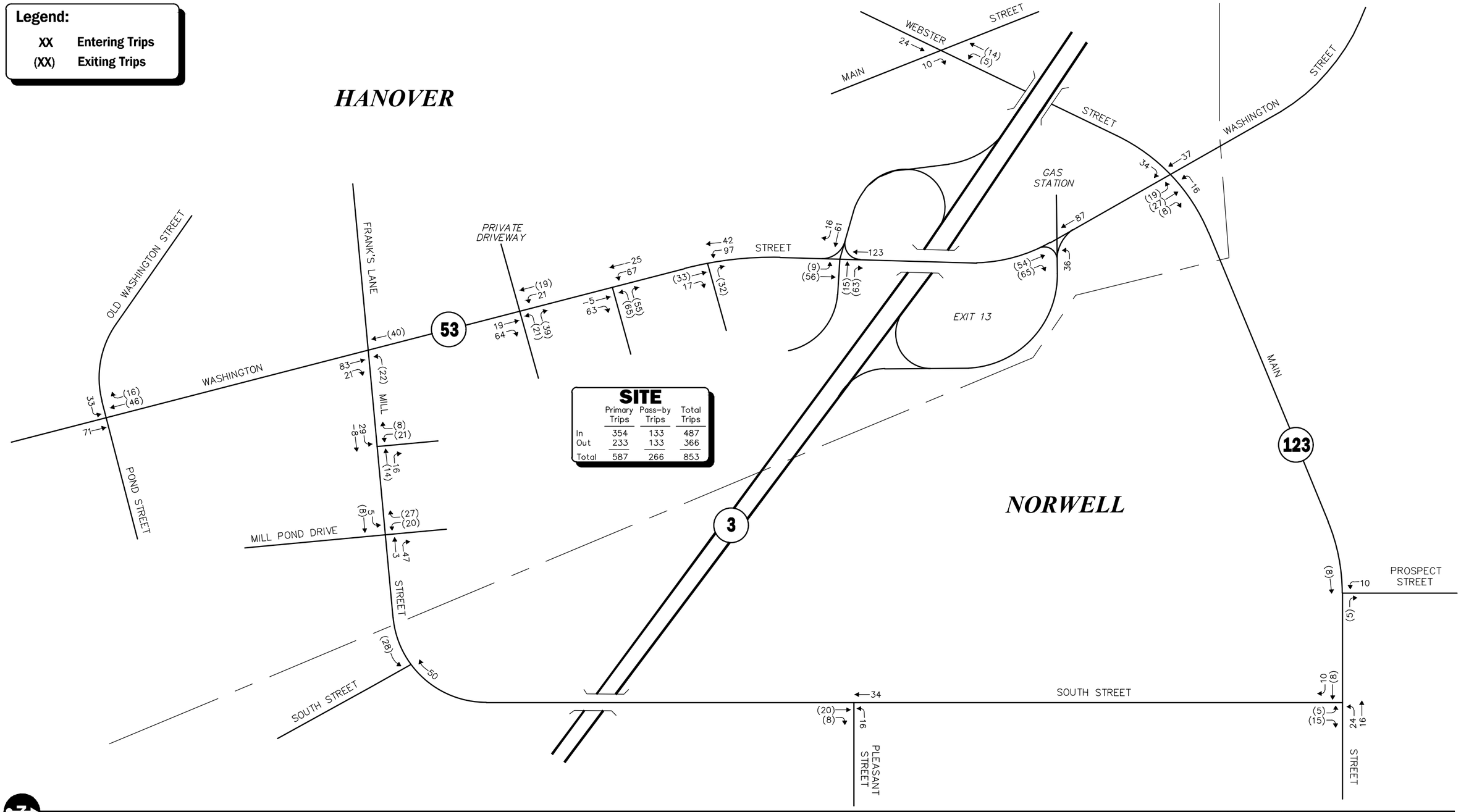


Figure 12

Project-Generated
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners

Legend:

XX	Entering Trips
(XX)	Exiting Trips

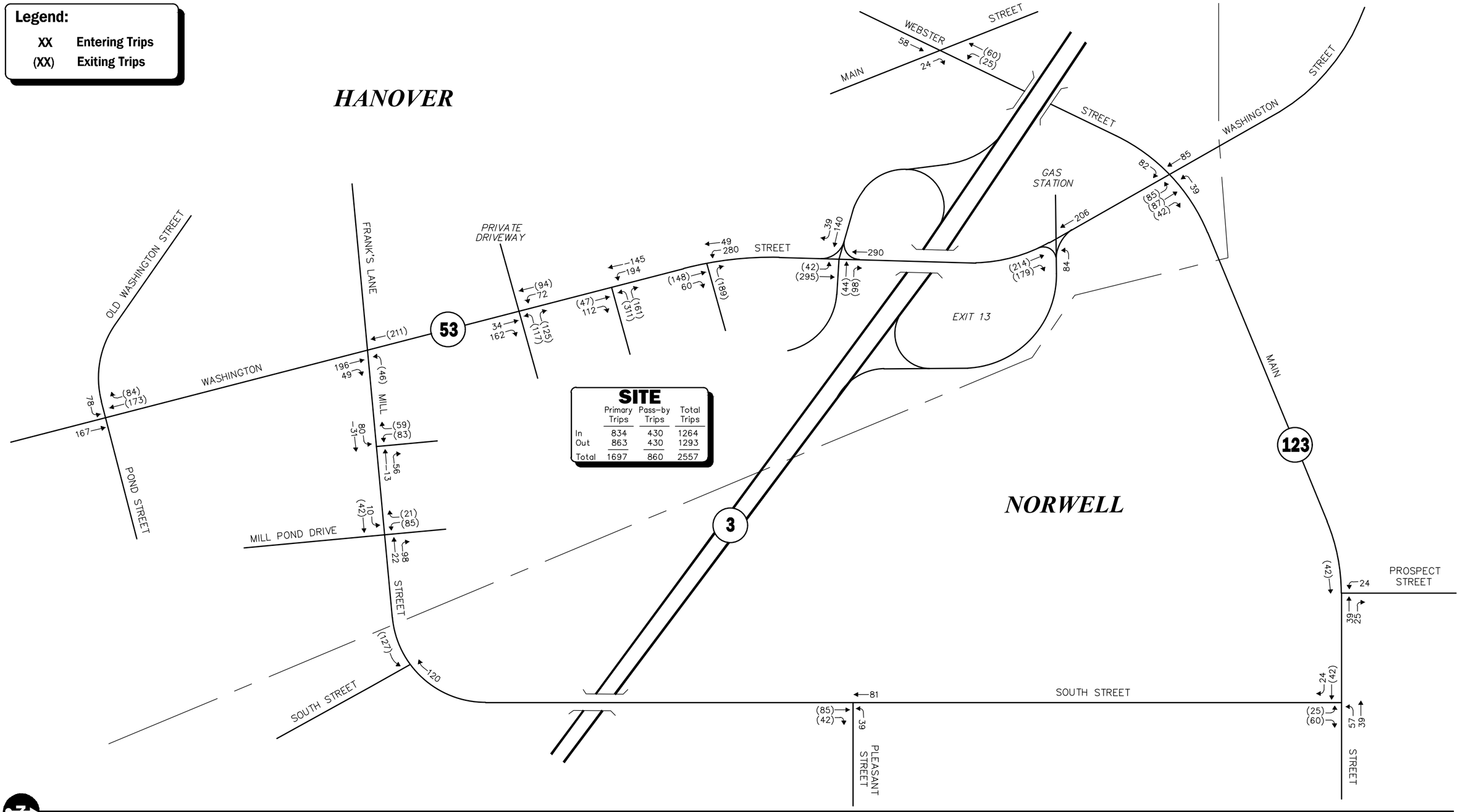


Figure 13

Project-Generated
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners

Legend:

XX	Entering Trips
(XX)	Exiting Trips

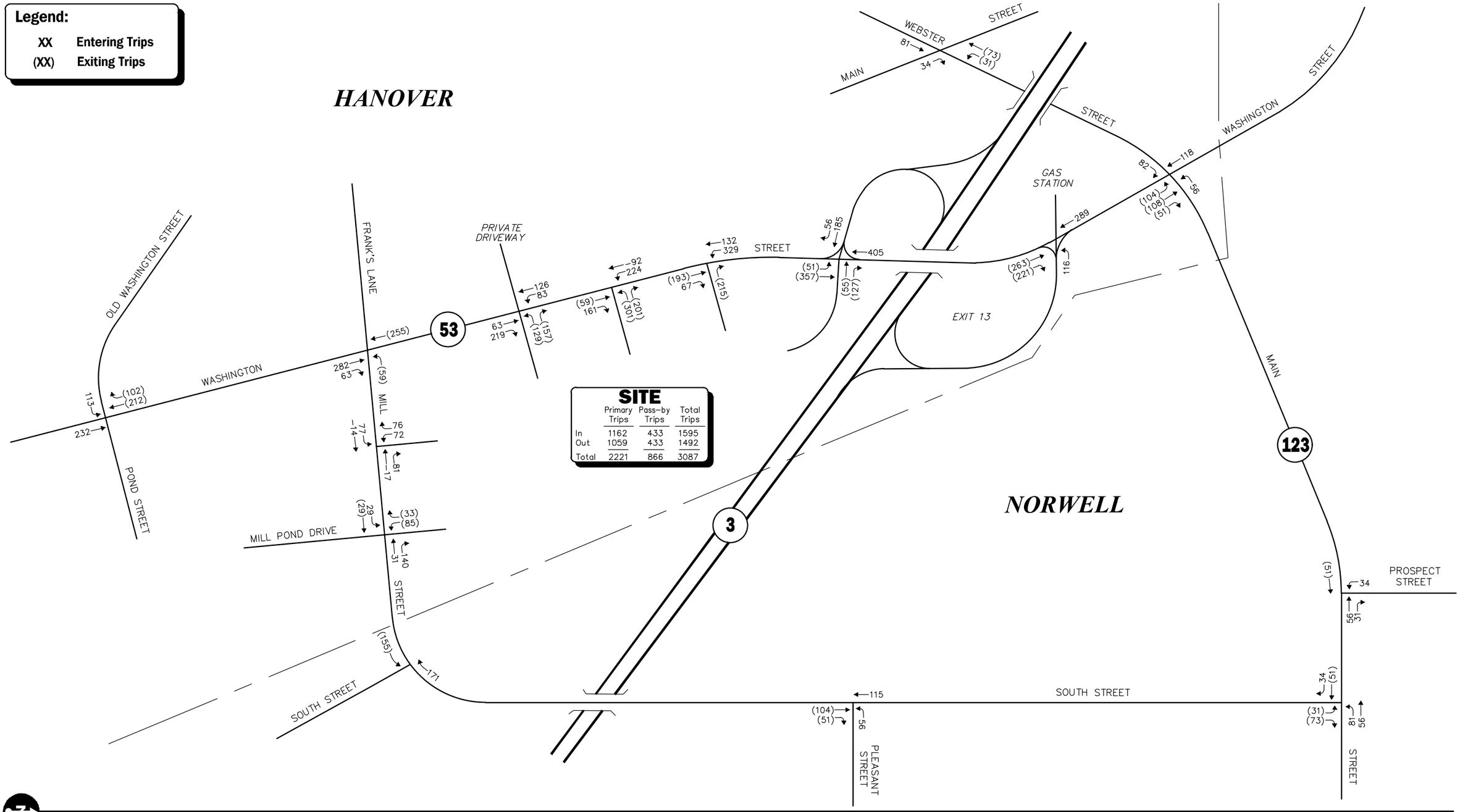
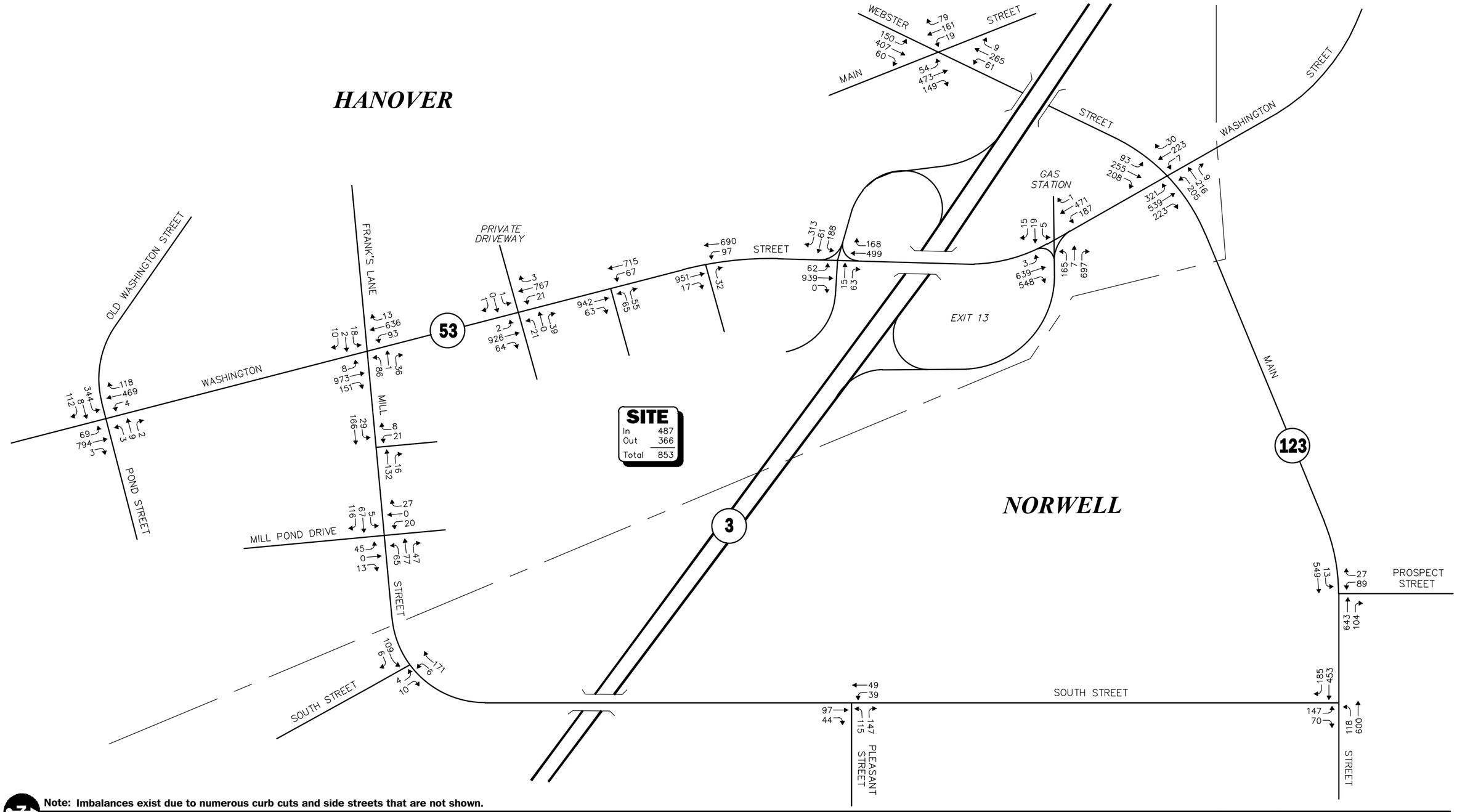


