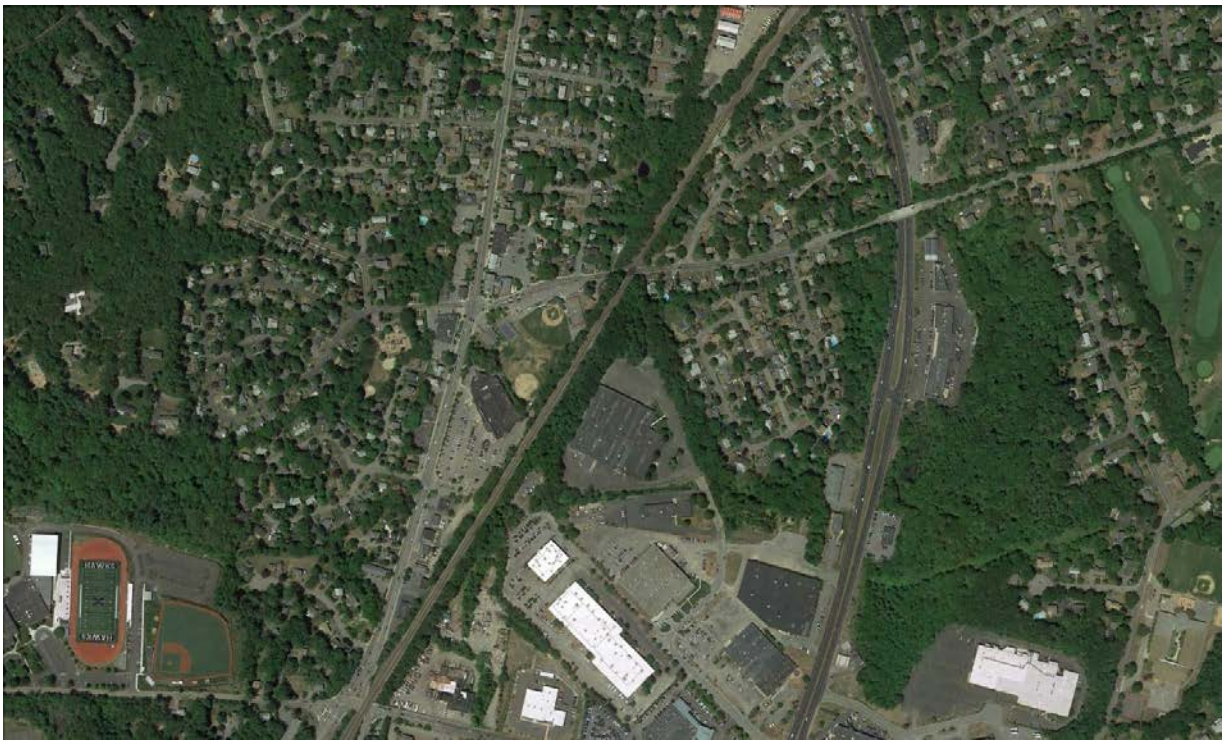
TRAFFIC IMPACT AND ACCESS STUDY



PROPOSED REDEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

PREPARED FOR:

PETRUZZIELLO PROPERTIES

NOVEMBER 2, 2015

PREPARED BY:

BAYSIDE ENGINEERING

600 UNICORN PARK DRIVE
WOBURN, MA 01801

TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED REDEVELOPMENT

301-323 Washington Street
Westwood, Massachusetts

Prepared for:

Petruzziello Properties

November 2, 2015

Prepared by:

Bayside Engineering
600 Unicorn Park Drive
Woburn, MA 01801

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SECTION 1: EXECUTIVE SUMMARY

Bayside Engineering has prepared this study to assess the traffic impact and to evaluate the access requirements of the proposed retail development to be located at 301-323 Washington Street in Westwood, Massachusetts.

This report identifies existing traffic operating parameters on key roadways and intersections within the study area, evaluates the anticipated traffic volume increases as a result of the proposed project, analyzes the project's traffic-related impacts, determines the projects access/egress requirements and identifies appropriate mitigating measures designed to minimize the traffic-related impacts created by the project. The following provides a brief summary of the study findings.

PROJECT DESCRIPTION

The development is to be located along the west side of Washington Street south of School Street in Westwood, MA. Currently, the site consists of one mixed-use/commercial building with several mixed-use tenants restaurant uses in 11,355 gross square feet (gsf) of space (301-315 Washington Street) and two additional buildings (317 Washington Street which is 2-story commercial building with 2,596 sf of floor area and 323 Washington Street which is a 2-story commercial building with 4,552 sf of floor area). Access to 301-317 Washington Street is currently provided to the site by way of a single driveway to Washington Street and a single driveway to School Street. Access to 323 Washington Street is currently provided to the site by way of a single driveway to Washington Street.

As currently proposed, the project will consist of the 're-facing' 301-315 Washington Street. The commercial buildings at 317 and 323 Washington Street will be removed and a new, 3-story building will be constructed. On the ground floor there will be 3,552 gsf of commercial space and 16 apartment units on the remaining two floors. Access to the site will continue to be provided by way of the existing driveway to Washington Street and the School Street driveway will be modified to permit exiting movements only. Figure 1 shows the site location in relation to the surrounding area.

Figure 1
Site Location Map

STUDY METHODOLOGY

This study has been prepared in three stages. The first stage involved an assessment of existing conditions within the study area and included an inventory of roadway geometrics, pedestrian and bicycle facilities and public transportation services. Existing traffic counts were performed at the study area intersections.

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 proposed project. In accordance with Massachusetts Department of Transportation (MassDOT) guidelines, the year 2022 was selected as the basis for modeling future transportation impacts of the proposed development to reflect a the opening year conditions and a five-year planning horizon.

The third stage of the study presents and evaluates measures to address traffic issues, if any, and necessary improvements to accommodate the development.

STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- Washington Street, School Street and East Street
- Washington Street and existing site driveways
- School Street and existing site driveways
- Washington Street and Brookfield Road
- Washington Street and Roche Brothers exit

EXISTING CONDITIONS

Evaluation of existing conditions within the study area includes a description of roadway geometrics, traffic constraints, land uses at the intersections, and quantification of traffic volumes.

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in October 2015. Peak-period turning movement counts were conducted during the weekday morning period (7:00 to 9:00 AM) and the weekday evening peak period (4:00 to 6:30 PM). Daily traffic counts were conducted on Washington Street for a two day period using automatic traffic recorders (ATR).

The traffic-volume data gathered as part of this study was collected during the month of October 2015. Data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. Based upon available data, October volumes are slightly higher than average month conditions. To be conservative, no downward adjustment has been made.

Washington Street, south of School Street was recorded to carry approximately 23,400 vehicles per day (vpd). School Street, west of Washington Street was recorded to carry approximately 4,000 vpd.

Motor Vehicle Crash Data

Motor vehicle crash data for the study area intersections and roadways were obtained from MassDOT from 2009 to 2013. The motor vehicle crash data was reviewed to determine crash trends in the study area. Twenty-three (23) crashes were reported during the five year interval at the study area intersections. Over the 5 year period, sixteen (16) crashes were reported at Washington Street and School Street/East Street (average of 3.2 crashes per year) and seven (7) crashes at Washington Street and Brookfield Road (average of 1.4 crashes per year). No fatalities were reported.

PROBABLE IMPACTS OF THE PROJECT

No-Build Traffic Volumes

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2022. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2022. A four (4.0) percent compounded growth rate was used to develop future No-Build conditions to conform to Town of Westwood Planning Board's *Rules and Regulations*. One background project was also identified (proposed assisted living facility in Norwood, MA) and their estimated traffic was included in the future No-Build and Build projections.

Build Traffic Volumes

Site generated traffic was based on trip-generation data published by the ITE *Trip Generation* manual[1]. The proposed site redevelopment is expected to include the following:

- 3,552 gsf commercial space
- 16 apartments

Trip generation data for Land Use Codes (LUC) 220 – Apartments and LUC 820 – Shopping Center were reviewed.

During an average weekday, the proposed project is expected to generate a total of 334 *new* vehicle trips (167 vehicles entering and 167 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 15 *new* vehicle trips (4 vehicles entering and 11 vehicles exiting) and during the weekday evening peak hour, a total of 32 *new* vehicle trips (21 vehicles entering and 11 vehicles exiting). During the Saturday midday peak hour, the proposed project is expected to generate a total of 39 *new* vehicle trips (21 vehicles entering and 18 vehicles exiting).

TRAFFIC OPERATIONS ANALYSIS

In order to assess the impacts of the proposed project on the roadway network, traffic operations analyses were performed at the study area intersections under 2015 Existing, 2022 No-Build and 2022 Build conditions. These analyses indicate that the proposed project will not result in a significant impact on traffic operations at the study area intersections over No-Build conditions.

[1] *Trip Generation*, Eighth Edition; Institute of Transportation Engineers; Washington, DC; 2009.

RECOMMENDATIONS

The final phase of the analysis process will be to identify the mitigation measures necessary to minimize the impact of the project on the transportation system.

As a result of the additional traffic generation being relatively low, it is not expected that the project will have a significant impact on intersection operations in the study area. However, in order to provide the best circulation on the site, the parking has been designed to modify the existing School Street driveway to permit exiting movements only.

At the existing Washington Street driveway, this driveway should continue to permit entering movements form both directions on Washington Street. The Washington Street driveway should permit right-turns out only.

Crosswalks and ADA compliant pedestrian ramps should be provided across the site driveways.

SUMMARY

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will meet safety standards and have a minimal impact on existing traffic conditions. With the proposed access, in conjunction with the mitigation measures described above and maintaining sight distances from the driveway (clear sight lines along frontage), safe and efficient access can be provided to the clienteles of the proposed project and to the motoring public in the area.