Figure 14

Project-Generated
Saturday Midday
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners

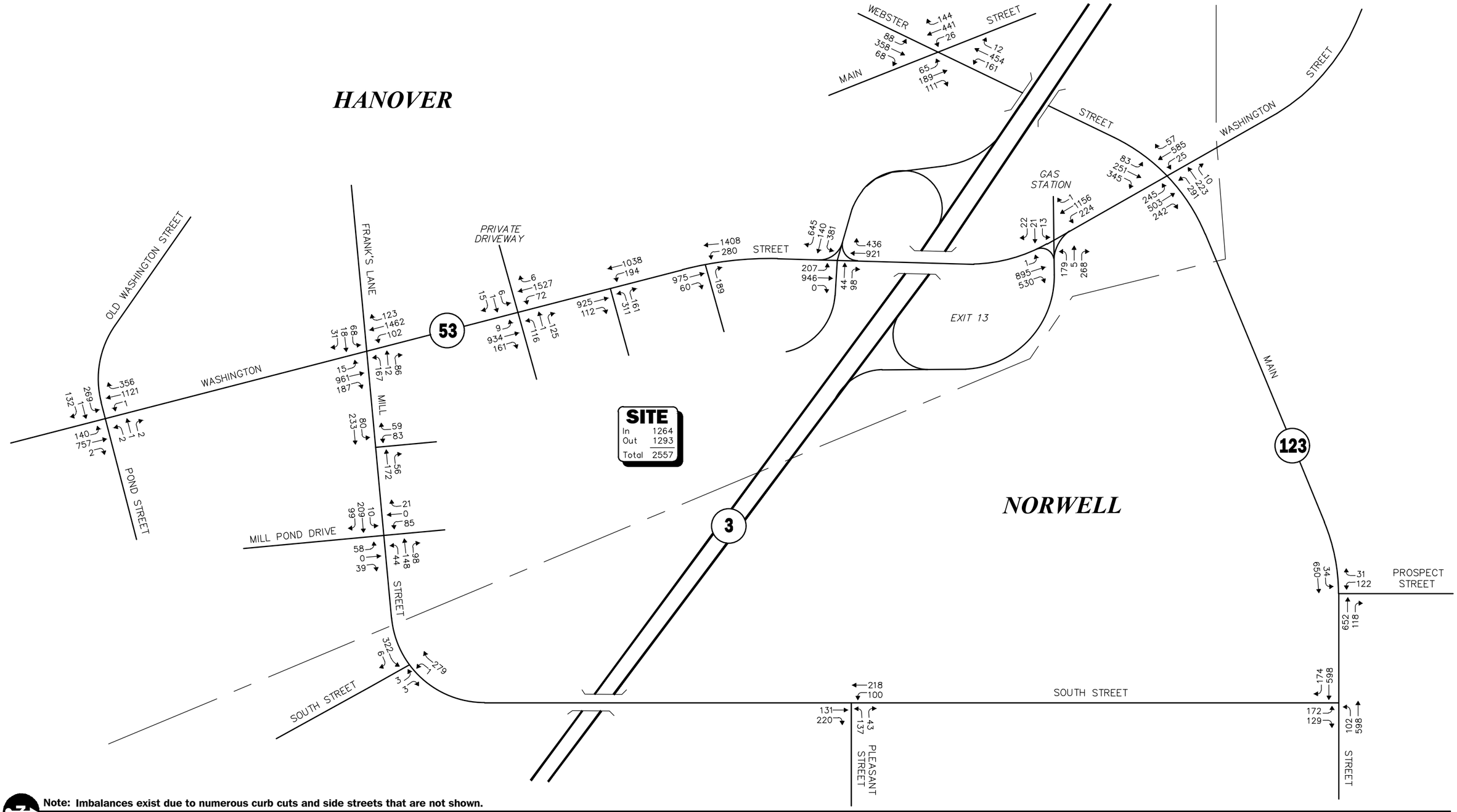


Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 15

2026 Build
Weekday Morning
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners

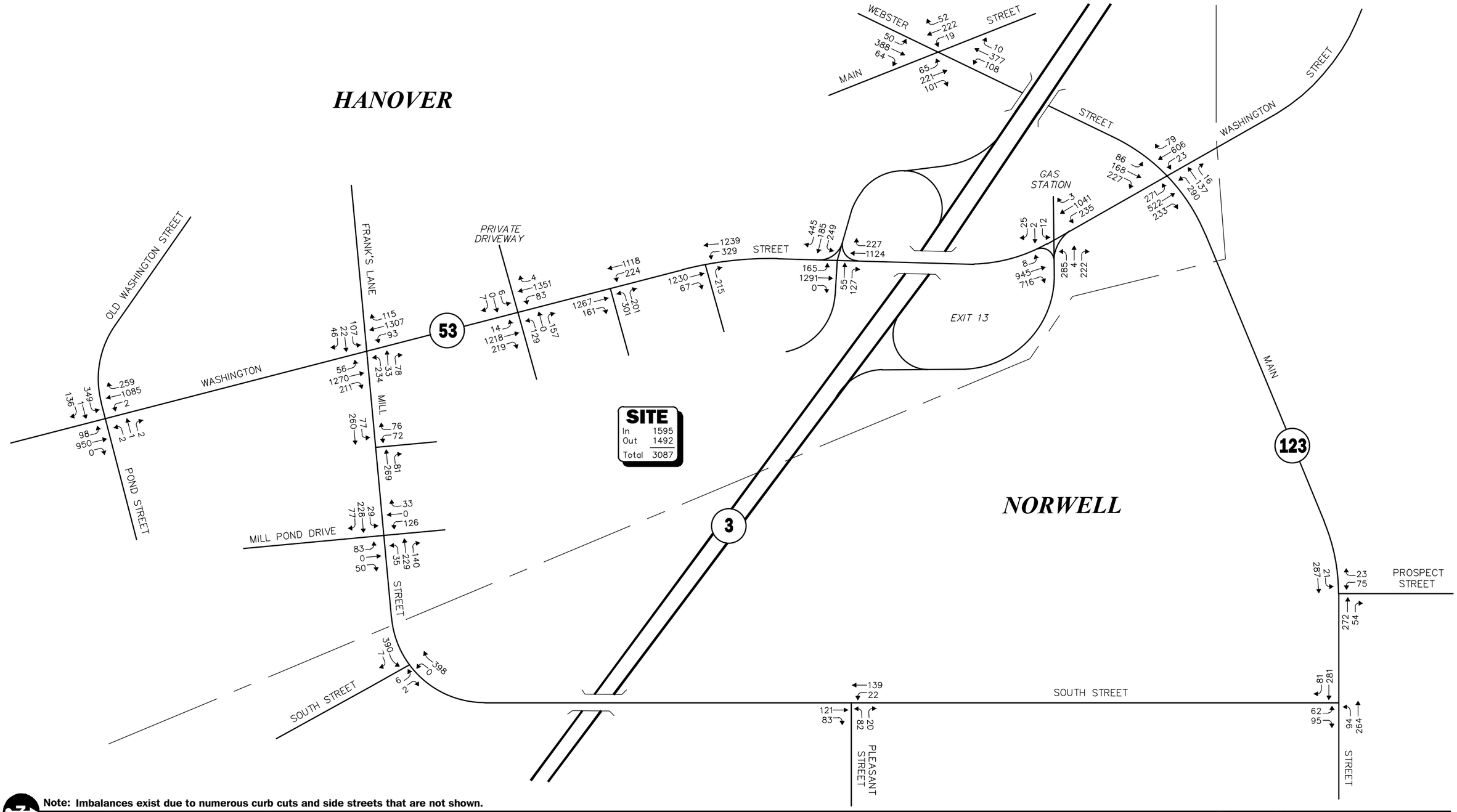


Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 16

2026 Build
Weekday Evening
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Figure 17

2026 Build
Saturday Midday
Peak Hour Traffic Volumes

Vanasse & Associates, Inc.
Transportation Engineers & Planners

Table 7
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2019 Existing	2026 No-Build	2026 Build	Traffic Volume Increase Over No-Build	Percent Increase Over No-Build
Route 53, north of Route 123:					
Weekday Morning	820	887	901	14	1.6
Weekday Evening	1,134	1,233	1,263	30	2.4
Saturday Midday	1,192	1,313	1,332	19	1.4
Route 53, south of Old Washington Street:					
Weekday Morning	1,271	1,380	1,450	70	5.1
Weekday Evening	1,840	2,031	2,154	123	6.1
Saturday Midday	1,923	2,232	2,271	39	1.7
Route 3 Northbound Ramps, east of Route 53:					
Weekday Morning	1,506	1,588	1,623	35	2.2
Weekday Evening	1,071	1,182	1,227	45	3.8
Saturday Midday	1,298	1,429	1,464	35	2.4
Route 3 Southbound Ramps, west of Route 53:					
Weekday Morning	715	820	807	-13	-1.6
Weekday Evening	1,751	1,898	1,853	-45	-2.4
Saturday Midday	1,206	1,357	1,326	-31	-2.3
Route 123, east of South Street:					
Weekday Morning	1,196	1,247	1,241	-6	-0.5
Weekday Evening	1,302	1,390	1,427	37	2.7
Saturday Midday	598	672	734	62	9.2
Route 123, west of Main Street:					
Weekday Morning	958	1,010	1,015	5	0.5
Weekday Evening	1,037	1,108	1,177	69	6.2
Saturday Midday	828	907	996	89	9.8
Old Washington Street, west of Route 53:					
Weekday Morning	608	638	660	22	3.4
Weekday Evening	776	842	899	57	6.8
Saturday Midday	598	758	844	86	11.3
Prospect Street, north of Route 123:					
Weekday Morning	224	274	233	-41	-15.0
Weekday Evening	251	316	305	-11	-3.5
Saturday Midday	85	154	173	19	12.3
Main Street, south of Route 123:					
Weekday Morning	915	954	958	4	3.2
Weekday Evening	966	1,011	1,035	24	2.4
Saturday Midday	710	753	781	28	3.7
Pleasant Street, east of South Street:					
Weekday Morning	299	341	345	4	1.2
Weekday Evening	415	439	500	61	13.9
Saturday Midday	176	196	207	11	5.6

As shown in Table 7, Project-related traffic-volume changes outside of the study area relative to 2026 No-Build conditions are anticipated to range from a reduction of 15 percent during the peak periods due to adjustment of the location of uses within the Project site[13] to an increase of 13.9 percent, with corresponding traffic volume decreases of up to 45 vehicles and increases of up to 123 vehicles. The largest traffic volume increase is expected to occur along the Route 53 corridor which has sufficient capacity to accommodate the predicted traffic volumes (discussion follows).

[13]The location of uses within the Project site and the origin/destination of trips define which access point will be used by traffic arriving to and departing from the Project site.

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build and Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.[14] The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

[14]The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2010.

Signalized Intersections

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than LOS A.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures are frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 2000 Highway Capacity Manual and implemented as a part of the Synchro® 10 software. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level-of-service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 8 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 8
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS[a]

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

[a]Source: *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2000; page 16-2.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2010 *Highway Capacity Manual.*[15] Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2010 *Highway Capacity Manual*. Table 9 summarizes the relationship between level of service and average control delay for two way stop controlled and all-way stop controlled intersections.

[15]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Table 9
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Level-Of-Service by Volume-to-Capacity Ratio		Average Control Delay (Seconds Per Vehicle)
v/c ≤ 1.0	v/c > 1.0	
A	F	≤10.0
B	F	10.1 to 15.0
C	F	15.1 to 25.0
D	F	25.1 to 35.0
E	F	35.1 to 50.0
F	F	>50.0

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 19-2.

Vehicle Queue Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro® intersection capacity analysis software which is based upon the methodology and procedures presented in the 2010 *Highway Capacity Manual*. The Synchro® vehicle queue analysis methodology is a simulation based model which reports the number of vehicles that experience a delay of six seconds or more at an intersection. For signalized intersections, Synchro® reports both the average (50th percentile) the 95th percentile vehicle queue. For unsignalized intersections, Synchro® reports the 95th percentile vehicle queue. Vehicle queue lengths are a function of the capacity of the movement under study and the volume of traffic being processed by the intersection during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only 5 percent of the time, or approximately three minutes out of sixty minutes during the peak one hour of the day (during the remaining fifty-seven minutes, the vehicle queue length will be less than the 95th percentile queue length).

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for 2019 Existing, 2026 No-Build and 2026 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Tables 10 and 11. The detailed analysis results are presented in the Appendix.

As can be seen in Tables 10 and 11, ***the addition of Project-related traffic to the study area intersections is not predicted to result in a significant increase in motorist delays or vehicle queuing over No-Build conditions, with operating conditions for the majority of the movements at the study area intersections maintained at LOS D or better, where an LOS of "D" or better is considered representative of "acceptable" traffic operations.*** Project-related impacts at the study area intersections were identified as follows:

Signalized Intersections

Route 123/Main Street – No change (degradation) in overall LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of up to 1.6 seconds and in vehicle queuing of up to two (2) vehicles.

Route 53/Route 123 – No change (degradation) in overall LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of up to 11.8 seconds and in vehicle queuing of up to three (3) vehicles. It was noted that one or more movements at the intersection were identified as operating at its design capacity during the Saturday midday peak-hour (defined as LOS "E") and can be improved with the implementation of an optimal traffic signal timing plan.

Route 53/Route 3 Northbound Ramps – Overall LOS was shown to degrade from LOS B to LOS C during the Saturday midday peak-hour as a result of a predicted increase in motorist delay of less than 5.0 seconds. Vehicle queuing at the intersection was shown to increase by up to four (4) vehicles with the addition of Project-related traffic. In addition, left-turn and through movements from the Route 3 northbound off-ramp were identified to degrade from LOS D to LOS F during the Saturday midday peak-hour with the addition of Project-related traffic. Operating conditions for this movement can be improved with the implementation of an optimal traffic signal timing plan.

Route 53/Route 3 Southbound Ramps/Hanover Mall Drive – No change (degradation) in overall LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of less than 1.0 seconds and in vehicle queuing of up to three (3) vehicles. One or more movements at the intersection were identified as operating at their design capacity during the weekday evening peak-hour (defined as LOS "E") independent of the Project and can be improved with the implementation of an optimal traffic signal timing plan.

Route 53/Hanover Mall Center Driveway – No change (degradation) in overall LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of up to 10.9 seconds and in vehicle queuing of up to seven (7) vehicles. Left-turn movements from the Hanover Mall driveway were shown to degrade from LOS D to LOS E during the weekday evening peak-hour with the addition of Project-related traffic. Operating conditions for this movement can be improved with the implementation of an optimal traffic signal timing plan.

Route 53/Mill Street/Frank's Lane – No change (degradation) in overall LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of less than 1.0 seconds and in vehicle queuing of up to three (3) vehicles. It was noted that the left-turn movement from Mill Street were operating at or over capacity during the Saturday midday peak-hour (defined as LOS "F") and can be improved with the implementation of an optimal traffic signal timing plan.

Route 53/Old Washington Street/Pond Street – Overall LOS was shown to degrade from LOS D to LOS E during the weekday evening and Saturday midday peak hours as a result of a predicted increase in overall motorist delay of 24.8 seconds during the weekday evening peak-hour and 11.4 seconds during the Saturday midday peak-hour. In addition, through/right-turn movements from the Route 53 soutbound approach were identified to degrade from LOS E to LOS F during the weekday evening and Saturday midday peak hours with the addition of Project-related traffic. These operating conditions can be improved with the implementation of an optimal traffic signal

timing plan. Vehicle queues at the intersection were predicted to increase by up to five (5) vehicles with the addition of Project-related traffic.

Unsignalized Intersections

Route 53/Hanover Mall North Driveway – No change (degradation) in LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of approximately 2.0 seconds and in vehicle queuing of up to one (1) vehicle.

Route 53/Hanover Mall South Driveway – Operating conditions for left-turn/through movements from the Hanover Mall south driveway were shown to degrade from LOS C to LOS D during the weekday evening peak-hour and LOS D to E during the Saturday midday peak-hour as a result of a predicted increase in average motorist delay of between 10.0 and 17.0 seconds with the addition of Project-related traffic. Vehicle queues at the intersection are predicted to increase by up to two (2) vehicles along the driveway (no material increases in vehicle queuing are predicted along Route 53).

Mill Street/Hanover Mall West Driveway – Operating conditions for all movements from the Hanover Mall west driveway were shown to degrade from LOS B to LOS C during the weekday evening peak-hour as a result of a predicted increase in average motorist delay of approximately 3.0 seconds with the addition of Project-related traffic. Vehicle queues at the intersection are predicted to increase by up to one (1) vehicle along the driveway (no material increases in vehicle queuing are predicted along Mill Street).

Mill Street/Mill Pond Drive/Hanover Mall Drive – No change (degradation) in LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of less than 1.0 seconds and in vehicle queuing of up to one (1) vehicle.

Main Street/Prospect Street – No change (degradation) in LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of approximately 2.0 seconds and in vehicle queuing of up to one (1) vehicle. Independent of the Project, it was noted that the all movements from Prospect Street are operating over capacity during the weekday morning and evening peak hours (defined as LOS "F") with vehicle queuing of up to 18 vehicles.

Main Street/South Street – No change (degradation) in LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of approximately 3.0 seconds and in vehicle queuing of up to one (1) vehicle. Independent of the Project, it was noted that the all movements from South Street are operating over capacity during the weekday morning and evening peak hours (defined as LOS "F") with vehicle queuing of up to 36 vehicles.

South Street/Pleasant Street – No change (degradation) in LOS over No-Build conditions, with Project-related impacts defined as a predicted increase in overall average motorist delay of approximately 8.0 seconds and in vehicle queuing of up to two (2) vehicles.

Mill Street/South Street – With the addition of Project-related traffic, operating conditions for left-turn movements from the South Street northbound approach were shown to degrade from LOS B to LOS C during the Saturday midday peak-hour as a result of a predicted increase in average motorist delay of 1.2 seconds with negligible increases in vehicle queuing expected.

Table 10
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2019 Existing				2026 No-Build				2026 Build			
Signalized Intersection/Peak-hour/Movement	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 123 at Main Street												
Weekday Morning:												
Route 123 EB LT	0.34	20.5	C	51/80	0.37	22.2	C	53/82	0.37	22.2	C	53/82
Route 123 EB TH	0.71	27.2	C	205/281	0.74	28.4	C	222/301	0.74	28.6	C	226/305
Route 123 EB RT	0.04	18.0	B	0/11	0.04	18.1	B	0/12	0.04	18.0	B	0/12
Route 123 WB LT	0.32	32.3	C	20/36	0.35	33.6	C	21/38	0.35	33.7	C	21/38
Route 123 WB TH/RT	0.67	31.7	C	144/199	0.70	32.3	C	161/210	0.70	32.2	C	182/210
Main Street NB LT/TH/RT	0.86	30.7	C	299/614	0.90	36.1	D	533/651	0.91	37.3	D	338/655
Main Street SB LT/TH/ RT	0.44	16.5	B	104/107	0.45	17.2	B	114/173	0.46	17.3	B	115/173
Overall	--	**26.6**	**C**	--	--	**29.1**	**C**	--	--	**29.5**	**C**	--
Weekday Evening:												
Route 123 EB LT	0.44	32.8	C	30/56	0.47	35.1	D	33/58	0.47	35.7	D	33/58
Route 123 EB TH	0.66	29.5	C	168/240	0.69	31.1	C	198/257	0.73	31.8	C	226/290
Route 123 EB RT	0.04	21.9	C	0/20	0.04	22.1	C	0/21	0.04	21.3	C	0/20
Route 123 WB LT	0.32	19.9	B	51/87	0.37	22.4	C	58/94	0.42	24.9	C	61/98
Route 123 WB TH/RT	0.70	25.4	C	228/333	0.74	27.6	C	262/373	0.77	28.9	C	284/406
Main Street NB LT/TH/RT	0.58	19.7	B	128/249	0.62	21.6	C	149/272	0.66	23.5	C	166/290
Main Street SB LT/TH/ RT	0.83	29.0	C	2756/531	0.86	32.7	C	317/574	0.87	34.7	C	334/580
Overall	--	**26.0**	**C**	--	--	**28.4**	**C**	--	--	**29.9**	**C**	--
Saturday Midday:												
Route 123 EB LT	0.14	14.0	B	10/30	0.16	15.5	B	11/32	0.17	17.1	B	12/32
Route 123 EB TH	0.61	18.2	B	111/206	0.65	19.6	B	135/239	0.69	21.2	C	169/281
Route 123 EB RT	0.04	13.4	B	0/12	0.05	13.8	B	0/13	0.05	13.8	B	0/13
Route 123 WB LT	0.20	13.6	B	14/46	0.25	15.9	B	18/55	0.32	19.0	B	23/63
Route 123 WB TH/RT	0.50	15.5	B	100/227	0.55	16.7	B	124/266	0.58	17.5	B	151/295
Main Street NB LT/TH/RT	0.61	18.0	B	100/230	0.65	19.8	B	118/262	0.67	22.0	C	132/275
Main Street SB LT/TH/ RT	0.53	16.3	B	27/185	0.54	17.4	B	100/205	0.54	18.9	B	109/208
Overall	--	**16.6**	**B**	--	--	**18.0**	**B**	--	--	**19.6**	**B**	--

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at Route 123												
Weekday Morning:												
Route 123 EB LT/TH/RT	0.81	44.8	D	155/298	0.85	49.3	D	168/330	0.85	49.3	D	170/333
Route 123 WB LT	0.75	35.1	D	87/224	0.87	50.2	D	98/282	0.83	45.2	D	92/265
Route 123 WB TH/RT	0.33	23.1	C	94/200	0.36	24.0	C	102/216	0.36	24.0	C	102/216
Route 53 NB LT/TH/RT	0.85	29.7	C	285/574	0.91	35.6	D	321/642	0.92	37.1	D	324/647
Route 53 SB LT/TH	0.14	15.3	B	35/77	0.16	15.6	B	40/86	0.16	15.8	B	41/90
Route 53 SB RT	0.02	14.4	B	0/0	0.02	14.6	B	0/0	0.02	14.7	B	0/0
Overall	--	**31.8**	**C**	--	--	**37.1**	**D**	--	--	**37.2**	**D**	--
Weekday Evening:												
Route 123 EB LT/TH/RT	0.82	48.5	D	160/312	0.86	52.8	D	179/356	0.92	61.1	E	195/394
Route 123 WB LT	0.82	41.3	D	119/332	0.90	56.0	E	137/373	0.95	66.9	E	149/402
Route 123 WB TH/RT	0.29	22.1	C	91/191	0.32	22.7	C	102/212	0.32	22.7	C	102/212
Route 53 NB LT/TH/RT	0.85	32.9	C	256/512	0.97	50.1	D	308/605	1.03	67.8	E	333/642
Route 53 SB LT/TH	0.37	19.8	B	112/208	0.43	20.8	C	127/233	0.46	21.2	C	137/253
Route 53 SB RT	0.04	16.4	B	0/0	0.04	16.9	B	0/0	0.04	16.9	B	0/0
Overall	--	**33.5**	**C**	--	--	**42.4**	**D**	--	--	**51.7**	**D**	--
Saturday Midday:												
Route 123 EB LT/TH/RT	0.68	41.9	D	87/174	0.73	43.2	D	104/201	0.75	43.8	D	113/218
Route 123 WB LT	0.82	37.7	D	125/275	0.91	50.7	D	137/337	0.96	64.3	E	139/381
Route 123 WB TH/RT	0.24	24.3	C	57/128	0.28	24.3	C	69/149	0.27	24.0	C	69/149
Route 53 NB LT/TH/RT	0.80	23.4	C	171/446	0.95	38.2	D	214/623	1.04	63.6	E	237/696
Route 53 SB LT/TH	0.43	20.7	C	113/241	0.49	22.1	C	133/270	0.53	23.3	C	148/291
Route 53 SB RT	0.05	17.2	B	0/6	0.05	17.8	B	0/8	0.05	18.4	B	0/8
Overall	--	**27.8**	**C**	--	--	**35.6**	**D**	--	--	**47.4**	**D**	--