SECTION 2: EXISTING TRAFFIC CONDITIONS

STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- Washington Street, School Street and East Street
- Washington Street and existing site driveways
- School Street and existing site driveways
- Washington Street and Brookfield Road
- Washington Street and Roche Brothers exit

FIELD SURVEY

A comprehensive field inventory of the proposed site was conducted in October 2015. The inventory included collection of existing roadway geometrics, traffic volumes, and safety data for the existing study area intersections and site access driveway locations. Traffic volumes were measured by means of automatic traffic recorder (ATR) counts and substantiated by manual turning movement counts (TMCs) conducted at the study area intersections.

GEOMETRICS

Primary study area roadways are described below.

Roadways

Washington Street (Route 1A)

Washington Street is an Urban Minor Arterial roadway extending in a generally north/south direction. The roadway is primarily under the jurisdiction of the Massachusetts Department of Transportation (MassDOT). However, within the study area, Washington Street is under the jurisdiction of the Town of Westwood. Washington Street provides two travel lanes in each direction separated by a double-yellow centerline. Additional turn lanes provided at key intersections. Land use along Washington Street in the study area is a mix of retail and commercial properties. Sidewalks are provided on the both sides of the Washington Street.

School Street

School Street is a local street extending in an east/west direction north of the site. School Street is under the Town of Westwood jurisdiction. School Street provides one travel lane per direction, separated by a double yellow centerline. Sidewalks are provided along both sides of the road in the vicinity of the site. Land use along School Street is a mix of retail/commercial uses near Washington Street and residential west of the site.

Intersections

Washington Street, East Street and School Street

This signalized intersection is under the jurisdiction of the Town of Westwood. Washington Street forms the north and south legs of the intersection and East Street forms the east leg and School Street forms the west leg. The Washington Street approaches each consist of two lanes permitting left or right turns. The westbound East Street approach consists of an exclusive left-turn lane and a shared through/right-turn lane. The eastbound School Street approach consists of a single lane approach permitting all movements. Parking is permitted along the west side of Washington Street south of the intersection. Sidewalks are present on all approaches to the intersection. Crosswalks are provided across all approaches of the intersection with push button pedestrian actuation. Land use at the intersection consists of a mix of retail/commercial uses and the Westwood Fire Station (currently under construction).

School Street and Site Driveway

This unsignalized intersection is under the jurisdiction of the Town of Westwood. School Street forms the east and west legs of the intersection and the existing site driveway forms the south leg. The School Street approaches each consist of a single lane

permitting left- or right-turns. The northbound driveway approach consists of a wide lane used for left- or right-turns. Perpendicular parking is provided along the south side of School Street between the site driveway and Washington Street. Sidewalks are present on both sides of School Street at the intersection. The driveway operates under STOP-like control. Land use at the intersection consists of a mix of retail/commercial uses and residential homes.

Washington Street and Site Driveway

This unsignalized intersection under the jurisdiction of the Town of Westwood. Washington Street forms the north and south legs of the intersection and the existing site driveway forms the west leg. The Washington Street approaches each consist of two lanes permitting left- or right-turns. The eastbound driveway approach consists of a single lane used for left- or right-turns. Sidewalks are present on both sides of Washington Street at the intersection. The driveway operates under STOP-like control. Land use at the intersection consists of a mix of retail/commercial uses and the existing site.

Washington Street, Roche Brothers Exit and 327 Washington Street Driveway

This unsignalized intersection is under the jurisdiction of the Town of Westwood. Washington Street forms the north and south legs of the intersection and the existing Roche Brothers driveway forms the east leg and the driveway to #327 Washington Street forms the west leg. The Washington Street approaches each consist of two lanes permitting left- or right-turns. The westbound Roche Brothers driveway approach consists of a single lane used for right-turns only. The eastbound #327 Washington Street driveway approach consists of a single lane used for left- or right-turns only Sidewalks are present on both sides of Washington Street at the intersection. The driveways operate under STOP-like control. Land use at the intersection consists of a mix of retail/commercial uses and the existing site.

Washington Street, Brookfield Road and Roche Brothers Driveway

This signalized intersection is under the jurisdiction of the Town of Westwood. Washington Street forms the north and south legs of the intersection and the Roche Brothers driveway forms the east leg and Brookfield Road forms the west leg. The Washington Street approaches each consist of two lanes permitting left or right turns. The westbound Roche Brothers driveway approach consists of an exclusive left-turn lane and a shared through/right-turn lane. The eastbound Brookfield Road approach consists of a single lane approach permitting all movements. Sidewalks are present on the Washington Street approaches to the intersection. Crosswalks are provided across all approaches of the intersection except the Washington Street northbound approach with push button pedestrian actuation. Land use at the intersection consists of a mix of retail/commercial uses and a residential home.

TRAFFIC VOLUMES

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in October 2015. Peak-period turning movement counts were conducted on Thursday, October 15, 2015 during the weekday morning and evening peak periods (7:00 to 9:00 AM and 4:00 to 6:00 PM) and on Saturday October 17, 2015 (10:30 AM to 1:30 PM) at the following intersections:

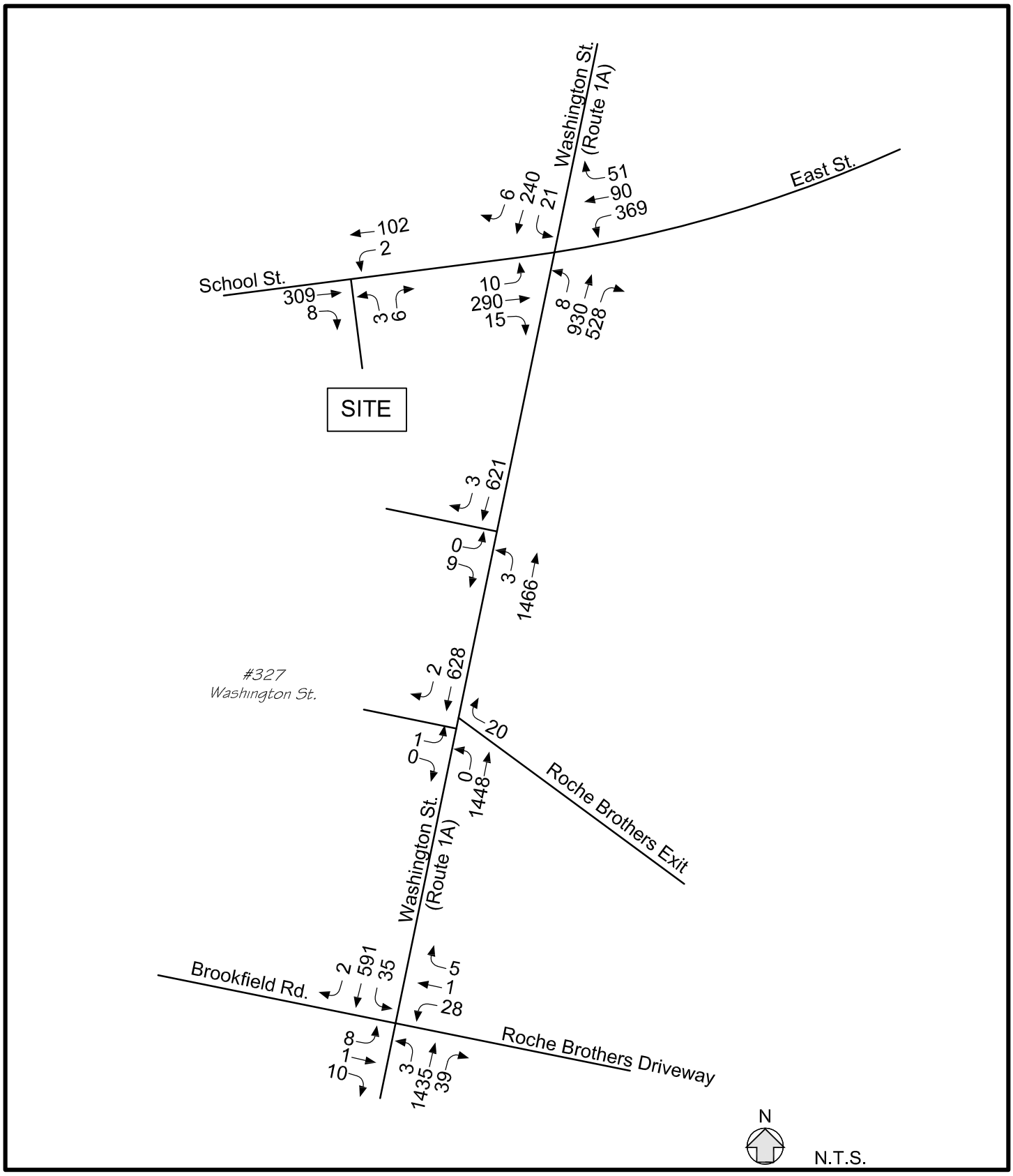
- Washington Street, School Street and East Street
- Washington Street and existing site driveways
- School Street and existing site driveways
- Washington Street and Brookfield Road
- Washington Street and Roche Brothers exit

Daily traffic counts were conducted on Washington Street and School for a two day period using automatic traffic recorders (ATR).

Analysis of the peak-period traffic counts indicated that the weekday morning commuter peak hour generally occurs between 7:15 AM and 8:15 AM and the weekday evening commuter peak generally hour occurs between 5:00 and 6:00 PM. The Saturday midday peak hour generally occurs between 12:30 and 1:30 PM. The traffic count worksheets are provided in the Appendix.

Seasonal Adjustment

The traffic-volume data gathered as part of this study was collected during the month of October 2015. Data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. The traffic data showed October volumes to be slightly higher than average month conditions. Therefore, to be conservative, the October traffic volumes were not adjusted and were used to represent average month conditions. The 2015 existing weekday daily and peak-hour traffic volumes for average-month conditions are summarized below in Table 1. The 2015 Existing weekday morning, weekday evening and Saturday midday peak hour traffic flow networks are shown graphically on Figures 2, 3 and 4, respectively. The seasonal worksheets are provided in the Appendix.