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Route 3 Northbound Ramps												
Weekday Morning:												
Driveway EB LT/TH	0.09	19.9	B	8/34	0.09	20.5	C	8/34	0.08	20.4	C	8/34
Driveway EB RT	0.01	19.5	B	0/0	0.01	20.1	C	0/0	0.01	20.0	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.51	23.1	C	42/151	0.54	24.5	C	48/174	0.58	25.3	C	55/201
Route 3 Northbound Off-Ramp WB RT	0.64	19.8	B	40/257	0.72	23.2	C	55/316	0.71	22.8	C	56/317
Route 53 NB LT/TH	0.47	14.7	B	68/180	0.50	15.0	B	80/198	0.50	15.4	B	85/200
Route 53 NB RT	0.45	14.8	B	27/144	0.50	15.3	B	37/177	0.52	16.0	B	41/183
Route 53 SB LT	0.46	8.6	A	22/57	0.52	9.5	A	26/105	0.53	10.0	A	28/105
Route 53 SB TH/RT	0.24	6.7	A	28/105	0.26	7.0	A	35/116	0.27	7.4	A	38/118
Overall	--	**14.8**	**B**	--	--	**16.0**	**B**	--	--	**16.3**	**B**	--
Weekday Evening:												
Driveway EB LT/TH	0.16	26.3	C	18/48	0.16	28.0	C	20/48	0.16	28.4	C	20/48
Driveway EB RT	0.12	25.4	C	0/0	0.02	27.1	C	0/0	0.02	27.4	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.58	31.5	C	63/189	0.67	36.6	D	84/229	0.72	39.9	D	95/259
Route 3 Northbound Off-Ramp WB RT	0.15	18.4	B	0/38	0.16	19.3	B	0/39	0.16	19.6	B	0/39
Route 53 NB LT/TH	0.60	17.2	B	144/305	0.65	18.9	B	171/341	0.66	19.4	B	176/351
Route 53 NB RT	0.52	16.4	B	75/241	0.59	18.4	B	101/290	0.62	19.5	B	113/319
Route 53 SB LT	0.57	11.0	B	30/110	0.64	14.5	B	35/178	0.66	15.4	B	35/185
Route 53 SB TH/RT	0.48	7.7	A	94/261	0.51	8.2	A	109/291	0.56	9.0	A	127/336
Overall	--	**14.6**	**B**	--	--	**16.3**	**B**	--	--	**16.9**	**B**	--
Saturday Midday:												
Driveway EB LT/TH	0.08	23.5	C	10/37	0.09	24.8	C	10/37	0.11	25.0	C	10/37
Driveway EB RT	0.02	23.1	C	0/0	0.02	24.3	C	0/0	0.02	24.4	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.68	32.9	C	88/242	0.81	44.1	D	107/297	1.04	>80.0	F	144/395
Route 3 Northbound Off-Ramp WB RT	0.12	18.4	B	0/32	0.14	19.8	B	0/34	0.14	19.9	B	0/34
Route 53 NB LT/TH	0.58	16.1	B	123/272	0.62	16.6	B	144/316	0.65	17.1	B	153/335
Route 53 NB RT	0.70	19.8	B	96/366	0.77	22.5	C	132/501	0.77	22.1	C	133/501
Route 53 SB LT	0.70	16.6	B	33/163	0.83	29.1	C	36/205	0.87	35.2	D	36/213
Route 53 SB TH/RT	0.44	8.5	A	80/221	0.47	8.7	A	91/248	0.52	9.2	A	105/286
Overall	--	**16.2**	**B**	--	--	**18.9**	**B**	--	--	**23.7**	**C**	--

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Route 3 Southbound Ramps and Hanover Mall Drive												
Weekday Morning:												
Route 3 Southbound Off-Ramp EB LT	0.66	36.5	D	94/154	0.70	38.6	D	103/166	0.70	33.6	D	103/166
Route 3 Southbound Off-Ramp EB TH	0.11	27.9	C	21/49	0.12	27.9	C	24/53	0.15	28.1	C	31/64
Route 3 Southbound Off-Ramp EB RT	0.11	21.5	C	0/27	0.12	21.3	C	1/28	0.11	20.9	C	2/27
Hanover Mall Drive WB TH	0.12	39.7	D	9/28	0.13	39.7	D	9/29	0.13	39.7	D	9/29
Hanover Mall Drive WB RT	0.05	39.3	D	0/11	0.06	39.3	D	0/19	0.04	39.2	D	0/5
Route 53 NB LT	0.26	20.6	C	27/45	0.29	19.6	B	32/46	0.33	19.0	B	37/49
Route 53 NB TH/RT	0.36	15.5	B	248/321	0.38	17.7	B	275/337	0.40	16.9	B	283/346
Route 53 SB TH	0.23	10.9	B	66/105	0.26	11.4	B	76/118	0.28	11.8	B	83/130
Route 53 SB RT	0.10	10.1	A	0/31	0.11	10.4	B	0/32	0.12	10.6	B	2/36
Overall	--	**18.4**	**B**	--	--	**19.5**	**B**	--	--	**18.9**	**B**	--
Weekday Evening:												
Route 3 Southbound Off-Ramp EB LT	0.85	49.8	D	232/347	0.91	58.2	E	254/398	0.92	61.5	E	256/416
Route 3 Southbound Off-Ramp EB TH	0.19	29.1	C	58/99	0.20	29.2	C	65/108	0.25	29.8	C	80/129
Route 3 Southbound Off-Ramp EB RT	0.42	20.5	C	139/175	0.46	20.3	C	156/201	0.43	19.9	B	148/188
Hanover Mall Drive WB TH	0.33	48.5	D	36/72	0.36	48.3	D	41/79	0.31	48.5	D	34/70
Hanover Mall Drive WB RT	0.08	46.5	D	0/51	0.16	46.7	D	8/62	0.07	46.6	D	0/50
Route 53 NB LT	0.64	55.2	E	117/186	0.69	59.1	E	132/230	0.68	64.5	E	151/235
Route 53 NB TH/RT	0.39	5.0	A	60/78	0.43	5.8	A	75/92	0.45	5.3	A	73/98
Route 53 SB TH	0.49	23.3	C	205/281	0.55	25.1	C	241/315	0.64	27.0	C	294/380
Route 53 SB RT	0.44	23.5	C	93/209	0.49	25.5	C	129/344	0.52	26.1	C	142/267
Overall	--	**24.1**	**C**	--	--	**26.1**	**C**	--	--	**26.6**	**C**	--
Saturday Midday:												
Route 3 Southbound Off-Ramp EB LT	0.64	31.3	C	112/161	0.69	33.0	C	125/181	0.75	37.8	D	128/190
Route 3 Southbound Off-Ramp EB TH	0.10	24.3	C	24/48	0.11	23.8	C	28/54	0.36	27.2	C	91/141
Route 3 Southbound Off-Ramp EB RT	0.38	18.7	B	98/128	0.432	18.3	B	109/152	0.32	17.6	B	82/111
Hanover Mall Drive WB TH	0.27	36.5	D	32/56	0.27	35.8	D	35/61	0.33	37.8	D	38/64
Hanover Mall Drive WB RT	0.40	37.9	D	33/69	0.51	38.6	D	48/88	0.24	37.2	D	15/51
Route 53 NB LT	0.57	27.1	C	63/110	0.65	31.1	C	71/115	0.61	31.6	C	78/92
Route 53 NB TH/RT	0.54	14.3	B	333/416	0.60	13.4	B	371/466	0.61	10.2	B	282/420
Route 53 SB TH	0.55	19.2	B	185/277	0.63	21.4	C	241/314	0.73	23.4	C	285/388
Route 53 SB RT	0.19	15.1	B	25/72	0.23	16.4	B	36/88	0.23	16.1	B	33/88
Overall	--	**19.7**	**B**	--	--	**20.4**	**C**	--	--	**20.1**	**C**	--

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Mall Center Drive												
Weekday Morning:												
Mall Center Drive WB LT	0.32	40.0	D	26/42	0.37	38.7	D	37/55	0.46	39.0	D	49/69
Mall Center Drive WB RT	0.09	31.3	C	11/24	0.13	29.6	C	19/32	0.14	28.9	C	22/34
Route 53 NB TH/RT	0.36	12.2	B	209/326	0.41	14.2	B	236/351	0.44	15.4	B	263/370
Route 53 SB LT	0.34	40.0	D	33/67	0.39	40.8	D	41/77	0.43	40.8	D	45/81
Route 53 SB TH	0.28	1.8	A	42/84	0.30	2.3	A	48/87	0.30	2.5	A	51/87
Overall	--	**9.8**	**A**	--	--	**11.5**	**B**	--	--	**12.7**	**B**	--
Weekday Evening:												
Mall Center Drive WB LT	0.61	4738	D	110/151	0.68	48.0	D	148/190	0.90	62.3	E	262/353
Mall Center Drive WB RT	0.27	31.8	C	58/86	0.33	28.9	C	83/105	0.23	22.9	C	54/83
Route 53 NB TH/RT	0.42	5.3	A	61/87	0.50	6.3	A	69/98	0.59	10.7	B	111/170
Route 53 SB LT	0.55	45.7	D	76/123	0.60	43.4	D	89/146	0.67	43.1	D	109/183
Route 53 SB TH	0.47	3.0	A	58/181	0.51	4.2	A	66/235	0.54	6.8	A	190/273
Overall	--	**10.5**	**B**	--	--	**12.2**	**B**	--	--	**18.0**	**B**	--
Saturday Midday:												
Mall Center Drive WB LT	0.60	37.9	D	102/160	0.66	37.4	D	131/193	0.74	38.2	D	170/246
Mall Center Drive WB RT	0.27	22.4	C	64/90	0.30	22.4	B	72/94	0.28	17.2	B	69/84
Route 53 NB TH/RT	0.71	26.9	C	418/524	0.84	33.9	C	468/673	0.99	54.2	D	516/758
Route 53 SB LT	0.55	35.5	D	89/157	0.60	36.8	D	114/182	0.66	41.3	D	140/201
Route 53 SB TH	0.44	4.4	A	96/189	0.48	6.0	A	134/231	0.48	8.2	A	124/236
Overall	--	**19.2**	**B**	--	--	**23.3**	**C**	--	--	**34.2**	**C**	--

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing V/C[a]	2019 Existing Delay[b]	2019 Existing LOS[c]	2019 Existing Queue[d] 50th/95th	2026 No-Build V/C	2026 No-Build Delay	2026 No-Build LOS	2026 No-Build Queue 50th/95th	2026 Build V/C	2026 Build Delay	2026 Build LOS	2026 Build Queue 50th/95th
Route 53 at Mill Street and Frank's Lane												
Weekday Morning:												
Frank's Lane EB LT/TH/RT	0.20	37.9	D	15/32	0.17	36.4	D	16/32	0.17	36.4	D	16/32
Mill Street WB LT	0.66	49.2	D	57/87	0.64	45.3	D	63/94	0.65	45.7	D	65/96
Mill Street WB TH/RT	0.03	368	D	1/21	0.03	35.4	D	1/22	0.03	35.4	D	1/22
Route 53 NB LT	0.16	44.3	D	4/18	0.16	44.3	D	4/18	0.16	44.3	D	4/18
Route 53 NB TH/RT	0.43	7.4	A	140/183	0.47	8.5	A	156/203	0.50	8.8	A	167/217
Route 53 SB LT	0.62	45.5	D	63/82	0.65	46.3	D	65/85	0.65	44.6	D	64/85
Route 53 SB TH	0.25	3.0	A	45/91	0.28	3.6	A	54/100	0.30	4.3	A	65/120
Route 53 SB RT	0.01	3.1	A	0/1	0.01	3.5	A	0/1	0.01	3.5	A	0/1
Overall	--	**11.7**	**B**	**--**	**--**	**12.1**	**B**	--	**--**	**12.2**	**B**	**--**
Weekday Evening:												
Frank's Lane EB LT/TH/RT	0.33	36.0	D	66/106	0.33	36.0	D	66/105	0.37	37.8	D	69/111
Mill Street WB LT	0.76	50.6	D	143/194	0.78	51.0	D	157/211	0.74	50.8	D	129/180
Mill Street WB TH/RT	0.10	37.7	C	8/43	0.10	33.7	C	8/42	0.11	35.0	C	8/44
Route 53 NB LT	0.22	53.2	D	11/33	0.23	53.2	D	11/33	0.23	53.2	D	11/33
Route 53 NB TH/RT	0.55	17.0	B	238/332	0.62	19.3	B	290/438	0.62	17.7	B	286/470
Route 53 SB LT	0.52	50.6	D	75/132	0.55	51.4	D	79/137	0.52	49.6	D	79/125
Route 53 SB TH	0.57	9.4	A	171/283	0.63	11.2	A	183/350	0.67	10.1	B	169/422
Route 53 SB RT	0.10	5.6	A	8/34	0.11	7.2	A	9/44	0.10	6.1	A	6/35
Overall	--	**18.4**	**B**	**--**	--	**20.0**	**B**	--	**--**	**18.2**	**B**	**--**
Saturday Midday:												
Frank's Lane EB LT/TH/RT	0.54	31.9	C	89/151	0.56	32.6	C	93/156	0.57	33.1	C	93/156
Mill Street WB LT	0.95	75.0	E	150/302	1.06	>80.0	F	187/345	0.92	68.4	E	140/282
Mill Street WB TH/RT	0.13	27.4	C	15/58	0.13	27.4	C	16/59	0.13	27.7	C	16/59
Route 53 NB LT	0.34	39.9	D	31/66	0.35	39.9	D	32/68	0.35	39.9	D	32/68
Route 53 NB TH/RT	0.74	18.7	B	318/408	0.82	21.5	C	385/493	0.81	20.8	C	378/484
Route 53 SB LT	0.55	38.3	D	41/90	0.57	42.1	D	45/101	0.57	44.5	D	50/104
Route 53 SB TH	0.59	13.6	B	204/291	0.64	14.5	B	245/338	0.69	15.4	B	269/381
Route 53 SB RT	0.08	8.4	A	7/20	0.09	8.8	A	8/20	0.09	7.0	A	5/13
Overall	--	**23.0**	**C**	**--**	**--**	**27.0**	**C**	--	**--**	**23.3**	**C**	**--**

See notes at end of table.