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PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 2

2015 Existing
Weekday Morning
Peak Hour Traffic Volumes

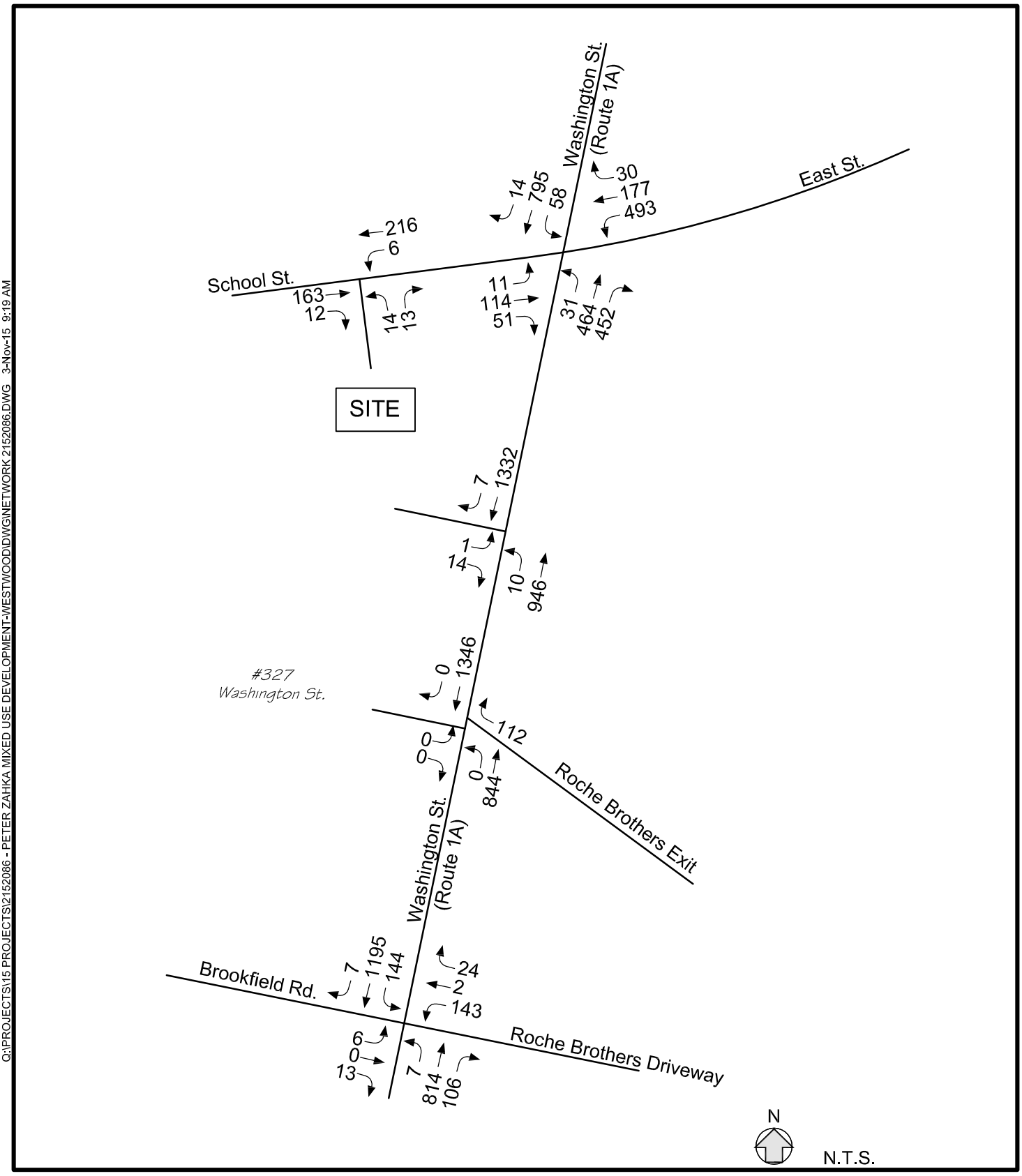

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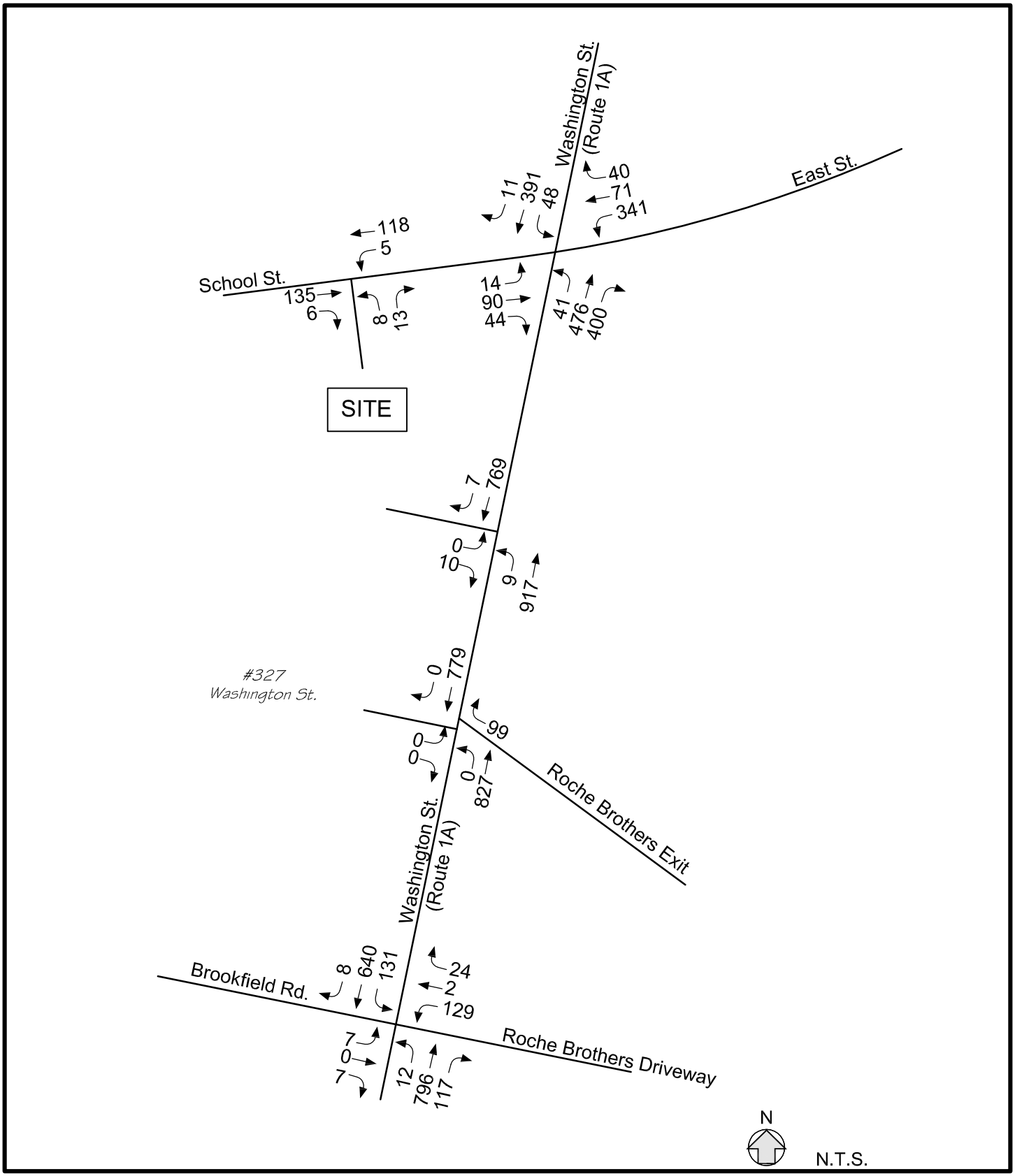
Figure 3

2015 Existing
Weekday Evening
Peak Hour Traffic Volumes



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PROPOSED MIXED-USE DEVELOPMENT
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Figure 4

2015 Existing
Saturday Midday
Peak Hour Traffic Volumes

TABLE 1
EXISTING WEEKDAY TRAFFIC-VOLUME SUMMARY[a]

Location	Daily Traffic Volume[b]	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume[c]	K Factor[d]	Directional Distribution[e]	Traffic Volume	K Factor	Directional Distribution
Washington Street, south of East Street	23,400	2,076	8.9	69.7% NB	2,190	9.4	61.5% SB
School Street, east of Washington Street	4,000	422	10.6	75.1% EB	405	10.1	56.8% WB

[a]Two-way traffic volume.
[b]Daily traffic expressed in vehicles per day.
[c]Expressed in vehicles per hour.
[d]Percent of daily traffic volumes which occurs during the peak hour.
[e]Percent of peak-hour volume in the predominant direction of travel.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

Washington Street, south of School Street was recorded to carry approximately 23,400 vehicles per day (vpd). During the weekday morning peak hour, approximately 2,076 vehicles per hour (vph) were recorded on Washington Street and during the weekday evening peak hour, 2,190 vph were recorded. During the Saturday midday peak hour, 1,606 vph were recorded.

School Street, west of Washington Street was recorded to carry approximately 4,000 vpd. During the weekday morning peak hour, approximately 422 vph were recorded on Washington Street and during the weekday evening peak hour, 405 vph were recorded. During the Saturday midday peak hour, 267 vph were recorded.

MOTOR VEHICLE CRASH DATA

Motor vehicle crash data for the study area intersections and roadways were obtained from the MassDOT for 2009 through 2013. The motor vehicle crash data was reviewed to determine crash trends in the study area. Twenty-three (23) crashes were reported during the five year interval. The crash data is included in the Appendix. The crash data is summarized in Table 2.

Most of the crashes occurred at the intersection of Washington Street, East Street and School Street (sixteen crashes). Of these crashes, five were rear-end type collisions, five were angle collisions and five were side-swipe collisions. None of the intersections experienced a significant crash rate.

TABLE 2
MOTOR VEHICLE CRASH DATA SUMMARY[a]

Scenario	Location: Washington Street/East Street/School Street	Location: Washington Street/Brookfield Road/Roche Brothers Driveway
Year[b]:		
2009	2	2
2010	4	1
2011	3	1
2012	2	1
2013	5	2
Total	16	7
Average[b]	5.2	1.4
Crash Rate[c]	0.35	0.17
Significant[d]	No	No
Type:		
Angle	5	6
Rear-End	5	0
Sideswipe	5	0
Head-On	1	0
Bicycle	0	0
Single Vehicle Crash	0	1
Unknown	0	0
Total	16	7
Time of Day:		
Morning (7:00 to 9:00 AM)	1	2
Evening (4:00 to 6:00 PM)	3	1
Remainder of Day	12	4
Total	16	7
Pavement Conditions:		
Dry	13	7
Wet	3	0
Snow/Ice/Slush	0	0
Unknown	0	0
Total	16	7
Severity:		
Property Damage Only	13	4
Personal Injury	3	3
Fatal Accident	0	0
Unknown	0	0
Total	16	7

[a]Source: MassDOT.
[b]Average crashes over analysis period.
[c]Crash rate per million entering vehicles (mev).
[d]Signalized intersections are significant if rate >0.76 crashes per million vehicles, and unsignalized intersections are significant if rate >0.58 crashes per million vehicles.

PUBLIC TRANSPORTATION

Public transportation services are provided within the study area by the Massachusetts Bay Transportation Authority (MBTA). The MBTA operates Bus service through Westwood on Washington Street (Bus Route 34E). Route 34E serves Forest Hills Station to the north to Walpole Center to the south. The closest bus stop to the Project on the Route 34E bus line is located at the intersection of Washington Street and School Street. Route 34E bus service is provided Monday through Friday from approximately 4:55 AM to 1:15 AM, on Saturday from approximately 5:36 AM to 1:43 AM, and on Sunday from approximately 6:20 AM to 1:15 AM.

PLANNED ROADWAY IMPROVEMENTS

Officials for the Town of Westwood were contacted regarding roadway improvements planned for the study area intersections. No capacity related improvements are currently planned.

As part of the on-going Westwood Fire Station project, minor changes are proposed for the signalization at the intersection of Washington Street, East Street and School Street and are related to fire station operations. The crosswalk across the Washington Street northbound approach is also being relocated slightly to the south. A copy of the relevant signal plan is included in the Appendix.

One other project has been identified and is the widening of the East Street bridge. No schedule has been identified. This project will include the widening of East Street to increase lane width on East Street.

SECTION 3:
FUTURE NO-BUILD AND BUILD TRAFFIC CONDITIONS

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2022. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2022. Consideration of these factors resulted in the development of 2022 No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic flow networks to develop the 2022 Build conditions.

FUTURE 2022 NO-BUILD TRAFFIC VOLUMES

Traffic growth on area roadways is a function of the expected land development in the immediate area as well as 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 produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations and historic traffic counts in the area were reviewed in order to determine traffic growth trends. Based on a review of this data, it was determined that traffic volumes within the study area have shown little growth or generally decreased over the past several years.

However, in order to conform to Town of Westwood Planning Board's *Rules and Regulations*, a four percent (4%) annual background growth rate was used to develop the future traffic volume baseline projections. This four percent (4%) annual background growth rate is significantly higher than the actual growth that the roadways and intersections have experienced recently. The four percent (4%) annual background growth rate is not likely to be realized and the future traffic volume projections presented in the final study will be very conservative and represent a "worst case" scenario.

Specific Development by Others

Traffic volumes generated by the specific local developments by others were included in the 2022 No-Build condition. The Town of Westwood was contacted to identify specific planned developments. Based on these discussions, there is one project that could impact future volumes. This is an assisted living facility on Clapboardtree Street in Norwood, MA. Traffic volume projections were obtained from the traffic data submitted as part of the project's application and is included in the Appendix.

No-Build Condition Traffic Volumes

The 2022 No-Build weekday morning, weekday evening and Saturday midday peak-hour traffic volumes were developed by applying a compounded four (4.0) percent annual growth rate to the 2015 Existing through peak-hour traffic volumes and adding traffic from the identified background project. Figures 5, 6 and 7 show the projected 2022 No-Build peak hour traffic volumes for the respective weekday morning, weekday evening and Saturday midday peak-hours.