Table 10 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at Old Washington Street and Pond Street												
Weekday Morning:												
Old Washington Street EB LT/TH	0.66	22.1	C	108/411	0.70	24.4	C	125/450	0.74	26.5	C	136/469
Old Washington Street EB RT	0.04	14.6	B	8/60	0.11	15.3	B	10/65	0.12	15.8	B	10/65
Pond Street WB LT/TH/RT	0.02	14.2	B	5/18	0.05	14.8	B	6/17	0.05	15.4	B	6/17
Route 53 NB LT	0.43	35.9	D	27/85	0.45	37.2	D	29/90	0.45	37.6	D	30/90
Route 53 NB TH/RT	0.57	21.3	C	107/270	0.60	21.9	C	120/298	0.62	22.0	C	128/317
Route 53 SB LT	0.25	45.0	D	2/15	0.25	46.2	D	2/15	0.26	47.6	D	2/15
Route 53 SB TH/RT	0.61	25.9	C	113/214	0.64	26.6	C	126/235	0.67	27.2	C	138/255
Overall	--	**23.0**	**C**	--	--	**24.0**	**C**	--	--	**24.7**	**C**	--
Weekday Evening:												
Old Washington Street EB LT/TH	0.81	44.7	D	116/267	0.83	45.7	D	129/310	0.83	45.0	D	136/329
Old Washington Street EB RT	0.18	25.9	C	18/73	0.21	26.0	C	24/84	0.20	25.6	C	24/84
Pond Street WB LT/TH/RT	0.01	24.7	C	2/10	0.01	24.7	C	2/10	0.01	24.1	C	2/10
Route 53 NB LT	0.57	38.7	D	59/152	0.62	41.1	D	70/169	0.63	42.4	D	72/169
Route 53 NB TH/RT	0.35	11.9	B	71/247	0.41	13.2	B	92/287	0.44	14.1	B	107/307
Route 53 SB LT	0.06	44.0	D	0/6	0.06	45.2	D	1/6	0.06	46.0	D	1/6
Route 53 SB TH/RT	0.93	35.6	D	303/790	1.04	61.0	E	412/872	1.16	>80.0	F	512/981
Overall	--	**30.0**	**C**	--	--	**43.4**	**D**	--	--	**68.2**	**E**	--
Saturday Midday:												
Old Washington Street EB LT/TH	0.81	39.8	D	140/370	0.81	40.1	D	163/434	0.82	40.4	D	166/443
Old Washington Street EB RT	0.05	22.0	C	0/30	0.16	22.9	C	20/82	0.16	22.9	C	20/82
Pond Street WB LT/TH/RT	0.01	21.7	C	0/0	0.01	21.6	C	0/0	0.01	21.6	C	0/0
Route 53 NB LT	0.56	42.3	D	44/112	0.54	42.7	D	55/127	0.54	42.8	D	55/127
Route 53 NB TH/RT	0.54	16.1	B	136/368	0.64	20.0	C	185/440	0.63	20.0	C	180/428
Route 53 SB LT	0.11	45.5	D	1/10	0.11	49.4	D	1/10	0.11	49.5	D	1/10
Route 53 SB TH/RT	0.88	30.6	C	297/703	1.07	77.3	E	430/825	1.13	>80.0	F	473/883
Overall	--	**26.8**	**C**	--	--	**49.1**	**D**	--	--	**60.5**	**E**	--

[a]Volume-to-capacity ratio.
[b]Percentile delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in feet.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 11
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2019 Existing				2026 No-Build				2026 Build			
Unsignalized Intersection/Peak Hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 53 at the North Mall Driveway												
Weekday Morning:												
North Mall Driveway WB RT	25	10.4	B	4	28	10.4	B	4	32	10.4	B	5
Route 53 NB TH/RT	864	0.0	A	0	930	0.0	A	0	968	0.0	A	0
Route 53 SB LT	86	10.2	B	11	105	10.7	B	14	97	10.8	B	13
Route 53 SB TH	657	0.0	A	0	693	0.0	A	0	690	0.0	A	0
Weekday Evening:												
North Mall Driveway WB RT	94	10.7	B	13	110	10.7	B	14	189	11.8	B	24
Route 53 NB TH/RT	95	0.0	A	0	1,018	0.0	A	0	1,035	0.0	A	0
Route 53 SB LT	18	11.0	B	24	231	12.0	B	35	280	12.4	B	44
Route 53 SB TH	1,321	0.0	A	0	1,392	0.0	A	0	1,408	0.0	A	0
Saturday Midday:												
North Mall Driveway WB RT	129	10.2	B	16	151	11.3	B	22	215	13.1	B	41
Route 53 NB TH/RT	1,126	0.0	A	0	1,249	0.0	A	0	1,297	0.0	A	0
Route 53 SB LT	267	12.6	B	42	321	14.0	B	59	329	14.0	B	59
Route 53 SB TH	1,158	0.0	A	0	1,245	0.0	A	0	1,239	0.0	A	0
Route 53 at the South Mall Driveway												
Weekday Morning:												
Driveway EB LT/TH/RT	3	15.9	C	2	3	16.5	C	2	2	14.6	B	1
South Mall Driveway WB LT/TH	4	16.1	C	1	6	16.4	C	2	21	17.1	C	7
South Mall Driveway WB RT	14	9.8	A	2	21	9.7	A	3	39	9.8	A	5
Route 53 NB LT	2	9.3	A	0	2	9.5	A	0	2	9.7	A	0
Route 53 NB TH/RT	896	0.0	A	0	940	0.0	A	0	990	0.0	A	0
Route 53 SB LT	34	9.7	A	4	41	9.9	A	5	21	9.9	A	3
Route 53 SB TH/RT	681	0.0	A	0	723	0.0	A	0	770	0.0	A	0
Weekday Evening:												
Driveway EB LT/TH/RT	22	20.0	B	11	22	21.8	C	13	22	24.0	C	14
South Mall Driveway WB LT/TH	46	19.6	C	17	57	21.0	C	23	117	30.1	D	67
South Mall Driveway WB RT	58	9.3	A	6	81	9.7	A	10	125	10.1	B	16
Route 53 NB LT	9	12.2	B	1	9	12.7	B	1	9	13.3	B	2
Route 53 NB TH/RT	969	0.0	A	0	1,057	0.0	A	0	1,095	0.0	A	0
Route 53 SB LT	54	9.7	A	6	66	10.0	B	7	72	10.3	B	8
Route 53 SB TH/RT	1,368	0.0	A	0	1,448	0.0	A	0	1,533	0.0	A	0
Saturday Midday:												
Driveway EB LT/TH/RT	13	21.4	C	7	13	24.9	C	8	13	24.6	C	8
South Mall Driveway WB LT/TH	53	26.2	D	29	65	30.2	D	40	129	47.2	E	98
South Mall Driveway WB RT	99	10.6	B	14	134	11.8	B	24	157	11.8	B	24
Route 53 NB LT	14	11.3	B	2	14	11.8	B	2	14	12.0	B	2
Route 53 NB TH/RT	1,292	0.0	A	0	1,424	0.0	A	0	1,437	0.0	A	0
Route 53 SB LT	79	11.9	B	12	96	13.0	B	17	83	13.0	B	14
Route 53 SB TH/RT	1,226	0.0	A	0	1,315	0.0	A	0	1,355	0.0	A	0

See notes at end of table.

Table 11 (Continued)
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak Hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Mill Street at the West Mall Driveway												
Weekday Morning:												
Mill Street EB LT/TH	187	0.3	A	0	196	0.3	A	0	195	1.3	A	2
Mill Street WB TH/RT	127	0.0	A	0	136	0.0	A	0	148	0.0	A	0
West Mall Driveway SB LT/RT	18	10.1	B	4	20	10.3	B	5	29	11.7	B	9
Weekday Evening:												
Mill Street EB LT/TH	281	1.1	A	2	299	1.3	A	3	313	2.5	A	6
Mill Street WB TH/RT	210	0.0	A	0	226	0.0	A	0	228	0.0	A	0
West Mall Driveway SB LT/RT	103	12.0	B	17	119	12.7	B	22	142	15.7	C	35
Saturday Midday:												
Mill Street EB LT/TH	338	1.8	A	4	364	2.2	A	5	337	2.5	A	6
Mill Street WB TH/RT	307	0.0	A	0	329	0.0	A	0	350	0.0	A	0
West Mall Driveway SB LT/RT	128	16.4	C	40	152	19.5	C	58	148	21.2	C	63
Mill Street at the Mill Pond Drive and Hanover Mall Drive												
Weekday Morning:												
Mill Street EB LT/TH/RT	189	9.0	A	30	198	9.3	A	33	188	8.7	A	28
Mill Street WB LT/TH/RT	200	9.4	A	33	217	9.8	A	38	189	9.2	A	30
Mill Pond Drive NB LT/TH	67	9.6	A	13	74	9.9	A	13	45	9.4	A	8
Mill Pond Drive NB RT	13	7.8	A	3	13	7.9	A	3	13	7.7	A	3
Hanover Mall Drive SB LT/TH/RT	44	8.7	A	5	52	8.9	A	8	47	8.3	A	5
Weekday Evening:												
Mill Street EB LT/TH/RT	291	12.8	B	63	309	14.2	B	75	318	12.5	B	68
Mill Street WB LT/TH/RT	216	11.6	B	43	233	12.6	B	53	290	12.2	B	63
Mill Pond Drive NB LT/TH	96	11.1	B	18	103	11.7	B	20	587	10.7	B	10
Mill Pond Drive NB RT	38	8.8	A	5	39	9.1	A	5	39	8.9	A	5
Hanover Mall Drive SB LT/TH/RT	177	11.8	B	35	203	13.0	B	45	106	10.6	B	20
Saturday Midday:												
Mill Street EB LT/TH/RT	328	17.3	C	95	2	22.0	C	128	334	17.8	C	100
Mill Street WB LT/TH/RT	332	18.6	C	113	364	25.2	D	160	404	25.0	D	173
Mill Pond Drive NB LT/TH	136	15.2	C	50	148	17.5	C	63	83	13.6	B	28
Mill Pond Drive NB RT	48	10.0	A	10	50	10.7	B	13	50	10.5	B	13
Hanover Mall Drive SB LT/TH/RT	132	12.8	B	30	156	14.8	B	43	159	14.0	B	40

See notes at end of table.

Table 11 (Continued)
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak Hour/Movement	2019 Existing				2026 No-Build				2026 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Main Street at Prospect Street												
Weekday Morning:												
Main Street EB LT/TH	547	0.3	A	1	572	0.4	A	2	562	0.6	A	1
Main Street WB TH/RT	736	0.0	A	0	772	0.0	A	0	747	0.0	A	0
Prospect Street SB LT/RT	106	>50.0	F	273	139	>50.0	F	438	116	>50.0	F	302
Weekday Evening:												
Main Street EB LT/TH	641	0.5	A	1	692	1.3	A	4	684	1.3	A	4
Main Street WB TH/RT	723	0.0	A	0	775	0.0	A	0	770	0.0	A	0
Prospect Street SB LT/RT	118	>50.0	F	174	144	>50.0	F	283	153	>50.0	F	314
Saturday Midday:												
Main Street EB LT/TH	267	0.1	A	0	305	0.9	A	3	308	0.9	A	2
Main Street WB TH/RT	284	0.0	A	0	318	0.0	A	0	326	0.0	A	0
Prospect Street SB LT/RT	49	13.8	B	13	85	16.0	C	28	98	17.2	C	36
Main Street at South Street												
Weekday Morning:												
Main Street EB TH/RT	638	0.0	A	0	671	8.0	A	0	638	0.0	A	0
Main Street WB LT/TH	695	3.9	A	14	734	4.4	A	16	718	4.0	A	15
South Street NB LT/RT	216	>50.0	F	836	226	>50.0	F	NC	217	>50.0	F	NC
Weekday Evening:												
Main Street EB TH/RT	728	0.0	A	0	771	0.0	A	0	772	0.0	A	0
Main Street WB LT/TH	614	2.3	A	7	656	4.4	A	9	700	3.0	A	12
South Street NB LT/RT	295	>50.0	F	739	322	>50.0	F	902	301	>50.0	F	866
Saturday Midday:												
Main Street EB TH/RT	309	0.0	A	0	346	0.0	A	0	362	0.0	A	0
Main Street WB LT/TH	300	2.3	A	5	337	2.5	A	6	358	3.0	A	8
South Street NB LT/RT	94	15.6	C	24	113	18.2	C	35	157	20.9	C	57
South Street at Pleasant Street												
Weekday Morning:												
South Street NB TH/RT	139	0.0	A	0	147	0.0	A	0	141	0.0	A	0
South Street SB LT/TH	105	3.1	A	4	117	3.0	A	5	88	3.7	A	4
Pleasant Street WB LT/RT	249	14.4	B	60	261	15.5	C	69	262	15.1	C	64
Weekday Evening:												
South Street NB TH/RT	296	0.0	A	0	330	0.0	A	0	141	0.0	A	0
South Street SB LT/TH	262	3.8	A	9	280	3.1	A	5	88	3.8	A	10
Pleasant Street NB LT/RT	153	21.6	C	62	161	25.5	D	69	262	33.2	D	110
Saturday Midday:												
South Street NB TH/RT	141	0.0	A	0	167	0.0	A	0	204	0.0	A	0
South Street SB LT/TH	107	1.6	A	2	129	1.6	A	2	161	1.6	A	2
Pleasant Street NB LT/RT	84	10.8	B	12	94	11.5	B	15	102	12.7	B	19

See notes at end of table.