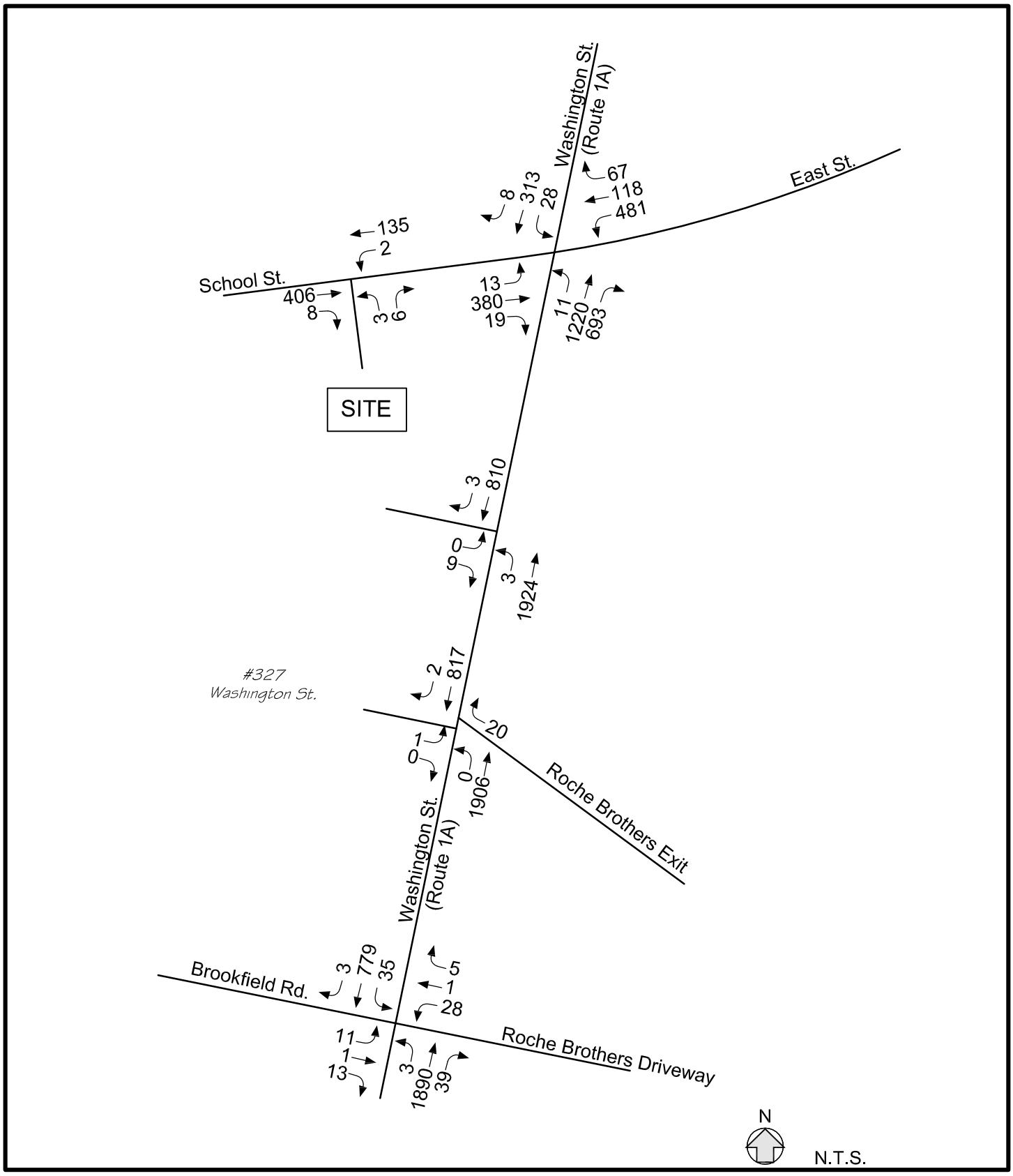

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Figure 5

2022 No-Build
Weekday Morning
Peak Hour Traffic Volumes

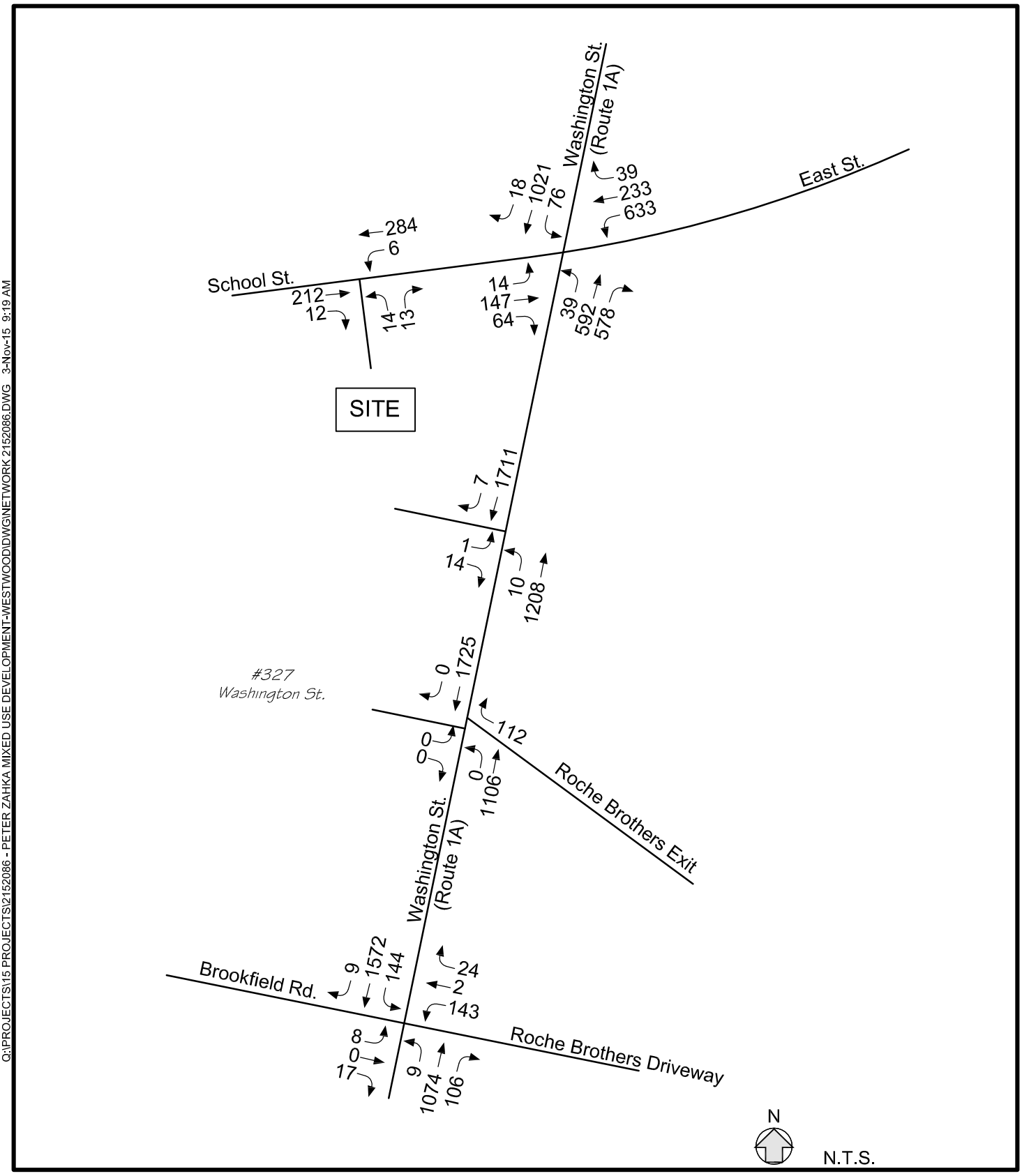

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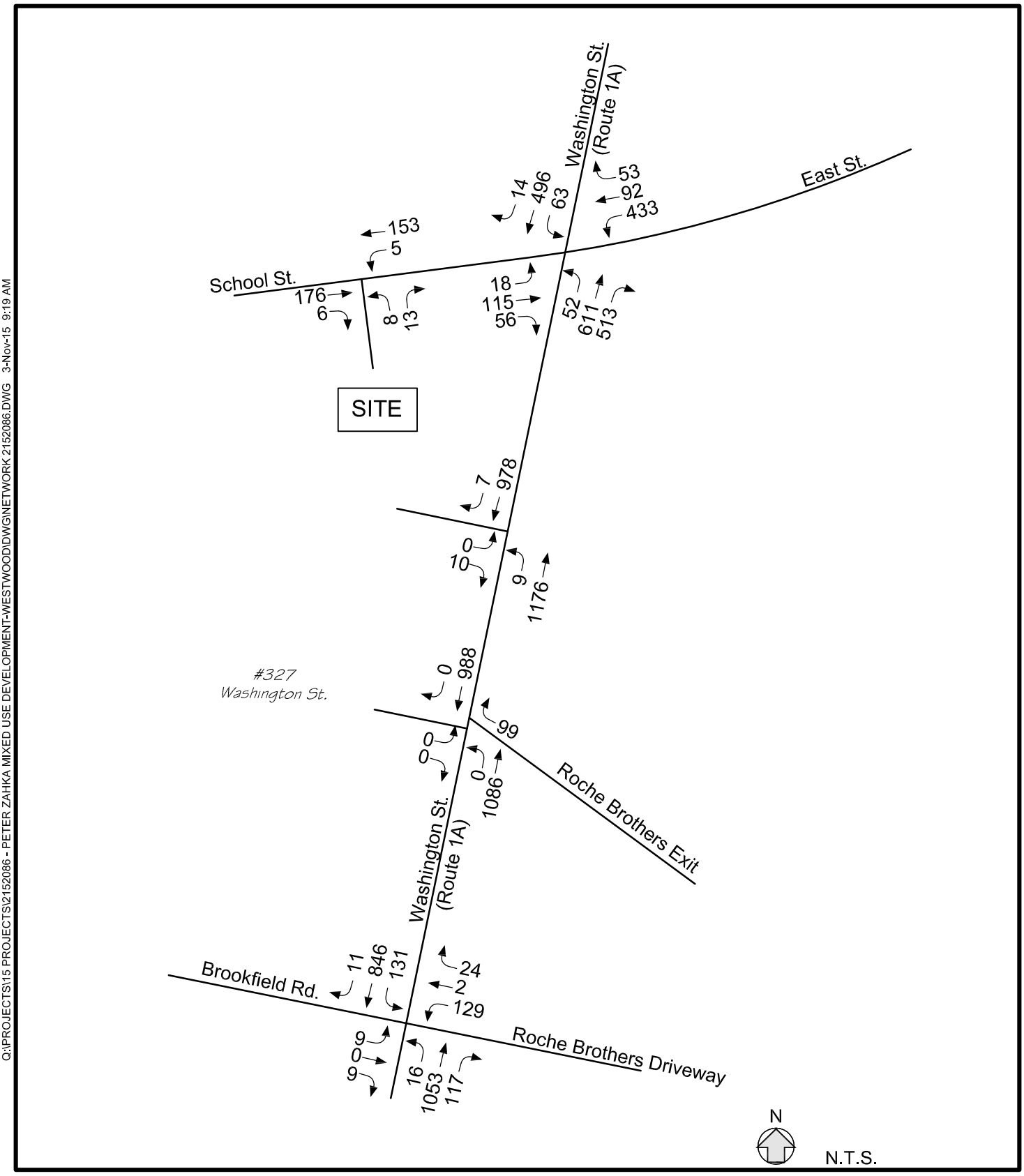
Figure 6

2022 No-Build
Weekday Evening
Peak Hour Traffic Volumes



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PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 7

2022 No-Build
Saturday Midday
Peak Hour Traffic Volumes

FUTURE 2017 BUILD CONDITIONS

Project Description

As currently proposed, the project will consist of the 're-facing' 301-315 Washington Street. The commercial buildings at 317 and 323 Washington Street will be removed and a new, 3-story building will be constructed. On the ground floor there will be 3,552 gsf of commercial space and 16 apartment units on the remaining two floors. Access to the site will continue to be provided by way of the existing driveway to Washington Street and the School Street driveway will be modified to permit exiting movements only. Access to the site will be provided by way of the existing driveway to Washington Street and the existing School Street driveway will be modified to permit exiting movements only.

Site Traffic Generation

The proposed site redevelopment is expected to include the following:

- 3,552 gsf commercial space
- 16 apartments

Site generated traffic for the redevelopment was based on trip-generation data published by the Institute of Transportation Engineers (ITE) in the *Trip Generation* manual[2]. Trip generation data for Land Use Codes (LUC) 220 – Apartments and LUC 820 – Shopping Center were reviewed. The preliminary trip generation for the project is summarized in Table 3.

[2] *Trip Generation*, Ninth Edition; Institute of Transportation Engineers; Washington, DC; 2012.

TABLE 3
TRIP-GENERATION SUMMARY

	Proposed Commercial Space[a]	Proposed Apartments[b]	Proposed Project
Daily	152	220	372
Weekday Morning Peak Hour:			
Entering	2	2	4
Exiting	1	10	11
Total	3	12	15
Weekday Evening Peak Hour:			
Entering	6	17	23
Exiting	7	9	13
Total	13	26	36
Saturday	178	102	280
Saturday Midday Peak Hour:			
Entering	9	14	23
Exiting	8	12	20
Total	17	26	43

[a]Based on ITE LUC 820, Shopping Center; 3,552 sf.
[b]Based on ITE LUC 220, Apartments; 16 units.

Not all of the trips expected to be generated by the proposed development will represent new trips on the study area roadway system. According to the ITE Trip Generation Handbook, a portion of these trips can be considered pass-by trips. That is, they are not considered primary trips of site generated traffic, but consist of vehicles passing by the site on their way to another destination. For mixed-use uses, the ITE Trip Generation Handbook estimates that on average, pass-by trips can account for approximately 26 to 34 percent of the peak hour trip generation. To remain conservative and consistent with MassDOT guidelines, a 25 pass-by credit was taken for the commercial trips only. Table 4 summarizes the pass-by and net new trips.

TABLE 4
TRIP-GENERATION SUMMARY WITH PASS-BY TRIPS

	Proposed Project[a]	Pass-By Trips	Net New Trips
Daily	372	38	334
Weekday Morning Peak Hour:			
Entering	4	0	4
Exiting	11	0	11
Total	15	0	15
Weekday Evening Peak Hour:			
Entering	23	2	21
Exiting	13	2	11
Total	36	4	32
Saturday	280	44	236
Saturday Midday Peak Hour:			
Entering	23	2	21
Exiting	20	2	18
Total	43	4	39

[a]From Table 3.

During an average weekday, the proposed project is expected to generate a total of 334 *new* vehicle trips (167 vehicles entering and 167 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 15 *new* vehicle trips (4 vehicles entering and 11 vehicles exiting) and during the weekday evening peak hour, a total of 32 *new* vehicle trips (21 vehicles entering and 11 vehicles exiting). During the Saturday midday peak hour, the proposed project is expected to generate a total of 39 *new* vehicle trips (21 vehicles entering and 18 vehicles exiting).