Table 11 (Continued)
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2019 Existing				2026 No-Build				2026 Build			
Unsignalized Intersection/Peak Hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Mill Street at South Street												
Weekday Morning:												
Mill Street EB TH/RT	113	0.0	A	0	121	0.0	A	0	115	0.0	A	0
South Street WB LT/TH	187	0.3	A	0	205	0.3	A	0	177	0.3	A	0
South Street NB LT	4	10.7	B	1	4	11.0	B	1	4	10.7	B	1
South Street NB RT	10	9.2	A	2	10	9.2	A	2	10	9.2	A	2
Weekday Evening:												
Mill Street EB TH/RT	329	0.0	A	0	359	0.0	A	0	328	0.0	A	0
South Street WB LT/TH	207	0.0	A	0	223	0.0	A	0	280	0.0	A	0
South Street NB LT	3	13.0	B	1	3	13.6	B	1	3	14.0	B	1
South Street NB RT	3	10.3	B	0	3	10.5	B	0	3	10.3	B	0
Saturday Midday:												
Mill Street EB TH/RT	333	0.0	A	0	360	0.0	A	0	397	0.0	A	0
South Street WB LT/TH	326	0.0	A	0	358	0.0	A	0	398	0.0	A	0
South Street NB LT	6	14.0	B	1	6	14.9	B	1	6	16.1	C	1
South Street NB RT	2	10.1	B	0	2	10.3	B	0	2	10.6	B	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level-of-Service.
[d]Queue length in feet.
NC = Not calculated.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

TRAFFIC SIGNAL WARRANTS ANALYSIS

A detailed Traffic Signal Warrants Analysis (TSWA) was performed for the intersections of Main Street at South Street and Main Street at Prospect Street following the methodology defined in the MUTCD. The MUTCD establishes nine warrants or criteria to evaluate a location for the installation (or retention) of a traffic signal; however, satisfaction of a warrant in and of itself does not necessarily indicate that the installation of a traffic signal is the best traffic control solution. An engineering evaluation of the location in question should indicate that the establishment of traffic signal control will improve the overall safety and/or operation of the intersection. Table 12 lists the nine warrants used to evaluate an intersection for traffic signal control as presented in the MUTCD.

Table 12
TRAFFIC SIGNAL WARRANTS

Warrant No.	Description
1	Eight-Hour Vehicular Volume
2	Four-Hour Vehicular Volume
3	Peak-Hour
4	Pedestrian Volume
5	School Crossing
6	Coordinated Signal System
7	Crash Experience
8	Roadway Network
9	Intersection Near a Grade Crossing

Each of the nine traffic signal warrants listed in Table 12 were evaluated for the subject intersections using the 2019 traffic count data adjusted to average-month conditions. Table 13 summarizes the results of the TSWA for the subject intersections, with the detailed TSWA worksheets and supporting materials attached.

Table 13
TRAFFIC SIGNAL WARRANTS ANALYSIS
2019 DESIGN YEAR

Warrant No.	Description	Main Street/ South Street Satisfied?	Main Street/ Prospect Street Satisfied?
1	Eight-Hour Vehicular Volume	**Yes**	**Yes**
2	Four-Hour Vehicular Volume	No	No
3	Peak Hour	No	No
4	Pedestrian Volume	No	No
5	School Crossing	No	No
6	Coordinated Signal System	No	No
7	Crash Experience	No	No
8	Roadway Network	No	No
9	Intersection Near a Grade Crossing	No	No

As can be seen in Table 13, the intersections of Main Street at South Street and Main Street at Prospect Street were found to satisfy Warrant 1, *Eight-Hour Vehicular Volume*, under current (2019) traffic volume conditions and independent of the future developments in the study area, including the Project. That being said, the close proximity of these intersections (separated by approximately 300 feet) and the lack of a pronounced motor vehicle crash history (calculated crash rates are well below the MassDOT average crash rates) suggests that an alternative improvement strategy may be more appropriate than the installation of a traffic control signal. As such, the Project proponent has committed to working with the Town of Norwell to review alternative improvement strategies at these intersections.

SIGHT DISTANCE EVALUATION

Sight distance measurements were performed at the Project site driveway intersections with Route 53 and Mill Street in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[16] requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 14 presents the measured SSD and ISD at the subject intersections.

[16] *A Policy on Geometric Design of Highway and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

Table 14
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Route 53 at Hanover Mall Drive			
Stopping Sight Distance:			
Route 53 approaching from the north	250	--	500+
Route 53 approaching from the south	360	--	500+
Intersection Sight Distance:			
Looking to the north from the Project Driveway	250	365/415	500+
Looking to the south from the Project Driveway	360	465/530	500+
Route 53 at the North Project Driveway			
Stopping Sight Distance:			
Route 53 approaching from the north	250	--	500+
Route 53 approaching from the south	360	--	500+
Intersection Sight Distance:			
Looking to the south from the Project Driveway	360	465	500+
Route 53 at the Center Project Driveway			
Stopping Sight Distance:			
Route 53 approaching from the north	250	--	348
Route 53 approaching from the south	360	--	500+
Intersection Sight Distance:			
Looking to the north from the Project Driveway	250	365/415	500
Looking to the south from the Project Driveway	360	465/530	500+
Route 53 at the South Project Driveway			
Stopping Sight Distance:			
Route 53 approaching from the north	250	--	500+
Route 53 approaching from the south	360	--	500+
Intersection Sight Distance:			
Looking to the north from the Project Driveway	250	365/415	500+
Looking to the south from the Project Driveway	360	465/530	500+
Mill Street at the West Project Driveway			
Stopping Sight Distance:			
Mill Street approaching from the east	305	--	500+
Mill Street approaching from the west	305	--	384
Intersection Sight Distance:			
Looking to the east from the Project Driveway	305	385/445	411
Looking to the west from the Project Driveway	305	385/445	318
Mill Street at Hanover Mall Drive			
Stopping Sight Distance:			
Mill Street approaching from the east	305	--	500+
Main Street approaching from the west	305	--	500+
Intersection Sight Distance:			
Looking to the east from Hanover Mall Drive	305	385/445	500+
Looking to the west from Hanover Mall Drive	305	385/445	500+

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on a 35 mph approach speed for Route 53 southbound, a 45 mph approach speed for Route 53 northbound, and a 40 mph approach speed on Mill Street.

[b]Values shown are the intersection sight distance for a vehicle turning right/left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed. The gap time for the intersection sight distance values along Route 53 was increased by 0.5 seconds in order to account for the increased time required to cross the additional travel lanes.

As can be seen in Table 14, the available lines of sight at the Project site driveway intersections with Route 53 and Mill Street were found to exceed the required minimum distances to function in a safe (SSD) manner based on the appropriate approach speed along both roadways and with consideration of the need to cross additional travel lanes along Route 53. We note that the Route 53 Project site driveways also meet or exceed the recommended ISD values, indicating that vehicles are able to exit the Project site without inhibiting the flow of traffic along Route 53.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

VAI has completed a detailed assessment of the potential impacts on the transportation infrastructure associated with the proposed re-envisioning of the Hanover Mall located at 1775 Washington Street (Route 53) in Hanover, Massachusetts, as a mixed-use, life-style center to be known as Hanover Crossing. The following specific areas have been evaluated as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the ITE[17] and after adjustment to account for internal trips and pass-by trips, the Project is expected to generate approximately 18,942 primary vehicle trips on an average weekday and 29,116 primary vehicle trips on a Saturday (both two-way, 24-hour volumes), with 587 primary vehicle trips expected during the weekday morning peak-hour, 1,697 primary vehicle trips expected during the weekday evening peak-hour and 2,221 primary vehicle trips expected during the Saturday midday peak-hour;

2. In comparison to the existing uses that occupy the Project site, the Project is expected to result in 3,032 additional vehicle trips on an average weekday and 8,022 additional vehicle trips on a Saturday (two-way, 24-hour volumes), with 27 additional vehicle trips expected during the weekday morning peak-hour, 389 additional vehicle trips expected during the weekday evening peak-hour and 337 additional vehicle trips expected during the Saturday midday peak-hour. ***The average weekday daily and Saturday increases exceed the Transportation thresholds of the Massachusetts Environmental Policy Act (MEPA) that would necessitate the filing of an Environmental Notification Form (ENF) and an Environmental Impact Report (EIR) for the Project based on Traffic/Transportation***;

3. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with the majority of the movements at the study area intersections shown to

[17] Ibid 1.

operate at a LOS of D or better under all analysis conditions, where an LOS of "D" or better is defined as "acceptable" traffic operations;

4. With the exception of the Mill Street/Mill Pond Drive/Hanover Mall Drive intersection, the study area intersections were found to have motor vehicle crash rates that were below the MassDOT average crash rates for a signalized or unsignalized intersection, as appropriate. The Town has advanced safety-related improvements at the Mill Street/ Mill Pond Drive/Hanover Mall Drive intersection that include the implementation of all-way STOP-sign control; and

5. Lines of sight to and from the Project site driveway intersections with Route 53 and Mill Street exceed the recommended minimum distances for the intersections to function in a safe manner.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to maintain safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The improvements that have been recommended as a part of this evaluation, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project site is and will continue to be provided by way of four (4) driveways that intersect the east side of Route 53 (two (2) full access driveways under traffic signal control located opposite the Route 3 southbound ramps and 250-feet south of Woodland Drive, respectively; a full ingress, right-turn only egress driveway located approximately 700 feet south of the Route 3 southbound ramps; and a full access driveway located at the south end of the Project site) and two (2) full access driveways that intersect the north side of Mill Street, with the eastern Mill Street driveway (Hanover Mall Drive) aligned opposite Mill Pond Drive. The following recommendations are offered with respect to Project access and internal circulation:

- The Project site driveways and internal circulating roadways should continue to support the turning and maneuvering requirements of delivery trucks and the largest anticipated responding emergency vehicle as defined by the Hanover Fire Department.

- Vehicles exiting the Project site should continue to operate as presently configured under traffic signal or STOP-sign control.

- All signs and pavement markings to be installed within the Project shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[18]

[18]Ibid 2.

- A sidewalk should be provided along at least one side of Hanover Mall Drive between the multifamily residential community and Mill Street, where a crosswalk would then be provided to allow pedestrians to walk to/from Mill Pond Drive and the South Shore YMCA.

- A defined pedestrian route should be provided between the multifamily residential community and the commercial area.

- Marked crosswalks and Americans with Disabilities Act (ADA) compliant wheelchair ramps should be provided at pedestrian crossings within the Project site.

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site driveways should be designed and maintained so as not to restrict lines of sight.

- Snow windrows within the sight triangle areas of the Project site driveways shall be promptly removed where such accumulations would impede sight lines.

- A school bus waiting area should be provided for the multifamily residential community at an appropriate location defined in consultation with the Town.

- Consideration should be given to installing electric vehicle charging stations within the Project site and to accommodating the staging of car-sharing vehicles (ZipCar or similar).

Off-Site

Route 53 at Route 123

The addition of Project-related traffic to this signalized intersection was not shown to result in a change in overall intersection operations; however, one or more movements were shown to operate below LOS D. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for the intersection. As can be seen in Table 15, with the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations will remain at LOS D and all movements will generally operate similar to or will be improved over 2026 No-Build Build conditions. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Route 53 at the Route 3 Northbound Ramps

The addition of Project-related traffic to this signalized intersection was not shown to result in a change in overall intersection operations; however, left-turn/through movements from the Route 3 northbound off-ramp were shown to degrade to LOS F during the Saturday midday peak-hour. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for the intersection. As can be seen in Table 15, with the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations will remain at LOS C or better, with no movement predicted to operate below LOS D. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Table 15
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build				2026 Build				2026 Build With Mitigation			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at Route 123												
Weekday Morning:												
Route 123 EB LT/TH/RT	0.85	49.3	D	168/330	0.85	49.3	D	170/333	0.85	49.3	D	170/333
Route 123 WB LT	0.87	50.2	D	98/282	0.83	45.2	D	92/265	0.83	45.2	D	92/265
Route 123 WB TH/RT	0.36	24.0	C	102/216	0.36	24.0	C	102/216	0.36	24.0	C	102/216
Route 53 NB LT/TH/RT	0.91	35.6	D	321/642	0.92	37.1	D	324/647	0.92	37.1	D	324/647
Route 53 SB LT/TH	0.16	15.6	B	40/86	0.16	15.8	B	41/90	0.16	15.8	B	41/90
Route 53 SB RT	0.02	14.6	B	0/0	0.02	14.7	B	0/0	0.02	14.7	B	0/0
Overall	--	**37.1**	**D**	--	--	**37.2**	**D**	--	--	**37.2**	**D**	--
Weekday Evening:												
Route 123 EB LT/TH/RT	0.86	52.8	D	179/356	0.92	61.1	E	195/394	0.89	54.8	D	192/383
Route 123 WB LT	0.90	56.0	E	137/373	0.95	66.9	E	149/402	0.88	49.7	D	142/380
Route 123 WB TH/RT	0.32	22.7	C	102/212	0.32	22.7	C	102/212	0.33	23.3	C	104/215
Route 53 NB LT/TH/RT	0.97	50.1	D	308/605	1.03	67.8	E	333/642	0.99	54.7	D	242/601
Route 53 SB LT/TH	0.43	20.8	C	127/233	0.46	21.2	C	137/253	0.54	28.0	C	163/284
Route 53 SB RT	0.04	16.9	B	0/0	0.04	16.9	B	0/0	0.04	22.2	C	0/0
Overall	--	**42.4**	**D**	--	--	**51.7**	**D**	--	--	**45.5**	**D**	--
Saturday Midday:												
Route 123 EB LT/TH/RT	0.73	43.2	D	104/201	0.75	43.8	D	113/218	0.85	54.7	D	130/284
Route 123 WB LT	0.91	50.7	D	137/337	0.96	64.3	E	139/381	0.99	73.5	E	156/412
Route 123 WB TH/RT	0.28	24.3	C	69/149	0.27	24.0	C	69/149	0.28	26.3	C	75/160
Route 53 NB LT/TH/RT	0.95	38.2	D	214/623	1.04	63.6	E	237/696	1.00	53.1	D	236/614
Route 53 SB LT/TH	0.49	22.1	C	133/270	0.53	23.3	C	148/291	0.50	22.4	C	143/271
Route 53 SB RT	0.05	17.8	B	0/8	0.05	18.4	B	0/8	0.05	17.8	B	143/271
Overall	--	**35.6**	**D**	--	--	**47.4**	**D**	--	--	**46.4**	**D**	--

See notes at end of table.