Trip Distribution

The directional distribution of the vehicular traffic approaching and departing the site is a function of population densities, the location of employment, existing travel patterns, similar uses, and the efficiency of the existing roadway system. Existing traffic flows were reviewed to determine the expected trip distribution pattern. Table 5 summarizes the expected trip distribution.

TABLE 5
PROPOSED TRIP DISTRIBUTION

Route	Direction	Percent of Trips
Washington Street	North	22
Washington Street	South	46
East Street	East	23
School Street	West	9
TOTAL		100

Future Traffic Volumes - Build Condition

The site-generated traffic was distributed within the study area according to the percentages summarized in Table 5. Existing counted driveway volumes were re-assigned as appropriate to reflect the changes in driveway operations. The site generated volumes were then superimposed onto the 2022 No-Build traffic volumes to represent the 2022 Build traffic-volume conditions. The anticipated 2022 Build weekday morning, weekday evening and Saturday midday traffic volumes are graphically presented in Figures 8, 9 and 10. These volumes were used as the basis for all analysis as well as to identify potential mitigation measures to ameliorate the project's impacts.

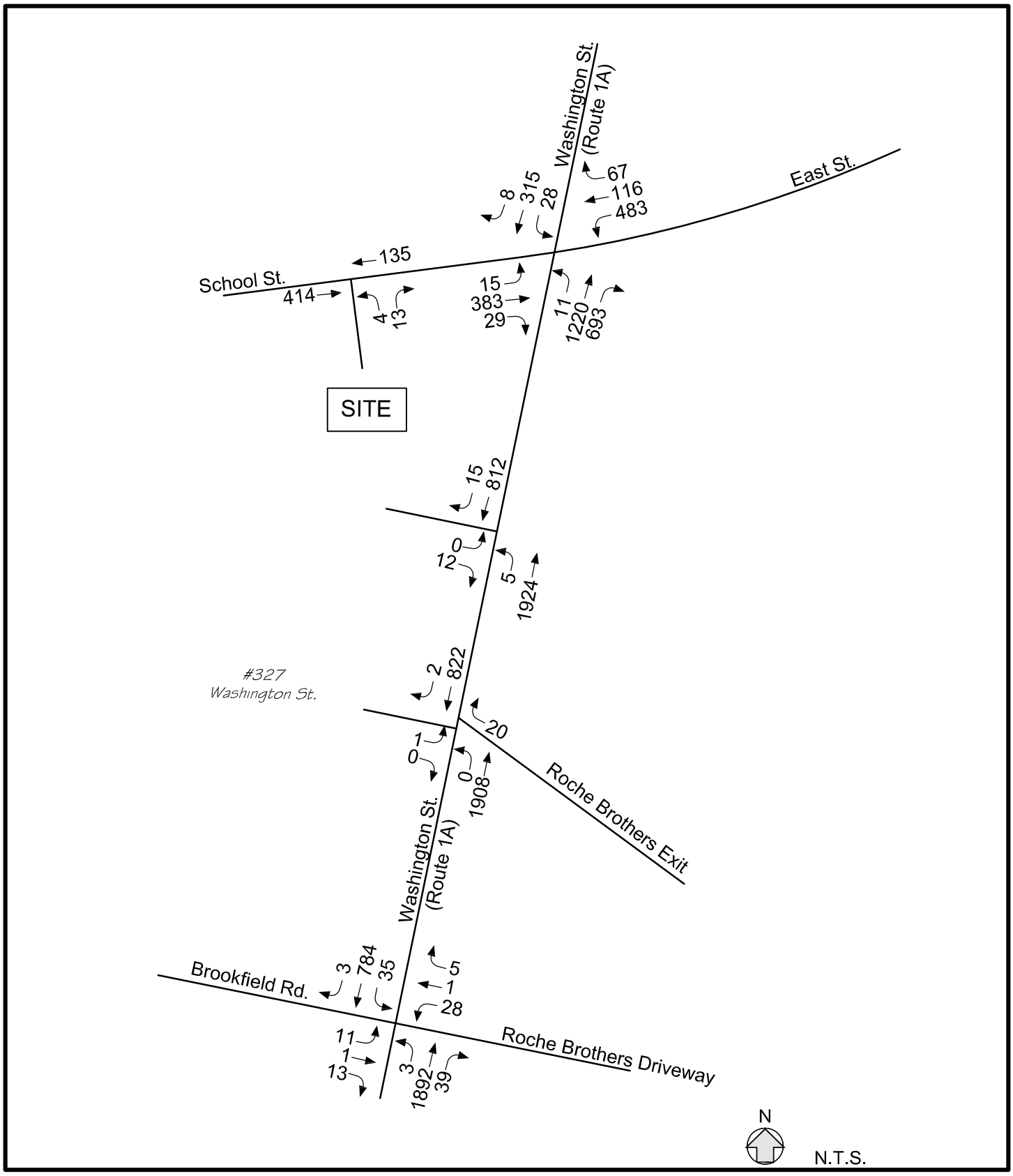
A summary of 2022 peak-hour projected traffic-volume changes in the site vicinity are shown in Table 6. These volumes are based on the expected increases from the site traffic generation.

TABLE 6
TRAFFIC-VOLUME INCREASES[a]

Location/Peak Hour	2022 No-Build	2022 Build	Volume Increase over No-Build	Percent Increase over No-Build
Washington Street, north of East Street				
Weekday Morning	1,649	1,653	4	0.2
Weekday Evening	1,760	1,766	6	0.3
Saturday Midday	1,255	1,264	9	0.7
School Street, west of site				
Weekday Morning	552	553	1	0.2
Weekday Evening	522	525	3	0.6
Saturday Midday	343	347	4	1.2
East Street, east of Washington Street				
Weekday Morning	1,767	1,770	3	0.2
Weekday Evening	1,706	1,714	8	0.5
Saturday Midday	1,269	1,277	8	0.6
Washington Street, south of Brookfield Road				
Weekday Morning	2,752	2,759	7	0.3
Weekday Evening	2,921	2,936	15	0.5
Saturday Midday	2,170	2,188	18	0.8

[a]All volumes are vehicles per hour, total of both directions.

As shown in Table 6, project-related increases are in the range of 1 to 18 bi-directional vehicles during the peak hours. This is approximately equivalent to one additional vehicle every Six minutes or less per direction on average during the peak hours.



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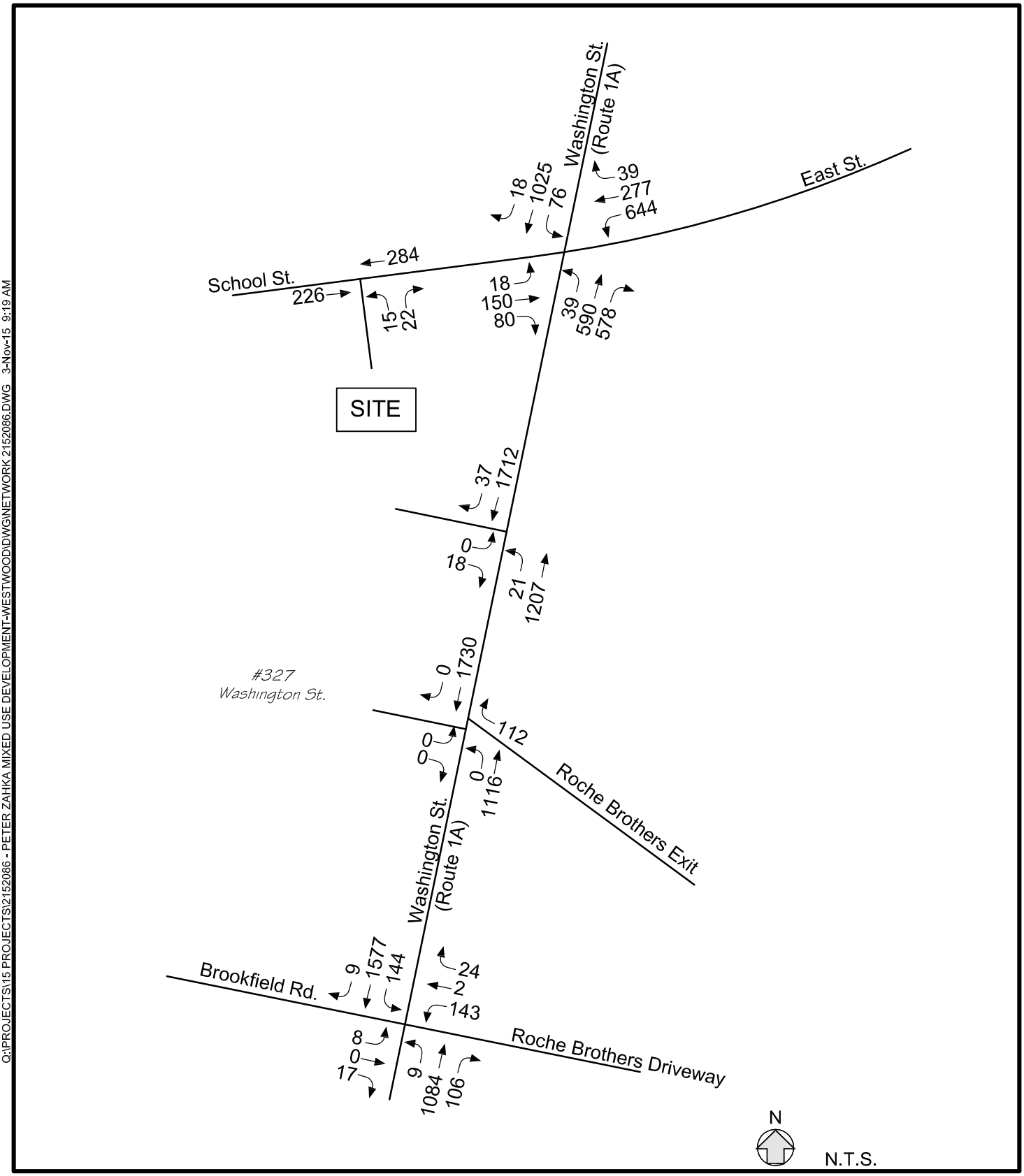
PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 8

2022 Build
Weekday Morning
Peak Hour Traffic Volumes



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PROPOSED MIXED-USE DEVELOPMENT
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Figure 9

2022 Build
Weekday Evening
Peak Hour Traffic Volumes

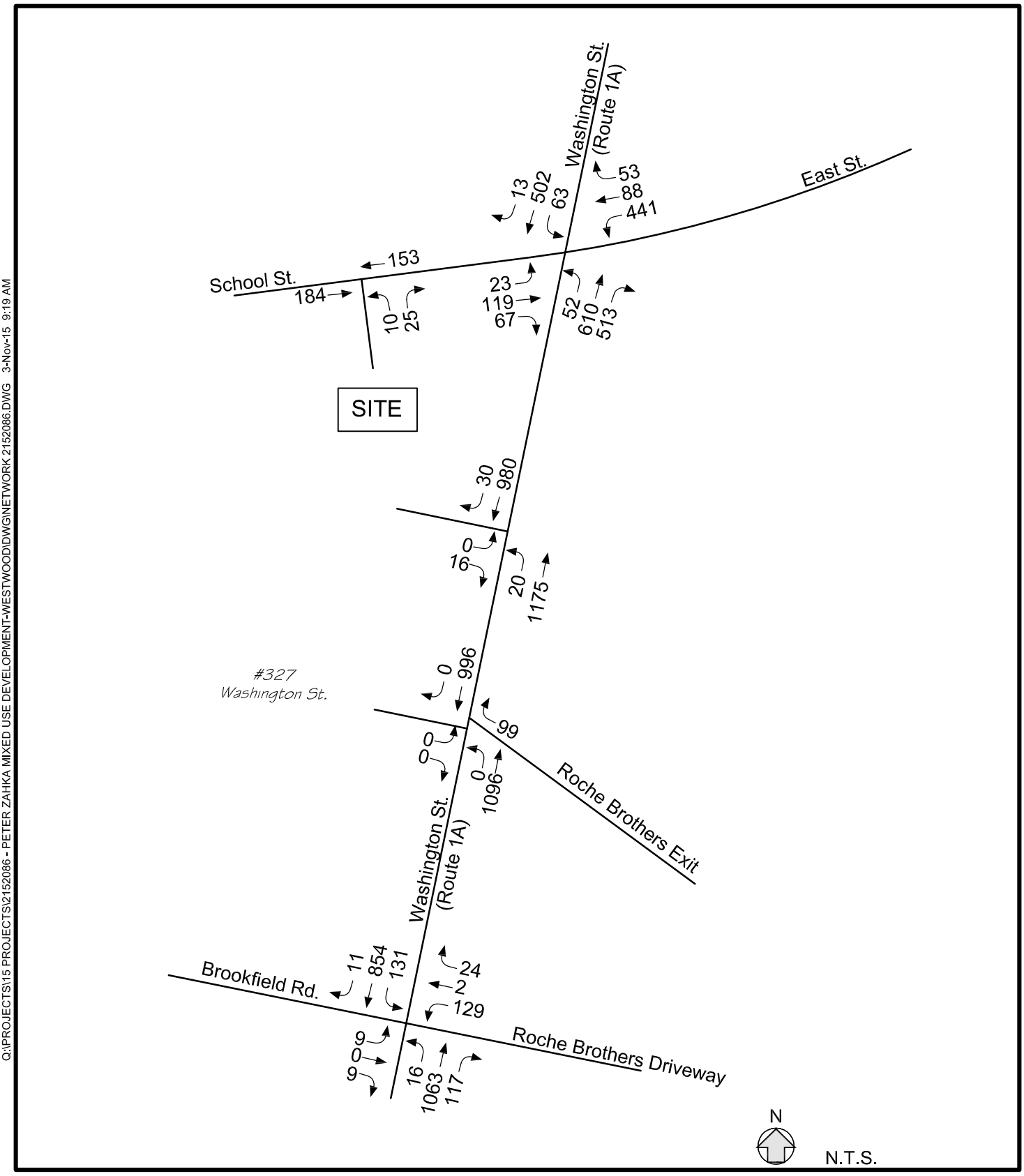

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Figure 10

2022 Build
Saturday Midday
Peak Hour Traffic Volumes

SECTION 4: ANALYSIS

To assess intersection operations, capacity analyses were conducted for Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the study area intersections serve existing and projected traffic volumes. Vehicle queue analyses provide a secondary measure of the operational characteristics of an intersection or section of roadway under study in terms of lane use and demand.

METHODOLOGY

Levels of Service

Level of service (LOS) is a quantitative measure used to describe the operation of an intersection or roadway segment. The level of service definition is described by the quality of traffic flow and is primarily defined in terms of traffic delays. The primary result of capacity analyses[3] is the assignment of a level of service to traffic intersections or roadway segments under various traffic-flow conditions. Six levels of service are defined for traffic intersections and roadway segments. Levels of service range from LOS A to LOS F. LOS A represents very good operating conditions and LOS F represents very poor operating conditions.

Signalized Intersections

Levels of service for signalized intersections are calculated using the methodology and procedures described in the 2010 *Highway Capacity Manual*. The methodology assesses the intersection based on type of signal operation, signal timing and phasing, progression, vehicle mix, and intersection geometrics. Level-of-service designations are based on the delay per vehicle. Table 7 summarizes the relationship between level of service and delay. The calculated delay values result in level-of-service designations which are

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

applied to individual lane groups, to individual intersection approaches, and to the entire intersection. In the 2010 HCM methodology, the critical lane group volume to capacity ratio is reported.

TABLE 7
LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS[a]

Delay per Vehicle (Seconds)	Resulting Level of Service v/c[b] < 1.0	Resulting Level of Service v/c[b] > 1.0
≤10.0	A	F
10.1 to 20.0	B	F
20.1 to 35.0	C	F
35.1 to 55.0	D	F
55.1 to 80.0	E	F
>80.0	F	F

[a]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 18-6.
[b]Volume to capacity ratio.

Unsignalized Intersections

The level of service for an unsignalized intersection is determined by the methodology and procedures described in the 2010 *Highway Capacity Manual.*[4] The level of service for unsignalized intersections is measured in terms of average delay for the critical movements (typically side street turning movements or mainline turning movements). The delay for the critical movements is a function of the available capacity for the movement and the degree of saturation of the lane group containing the critical movement. The delay calculation 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. The definitions for level of service at unsignalized intersections are also provided in the 2010 *Highway Capacity Manual*. Table 8 summarizes the relationship between level of service and average control delay for the critical movements at unsignalized intersections.

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

TABLE 8
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Average Delay (seconds per vehicle)	Resulting Level of Service v/c[b] < 1.0	Resulting Level of Service v/c > 1.0
≤ 10.0	A	F
10.1 to 15.0	B	F
15.1 to 25.0	C	F
25.1 to 35.0	D	F
35.1 to 50.0	E	F
>50.0	F	F

[a]*Highway Capacity Manual*; Transportation Research Board; Elm, DC; 2010; page 19-2
[b]Volume to capacity ratio.

The analytical methodologies used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps. The critical gap is defined as the minimum time between successive main line vehicles for a side street vehicle to execute the appropriate turning maneuver. Actual field observations indicate that drivers on minor streets accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than calculated by the HCM methodology. **The analysis results overstate the actual delays experienced in the field.** It should be noted that the unsignalized intersections along heavily trafficked roadways operate at constrained levels and the resulting calculated results of the unsignalized intersection analyses should be considered highly conservative.

CAPACITY ANALYSIS RESULTS

Level-of-service analyses were conducted for 2015 Existing, 2022 No-Build, and 2022 Build conditions for the intersections within the study area. The results of the 2022 signalized analyses are summarized in Tables 9 and 10 and the unsignalized analyses are summarized in Table 11. Detailed analysis sheets are presented in the Appendix.

TABLE 9
SIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY
WASHINGTON STREET, EAST STREET AND SCHOOL STREET

Signalized Intersection/	2015 Existing			2022 No-Build			2022 Build		
Peak Hour/Lane Group	V/C[a]	Delay[b]	LOS[c]	V/C	Delay	LOS	V/C	Delay	LOS
Weekday Morning									
Eastbound Lt/Th/Rt	0.82	47.0	D	1.09	109.7	F	1.14	126.8	F
Westbound Lt	0.90	39.8	D	1.15	116.1	F	1.15	117.7	F
Westbound Th/Rt	0.19	14.6	B	0.24	14.6	B	0.24	14.6	B
Northbound Lt/Th	1.06	74.0	F	1.38	207.4	F	1.38	207.4	F
Northbound Th/Rt	1.17	118.2	F	1.64	321.9	F	1.64	321.9	F
Southbound Lt/Th	0.29	54.7	D	0.39	61.4	E	0.39	61.4	E
Southbound Th/Rt	0.39	19.6	B	0.52	23.4	C	0.52	23.5	C
Overall	--	**68.8**	**E**	--	**184.5**	**F**	--	**186.6**	**F**
Weekday Evening									
Eastbound Lt/Th/RT	0.67	37.9	D	0.74	41.2	D	0.78	44.1	D
Westbound Lt	0.96	52.7	D	1.29	169.1	F	1.35	194.8	F
Westbound Th/Rt	0.27	15.7	B	0.34	15.9	B	0.33	15.6	B
Northbound Lt/Th	0.96	65.5	E	1.29	183.5	F	1.31	193.0	F
Northbound Th/Rt	1.07	80.8	F	1.51	261.6	F	1.53	273.9	F
Southbound Lt/Th	0.77	92.9	F	1.05	161.4	F	1.06	168.0	F
Southbound Th/Rt	1.17	114.6	F	1.56	284.7	F	1.59	298.7	F
Overall	--	**76.4**	**E**	--	**207.8**	**F**	--	**220.1**	**F**
Saturday Midday									
Eastbound Lt/Th/RT	0.61	36.7	D	0.67	38.0	D	0.70	39.0	D
Westbound Lt	0.78	28.8	C	0.97	54.4	D	1.00	64.4	F
Westbound Th/Rt	0.18	15.8	B	0.22	15.3	B	0.21	15.0	B
Northbound Lt/Th	0.62	19.4	B	0.99	61.3	E	1.02	70.4	F
Northbound Th/Rt	0.65	21.2	C	1.07	80.2	F	1.11	93.2	F
Southbound Lt/Th	0.40	17.0	B	0.84	105.2	F	0.85	108.8	F
Southbound Th/Rt	0.41	15.8	B	0.74	26.7	C	0.76	28.3	C
Overall	--	**21.9**	**C**	--	**54.5**	**D**	--	**62.0**	**E**

[a]Maximum volume-to-capacity ratio.
[b]Delay in seconds per vehicle.
[c]Level of service.
Lt = Left; Th = Through; Rt = Right.