Table 15 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2026 Build V/C	Delay	LOS	Queue 50th/95th	2026 Build With Mitigation V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Route 3 Northbound Ramps												
Weekday Morning:												
Driveway EB LT/TH	0.09	20.5	C	8/34	0.08	20.4	C	8/34	0.08	20.4	C	8/34
Driveway EB RT	0.01	20.1	C	0/0	0.01	20.0	C	0/0	0.01	20.0	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.54	24.5	C	48/174	0.58	25.3	C	55/201	0.58	25.3	C	55/201
Route 3 Northbound Off-Ramp WB RT	0.72	23.2	C	55/316	0.71	22.8	C	56/317	0.71	22.8	C	56/317
Route 53 NB LT/TH	0.50	15.0	B	80/198	0.50	15.4	B	85/200	0.50	15.4	B	85/200
Route 53 NB RT	0.50	15.3	B	37/177	0.52	16.0	B	41/183	0.52	16.0	B	41/183
Route 53 SB LT	0.52	9.5	A	26/105	0.53	10.0	A	28/105	0.53	10.0	A	28/105
Route 53 SB TH/RT	0.26	7.0	A	35/116	0.27	7.4	A	38/118	0.27	7.4	A	38/118
Overall	--	**16.0**	**B**	--	--	**16.3**	**B**	--	--	**16.3**	**B**	--
				--								
Weekday Evening:												
Driveway EB LT/TH	0.16	28.0	C	20/48	0.16	28.4	C	20/48	0.16	28.4	C	20/48
Driveway EB RT	0.02	27.1	C	0/0	0.02	27.4	C	0/0	0.02	27.4	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.67	36.6	D	84/229	0.72	39.9	D	95/259	0.72	39.9	D	95/259
Route 3 Northbound Off-Ramp WB RT	0.16	19.3	B	0/39	0.16	19.6	B	0/39	0.16	19.6	B	0/39
Route 53 NB LT/TH	0.65	18.9	B	171/341	0.66	19.4	B	176/351	0.66	19.4	B	176/351
Route 53 NB RT	0.59	18.4	B	101/290	0.62	19.5	B	113/319	0.62	19.5	B	113/319
Route 53 SB LT	0.64	14.5	B	35/178	0.66	15.4	B	35/185	0.66	15.4	B	35/185
Route 53 SB TH/RT	0.51	8.2	A	109/291	0.56	9.0	A	127/336	0.56	9.0	A	127/336
Overall	--	**16.3**	**B**	--	--	**16.9**	**B**	--	--	**16.9**	**B**	--
Saturday Midday:												
Driveway EB LT/TH	0.09	24.8	C	10/37	0.11	25.0	C	10/37	0.88	23.1	C	9/35
Driveway EB RT	0.02	24.3	C	0/0	0.02	24.4	C	0/0	0.02	22.8	C	0/0
Route 3 Northbound Off-Ramp WB LT/TH	0.81	44.1	D	107/297	1.04	>80.0	F	144/395	0.90	52.4	D	135/365
Route 3 Northbound Off-Ramp WB RT	0.14	19.8	B	0/34	0.14	19.9	B	0/34	0.14	13.6	B	0/31
Route 53 NB LT/TH	0.62	16.6	B	144/316	0.65	17.1	B	153/335	0.69	19.5	B	169/356
Route 53 NB RT	0.77	22.5	C	132/501	0.77	22.1	C	133/501	0.31	26.6	C	157/528
Route 53 SB LT	0.83	29.1	C	36/205	0.87	35.2	D	36/213	0.94	54.0	D	44/252
Route 53 SB TH/RT	0.47	8.7	A	91/248	0.52	9.2	A	105/286	0.55	10.8	B	123/308
Overall	--	**18.9**	**B**	--	--	**23.7**	**C**	--	--	**23.5**	**C**	--

See notes at end of table.

Table 15 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2026 Build V/C	Delay	LOS	Queue 50th/95th	2026 Build With Mitigation V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Route 3 Southbound Ramps and Hanover Mall Drive												
Weekday Morning:												
Route 3 Southbound Off-Ramp EB LT	0.70	38.6	D	103/166	0.70	33.6	D	103/166	0.70	33.6	C	103/166
Route 3 Southbound Off-Ramp EB TH	0.12	27.9	C	24/53	0.15	28.1	C	31/64	0.15	28.1	C	31/64
Route 3 Southbound Off-Ramp EB RT	0.12	21.3	C	1/28	0.11	20.9	C	2/27	0.11	20.9	C	2/27
Hanover Mall Drive WB TH	0.13	39.7	D	9/29	0.13	39.7	D	9/29	0.13	39.7	D	9/29
Hanover Mall Drive WB RT	0.06	39.3	D	0/19	0.04	39.2	D	0/5	0.04	39.2	D	0/5
Route 53 NB LT	0.29	19.6	B	32/46	0.33	19.0	B	37/49	0.33	19.0	B	37/49
Route 53 NB TH/RT	0.38	17.7	B	275/337	0.40	16.9	B	283/346	0.40	16.9	B	283/346
Route 53 SB TH	0.26	11.4	B	76/118	0.28	11.8	B	83/130	0.28	11.8	B	83/130
Route 53 SB RT	0.11	10.4	B	0/32	0.12	10.6	B	2/36	0.12	10.6	B	2/36
Overall	--	**19.5**	**B**	--	--	**18.9**	**B**	--	--	**18.9**	**B**	--
Weekday Evening:												
Route 3 Southbound Off-Ramp EB LT	0.91	58.2	E	254/398	0.92	61.5	E	256/416	0.89	53.6	D	253/393
Route 3 Southbound Off-Ramp EB TH	0.20	29.2	C	65/108	0.25	29.8	C	80/129	0.24	29.1	C	79/127
Route 3 Southbound Off-Ramp EB RT	0.46	20.3	C	156/201	0.43	19.9	B	148/188	0.43	18.8	B	154/169
Hanover Mall Drive WB TH	0.36	48.3	D	41/79	0.31	48.5	D	34/70	0.31	43.5	D	34/70
Hanover Mall Drive WB RT	0.16	46.7	D	8/62	0.07	46.6	D	0/50	0.07	46.6	D	0/50
Route 53 NB LT	0.69	59.1	E	132/230	0.68	64.5	E	151/235	0.66	45.0	D	108/165
Route 53 NB TH/RT	0.43	5.8	A	75/92	0.45	5.3	A	73/98	0.46	3.9	A	51/62
Route 53 SB TH	0.55	25.1	C	241/315	0.64	27.0	C	294/380	0.67	28.8	C	295/417
Route 53 SB RT	0.49	25.5	C	129/344	0.52	26.1	C	142/267	0.55	28.0	C	158/307
Overall	--	**26.1**	**C**	--	--	**26.6**	**C**	--	--	**24.9**	**C**	--
Saturday Midday:												
Route 3 Southbound Off-Ramp EB LT	0.69	33.0	C	125/181	0.75	37.8	D	128/190	0.75	37.8	D	129/190
Route 3 Southbound Off-Ramp EB TH	0.11	23.8	C	28/54	0.36	27.2	C	91/141	0.36	20.2	C	91/141
Route 3 Southbound Off-Ramp EB RT	0.432	18.3	B	109/152	0.32	17.6	B	82/111	0.32	17.6	B	82/101
Hanover Mall Drive WB TH	0.27	35.8	D	35/61	0.33	37.8	D	38/64	0.33	37.8	D	38/64
Hanover Mall Drive WB RT	0.51	38.6	D	48/88	0.24	37.2	D	15/51	0.24	37.2	D	15/51
Route 53 NB LT	0.65	31.1	C	71/115	0.61	31.6	C	78/92	0.61	32.9	C	78/96
Route 53 NB TH/RT	0.60	13.4	B	371/466	0.61	10.2	B	282/420	0.61	9.3	A	230/424
Route 53 SB TH	0.63	21.4	C	241/314	0.73	23.4	C	285/388	0.73	23.4	C	285/388
Route 53 SB RT	0.23	16.4	B	36/88	0.23	16.1	B	33/88	0.23	16.1	B	35/88
Overall	--	**20.4**	**C**	--	--	**20.1**	**C**	--	--	**19.8**	**B**	--

See notes at end of table.

Table 15 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2026 Build V/C	Delay	LOS	Queue 50th/95th	2026 Build With Mitigation V/C	Delay	LOS	Queue 50th/95th
Route 53 at the Mall Center Drive												
Weekday Morning:												
Mall Center Drive WB LT	0.37	38.7	D	37/55	0.46	39.0	D	49/69	0.46	39.0	D	49/69
Mall Center Drive WB RT	0.13	29.6	C	19/32	0.14	28.9	C	22/34	0.14	28.9	C	22/34
Route 53 NB TH/RT	0.41	14.2	B	236/351	0.44	15.4	B	263/370	0.44	15.4	B	263/370
Route 53 SB LT	0.39	40.8	D	41/77	0.43	40.8	D	45/81	0.43	40.8	D	45/81
Route 53 SB TH	0.30	2.3	A	48/87	0.30	2.5	A	51/87	0.30	2.5	A	51/87
Overall	--	**11.5**	**B**	--	--	**12.7**	**B**	--	--	**12.7**	**B**	--
Weekday Evening:												
Mall Center Drive WB LT	0.68	48.0	D	148/190	0.90	62.3	E	262/353	0.83	51.2	D	253/309
Mall Center Drive WB RT	0.33	28.9	C	83/105	0.23	22.9	C	54/83	0.23	21.2	C	60/84
Route 53 NB TH/RT	0.50	6.3	A	69/98	0.59	10.7	B	111/170	0.62	15.1	B	117/207
Route 53 SB LT	0.60	43.4	D	89/146	0.67	43.1	D	109/183	0.64	52.5	D	122/198
Route 53 SB TH	0.51	4.2	A	66/235	0.54	6.8	A	190/273	0.56	4.0	A	88/100
Overall	--	**12.2**	**B**	--	--	**18.0**	**B**	--	--	**17.4**	**B**	--
Saturday Midday:												
Mall Center Drive WB LT	0.66	37.4	D	131/193	0.74	38.2	D	170/246	0.76	39.8	D	170/254
Mall Center Drive WB RT	0.30	22.4	B	72/94	0.28	17.2	B	69/84	0.28	17.5	B	69/100
Route 53 NB TH/RT	0.84	33.9	C	468/673	0.99	54.2	D	516/758	0.98	26.6	C	352/692
Route 53 SB LT	0.60	36.8	D	114/182	0.66	41.3	D	140/201	0.66	42.1	D	140/201
Route 53 SB TH	0.48	6.0	A	134/231	0.48	8.2	A	124/236	0.48	7.5	A	117/215
Overall	--	**23.3**	**C**	--	--	**34.2**	**C**	--	--	**21.9**	**C**	--

See notes at end of table.

Table 15 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	2026 Build V/C	Delay	LOS	Queue 50th/95th	2026 Build With Mitigation V/C	Delay	LOS	Queue 50th/95th
Route 53 at Mill Street and Frank's Lane												
Weekday Morning:												
Frank's Lane EB LT/TH/RT	0.17	36.4	D	16/32	0.17	36.4	D	16/32	0.17	36.4	D	16/32
Mill Street WB LT	0.64	45.3	D	63/94	0.65	45.7	D	65/96	0.65	45.7	D	65/96
Mill Street WB TH/RT	0.03	35.4	D	1/22	0.03	35.4	D	1/22	0.03	35.4	D	1/22
Route 53 NB LT	0.16	44.3	D	4/18	0.16	44.3	D	4/18	0.16	44.3	D	4/18
Route 53 NB TH/RT	0.47	8.5	A	156/203	0.50	8.8	A	167/217	0.50	8.8	A	167/217
Route 53 SB LT	0.65	46.3	D	65/85	0.65	44.6	D	64/85	0.65	44.6	D	64/85
Route 53 SB TH	0.28	3.6	A	54/100	0.30	4.3	A	65/120	0.30	4.3	A	65/120
Route 53 SB RT	0.01	3.5	A	0/1	0.01	3.5	A	0/1	0.01	3.5	A	0/1
Overall	**--**	**12.1**	**B**	--	**--**	**12.2**	**B**	**--**	**--**	**12.2**	**B**	**--**
Weekday Evening:												
Frank's Lane EB LT/TH/RT	0.33	36.0	D	66/105	0.37	37.8	D	69/111	0.37	37.8	D	69/111
Mill Street WB LT	0.78	51.0	D	157/211	0.74	50.8	D	129/180	0.74	50.8	D	129/180
Mill Street WB TH/RT	0.10	33.7	C	8/42	0.11	35.0	C	8/44	0.11	35.0	C	8/44
Route 53 NB LT	0.23	53.2	D	11/33	0.23	53.2	D	11/33	0.23	53.2	D	11/33
Route 53 NB TH/RT	0.62	19.3	B	290/438	0.62	17.7	B	286/470	0.62	17.7	B	286/470
Route 53 SB LT	0.55	51.4	D	79/137	0.52	49.6	D	79/125	0.52	49.6	D	79/125
Route 53 SB TH	0.63	11.2	A	183/350	0.67	10.1	B	169/422	0.67	10.1	B	169/422
Route 53 SB RT	0.11	7.2	A	9/44	0.10	6.1	A	6/35	0.10	6.1	A	6/35
Overall	--	**20.0**	**B**	--	**--**	**18.2**	**B**	**--**	**--**	**18.2**	**B**	**--**
Saturday Midday:												
Frank's Lane EB LT/TH/RT	0.56	32.6	C	93/156	0.57	33.1	C	93/156	0.50	29.6	C	85/142
Mill Street WB LT	1.06	>80.0	F	187/345	0.92	68.4	E	140/282	0.83	48.1	D	130/242
Mill Street WB TH/RT	0.13	27.4	C	16/59	0.13	27.7	C	16/59	0.13	25.8	C	15/54
Route 53 NB LT	0.35	39.9	D	32/68	0.35	39.9	D	32/68	0.35	39.9	D	32/68
Route 53 NB TH/RT	0.82	21.5	C	385/493	0.81	20.8	C	378/484	0.36	24.8	C	425/601
Route 53 SB LT	0.57	42.1	D	45/101	0.57	44.5	D	50/104	0.55	38.1	D	56/88
Route 53 SB TH	0.64	14.5	B	245/338	0.69	15.4	B	269/381	0.73	16.5	B	320/322
Route 53 SB RT	0.09	8.8	A	8/20	0.09	7.0	A	5/13	0.10	9.3	A	14/24
Overall	**--**	**27.0**	**C**	--	**--**	**23.3**	**C**	**--**	--	**23.7**	**C**	--

See notes at end of table.

Table 15 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-hour/Movement	2026 No-Build				2026 Build				2026 Build With Mitigation			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 53 at Old Washington Street and Pond Street												
Weekday Morning:												
Old Washington Street EB LT/TH	0.70	24.4	C	125/450	0.74	26.5	C	136/469	0.74	26.5	C	136/469
Old Washington Street EB RT	0.11	15.3	B	10/65	0.12	15.8	B	10/65	0.12	15.8	B	10/65
Pond Street WB LT/TH/RT	0.05	14.8	B	6/17	0.05	15.4	B	6/17	0.05	15.4	B	6/17
Route 53 NB LT	0.45	37.2	D	29/90	0.45	37.6	D	30/90	0.45	37.6	D	30/90
Route 53 NB TH/RT	0.60	21.9	C	120/298	0.62	22.0	C	128/317	0.62	22.0	C	128/317
Route 53 SB LT	0.25	46.2	D	2/15	0.26	47.6	D	2/15	0.26	47.6	D	2/15
Route 53 SB TH/RT	0.64	26.6	C	126/235	0.67	27.2	C	138/255	0.67	27.2	C	138/255
Overall	--	**24.0**	**C**	--	--	**24.7**	**C**	--	--	**24.7**	**C**	--
Weekday Evening:												
Old Washington Street EB LT/TH	0.83	45.7	D	129/310	0.83	45.0	D	136/329	0.86	54.5	D	160/325
Old Washington Street EB RT	0.21	26.0	C	24/84	0.20	25.6	C	24/84	0.21	29.1	C	28/90
Pond Street WB LT/TH/RT	0.01	24.7	C	2/10	0.01	24.1	C	2/10	0.01	22.4	C	2/10
Route 53 NB LT	0.62	41.1	D	70/169	0.63	42.4	D	72/169	0.72	54.3	D	82/209
Route 53 NB TH/RT	0.41	13.2	B	92/287	0.44	14.1	B	107/307	0.42	13.7	B	107/283
Route 53 SB LT	0.06	45.2	D	1/6	0.06	46.0	D	1/6	0.06	50.4	D	1/6
Route 53 SB TH/RT	1.04	61.0	E	412/872	1.16	>80.0	F	512/981	1.03	60.4	E	468/866
Overall	--	**43.4**	**D**	--	--	**68.2**	**E**	--	--	**45.2**	**D**	--
Saturday Midday:												
Old Washington Street EB LT/TH	0.81	40.1	D	163/434	0.82	40.4	D	166/443	0.89	54.0	D	189/452
Old Washington Street EB RT	0.16	22.9	C	20/82	0.16	22.9	C	20/82	0.17	19.7	B	26/55
Pond Street WB LT/TH/RT	0.01	21.6	C	0/0	0.01	21.6	C	0/0	0.01	24.4	C	0/0
Route 53 NB LT	0.54	42.7	D	55/127	.054	42.8	D	55/127	0.64	51.2	D	60/153
Route 53 NB TH/RT	0.64	20.0	C	185/440	0.63	20.0	C	180/428	0.58	18.1	B	174/422
Route 53 SB LT	0.11	49.4	D	1/10	0.11	49.5	D	1/10	0.11	51.4	D	1/10
Route 53 SB TH/RT	1.07	77.3	E	430/825	1.13	>80.0	F	473/883	0.99	50.2	D	413/793
Overall	--	**49.1**	**D**	--	--	**60.5**	**E**	--	--	**38.5**	**D**	--

[a]Volume-to-capacity ratio.
[b]Percentile delay per vehicle in seconds.
[c]Level-of-Service.
[d]Queue length in feet.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Route 53 Traffic Signal System

Overall operating conditions at the three (3) traffic signals that comprise the Washington Street (Route 53) traffic signal system (Route 53/Route 3 southbound ramps/Hanover Mall Drive, Route 53/Hanover Mall center driveway, and Route 53/Mill Street/Frank's Lane) were shown to remain acceptable; however, one or more movements were shown to operate below LOS D. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan for the three (3) traffic signals that comprise the Washington Street traffic signal system, including the upgrade/replacement of traffic signal equipment and appurtenances as may be necessary to effectuate the recommended changes. In addition and as discussed with the Town of Hanover, the Project proponent will repair and/or replace the emergency vehicle pre-emption system (OPTICOM™) at these intersections. As can be seen in Table 15, with the implementation of an optimal traffic signal timing, phasing and coordination plan, overall intersection operations will be maintained at LOS C or better during the peak hours, with no movement predicted to operate below LOS D. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Route 53 at Old Washington Street and Pond Street

The addition of Project-related traffic to this signalized intersection was shown to result in a degradation in overall operating conditions during both the weekday evening and Saturday midday peak hours from LOS D to LOS E. In an effort to improve traffic operations, the Project proponent will design and implement an optimal traffic signal timing and phasing plan for this intersection. As can be seen in Table 15, with the implementation of an optimal traffic signal timing and phasing plan, overall intersection operations were shown to improve to LOS D or better and all movements will operate similar to or will be improved over 2026 No-Build Build conditions. These improvements will be completed prior to the issuance of the final Certificate of Occupancy for the Project.

Mill Street/Mill Pond Drive/Hanover Mall Drive

The Mill Street/Mill Pond Drive/Hanover Mall Drive intersection was found to have a motor vehicle crash rate above the MassDOT statewide and District averages for an unsignalized intersection. Improvements were recently completed by the Town at this intersection in an effort to improve safety and included the implementation of all-way STOP-sign control. As such, the Project proponent will participate with the Town and other area stakeholders to facilitate the completion of an "after" study of the intersection in order to determine if the recently completed safety improvements have been effective at reducing the frequency and severity of motor vehicle collisions at the intersection. The "after" study will performed in conjunction with the annual Traffic Monitoring and Reporting Program for the Project (discussion follows).

Mill Street/South Street

All movements at this unsignalized intersection are predicted to operate at LOS C or better during the peak-hours with minimal vehicle queuing (up to two (2) vehicles) with the addition of Project-related traffic. In an effort to assist the Town of Norwell in advancing geometric improvements at the Mill Street/South Street intersection, the Project proponent will prepare a Functional Design Report (FDR) that will assess alternative improvement strategies at the intersection and will include conceptual design plans for each alternative. The FDR and conceptual design plans will be provided to the Town of Norwell prior to the issuance of a Certificate of Occupancy for the residential component of the Project.

Main Street/South Street and Main Street/Prospect Street

The addition of Project-related traffic to the Main Street/South Street and Main Street/ Prospect Street intersections was not shown to result in a significant increase in motorist delays or vehicle queuing over No-Build conditions; however, it was noted that all movements exiting from South Street and Prospect Street are operating at over capacity during the weekday morning and evening peak hours independent of the Project due to the relatively large volume of conflicting traffic on Main Street. In order to assess potential improvement strategies at these intersections, a Traffic Signal Warrant Analysis (TSWA) was performed following the methodology defined in the MUTCD.[19] This analysis indicates that the installation of a traffic control signal is warranted at both intersections under 2019 Existing conditions, again, independent of the Project.

In an effort to assist the Town of Norwell in advancing improvements at the Main Street/ South Street and Main Street/Prospect Street intersections that are warranted as a result of existing conditions unrelated to the Project, the Project proponent will prepare a FDR that will assess alternative improvement strategies at the intersections and will include conceptual design plans for each alternative. The FDR and conceptual design plans will be provided to the Town of Norwell prior to the issuance of the issuance of a Certificate of Occupancy for the residential component of the Project.

Transportation Demand Management

Regularly scheduled public transportation services are not currently provided within the study area or to the Project site. The Town of Hanover is served by GATRA, which provides demand response (Dial-A-Ride) services for people with disabilities and seniors. In addition, the Hanover Council on Aging (COA) provides transportation services by appointment for doctor's appointments, shopping and errands. In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- The owner or property manager will contact MassRIDES to obtain information on facilitating and encouraging healthy transportation options for residents and employees of the Project, and will become a MassRIDES employer partner;

- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location and/or otherwise made available to residents and employees;

- A "welcome packet" will be provided to new residents and employees detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES' and their Bay State Commute program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;

- Residents and employees will be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;

[19] Ibid 2.

- Pedestrian accommodations have been incorporated within the Project site consisting of sidewalks/walkways linking buildings and parking to on-site amenities, and should be expanded to include a sidewalk connection between the multifamily residential community and Mill Street;

- A mail drop will be provided in a central location within the multifamily residential building; and

- Secure bicycle parking will be provided consisting of: i) exterior bicycle parking conveniently located proximate to building entrances; and ii) weather protected bicycle parking located in secure areas.

In addition, the Project proponent will initiate discussions with the Town of Hanover and GATRA concerning the establishment of fixed-route bus service within the Town. In the interim, space will be reserved within the Project site for a bus stop to serve the commercial and residential components of the Project.

Traffic Monitoring and Reporting Program

The Project proponent will conduct a post-development traffic monitoring program in order to validate the trip projections for the Project and to evaluate the success and refine the elements of the TDM program. The monitoring program will include:

i) Obtaining traffic volume information over a continuous seven day, weeklong period at the driveways serving the Project site;

ii) Performing manual turning movement and vehicle classification counts at the Project site driveway intersections during the weekday morning (7:00 to 9:00 AM), weekday evening (4:00 to 6:00 PM) and Saturday midday (11:00 AM to 2:00 PM) peak periods; and

iii) Evaluating motor vehicle crash data at the Project site driveways intersections with Route 53 and Mill Street.

The monitoring program will commence six (6) months after issuance of the first Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report to be provided to the Town of Hanover and MassDOT within 2-months after the completion of the data collection effort. The report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the Project site driveway intersections; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to single-occupant vehicles by residents and employees of the Project.

If any of the following conditions are documented as a part of the monitoring program: i) the measured traffic volumes exceed the observed traffic volumes that are presented herein by more than 10 percent on a regular and sustained basis during the monitoring period; ii) there is a material increase in the number of motor vehicle crashes occurring at or in immediate vicinity of the Project site driveway intersections that are attributable to the Project; or iii) the overall directional distribution of Project-related traffic as measured at the Project site driveways varies by more than 10 percent from the direction distribution that form the basis of this assessment; the Project proponent will identify and undertake corrective measures in conjunction with the

appropriate parties and subject to receipt of all necessary rights permits and approvals. These measures may include without limitation:

- Traffic signal timing modifications
- Sign and pavement marking improvements
- Wayfinding sign program to encourage regional traffic to use Route 53 (vs. Mill Street and South Street)
- On-site operation and management strategies that are designed to reduce overall and peak traffic volumes and parking demands
- Providing financial incentives for employees to carpool or use alternative modes of transportation to SOVs

The identified corrective measures, if any, will be documented in the transportation monitoring program report, and will identify the appropriate parties responsible for implementation, required approvals, and the timeline for implementation. The status of implementation of the identified improvement measure(s) will be documented in the subsequent monitoring report.

With implementation of the aforementioned recommendations, safe and efficient access will continue to be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.