TABLE 10
SIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY
WASHINGTON STREET, BROOKFIELD ROAD AND ROCHE BROTHERS DRIVEWAY

Signalized Intersection/	2015 Existing			2022 No-Build			2022 Build		
Peak Hour/Lane Group	V/C[a]	Delay[b]	LOS[c]	V/C	Delay	LOS	V/C	Delay	LOS
Weekday Morning									
Eastbound Lt/Th/RT	0.15	26.4	C	0.18	26.4	C	0.18	26.4	C
Westbound Lt	0.20	27.8	C	0.20	27.9	C	0.20	27.9	C
Westbound Th/Rt	0.10	26.3	C	0.09	26.0	C	0.09	26.0	C
Northbound Lt/Th	0.55	4.2	A	0.73	6.9	A	0.73	6.9	A
Northbound Th/Rt	0.58	4.6	A	0.77	8.2	A	0.77	8.2	A
Southbound Lt/Th	0.29	2.4	A	0.38	3.1	A	0.38	3.1	A
Southbound Th/Rt	0.30	2.5	A	0.41	3.2	A	0.41	3.2	A
Overall	--	**4.4**	**A**	--	**6.6**	**A**	--	**6.7**	**A**
Weekday Evening									
Eastbound Lt/Th/RT	0.09	23.3	C	0.11	23.4	C	0.11	23.4	C
Westbound Lt	0.54	28.5	C	0.55	29.1	C	0.55	29.1	C
Westbound Th/Rt	0.12	23.4	C	0.12	23.4	C	0.12	23.4	C
Northbound Lt/Th	0.43	5.5	A	0.55	6.7	A	0.55	6.8	A
Northbound Th/Rt	0.45	5.8	A	0.58	7.3	A	0.58	7.3	A
Southbound Lt/Th	0.72	11.7	B	1.11	79.4	F	1.12	83.8	F
Southbound Th/Rt	0.71	9.8	A	0.87	16.4	B	0.87	16.6	B
Overall	--	**10.0**	**B**	--	**28.8**	**C**	--	**29.9**	**C**
Saturday Midday									
Eastbound Lt/Th/RT	0.06	23.5	C	0.08	23.5	C	0.08	23.5	C
Westbound Lt	0.51	27.8	C	0.51	27.9	C	0.51	27.9	C
Westbound Th/Rt	0.13	23.8	C	0.13	23.7	C	0.13	23.7	C
Northbound Lt/Th	0.40	5.0	A	0.52	6.1	A	0.52	6.2	A
Northbound Th/Rt	0.42	5.2	A	0.54	6.6	A	0.55	6.6	A
Southbound Lt/Th	0.45	7.4	A	0.60	11.8	B	0.60	12.0	B
Southbound Th/Rt	0.48	5.7	A	0.65	8.1	A	0.65	8.2	A
Overall	--	**7.7**	**A**	--	**9.2**	**A**	--	**9.2**	**A**

[a]Maximum volume-to-capacity ratio.
[b]Delay in seconds per vehicle.
[c]Level of service.
Lt = Left; Th = Through; Rt = Right.

TABLE 11
UNSIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY

Critical Movement/ Peak Hour	2015 Existing				2022 No-Build				2022 Build			
	Demand[a]	V/C[b]	Delay[c]	LOS[d]	Demand	V/C	Delay	LOS	Demand	V/C	Delay	LOS
School Street and Site Driveway												
All movements from driveway:												
Weekday Morning	9	0.04	10.9	B	9	0.05	12.0	B	17	0.10	12.2	B
Weekday Evening	27	0.06	10.7	B	27	0.07	11.6	B	37	0.09	11.4	B
Saturday Midday	21	0.04	9.8	A	21	0.04	10.3	B	35	0.06	10.3	B
Washington Street and Site Driveway												
All movements from driveway:												
Weekday Morning	9	0.02	10.9	B	9	0.02	11.9	B	12	0.03	12.1	B
Weekday Evening	15	0.11	20.2	C	15	0.19	34.4	D	18	0.12	20.0	C
Saturday Midday	10	0.03	11.4	B	10	0.04	12.6	B	16	0.07	12.9	B
Washington Street and Roche Brothers Exit												
All movements from exit:												
Weekday Morning	20	0.10	16.7	C	20	0.15	23.0	C	20	0.15	23.0	C
Weekday Evening	112	0.29	14.8	B	112	0.37	18.9	C	112	0.37	19.1	C
Saturday Midday	99	0.21	13.0	B	99	0.26	15.4	C	99	0.26	15.5	C

[a]Demand of critical movements in vehicles per hour.
[b]Volume-to-capacity ratio.
[c]Delay in seconds per vehicle.
[d]Level of service.
[e]Delay not representative of actual conditions when v/c is greater than 1.00.

Washington Street, East Street and School Street

Under 2015 Existing weekday morning peak hour conditions, this signalized intersection currently is modeled to operate at level of service (LOS) E and at LOS E during the weekday evening peak hour. During the Saturday midday peak hour, this signalized intersection is modeled to operate at LOS C. These results generally confirm existing peak hour observations. During the morning peak hour, long queues were observed on Washington Street northbound and during the evening peak hour long vehicle queues were observed on Washington Street southbound.

Under future 2022 No-Build conditions, this intersection is projected to conservatively operate at LOS F during the weekday morning peak hour, at LOS F during the weekday evening peak hour and at LOS D during the Saturday midday peak hour. Under 2022 Build conditions, with the project, the intersection is projected to conservatively operate at LOS F during the weekday morning peak hour, at LOS F during the weekday evening peak hour and at LOS E during the Saturday midday peak hour.

School Street and Site Driveway

Under 2015 Existing weekday morning conditions, the critical movements at this unsignalized intersection (all movements out of the driveway) are modeled to operate at LOS B and at LOS B during the weekday evening peak hour. During the Saturday midday peak hour, these critical movements are projected to operate at LOS A. Under future 2022 No-Build conditions, the critical movements are projected to operate at LOS B during the weekday morning peak hour, at LOS B during the weekday evening peak hour and at LOS B during the Saturday midday peak hour. Under 2022 Build conditions, with the project, the critical movements are projected to operate at LOS B during the weekday morning peak hour, at LOS B during the weekday evening peak hour and at LOS B during the Saturday midday peak hour.

Washington Street and Site Driveway

Under 2015 Existing weekday morning conditions, the critical movements at this unsignalized intersection (all movements out of the driveway) are modeled to operate at LOS B and at LOS C during the weekday evening peak hour. During the Saturday midday peak hour, these critical movements are projected to operate at LOS B. Under future 2022 No-Build conditions, the critical movements are projected to operate at LOS B during the weekday morning peak hour, at LOS D during the weekday evening peak hour and at LOS B during the Saturday midday peak hour. Under 2022 Build conditions, with the project, the critical movements are projected to operate at LOS B during the weekday morning peak hour, at LOS C during the weekday evening peak hour and at LOS B during the Saturday midday peak hour.

Washington Street and Roche Brothers Exit Driveway

Under 2015 Existing weekday morning conditions, the critical movements at this

unsignalized intersection (all movements out of the driveway) are modeled to operate at LOS C and at LOS B during the weekday evening peak hour. During the Saturday midday peak hour, these critical movements are projected to operate at LOS B. Under future 2022 No-Build conditions, the critical movements are projected to operate at LOS C during the weekday morning peak hour, at LOS C during the weekday evening peak hour and at LOS C during the Saturday midday peak hour. Under 2022 Build conditions, with the project, the critical movements are projected to operate at LOS C during the weekday morning peak hour, at LOS C during the weekday evening peak hour and at LOS C during the Saturday midday peak hour.

Washington Street, Brookfield Road and Roche Brothers Driveway

Under 2015 Existing weekday morning conditions, this signalized intersection currently is modeled to operate at level of service (LOS) A and at LOS B during the weekday evening peak hour. During the Saturday midday peak hour, this signalized intersection is modeled to operate at LOS A. Under future 2022 No-Build conditions, this intersection is projected to conservatively operate at LOS A during the weekday morning peak hour, at LOS C during the weekday evening peak hour and at LOS A during the Saturday midday peak hour. Under 2022 Build conditions, with the project, the intersection is projected to conservatively operate at LOS A during the weekday morning peak hour, at LOS C during the weekday evening peak hour and at LOS A during the Saturday midday peak hour.

SECTION 5: RECOMMENDATIONS AND CONCLUSION

RECOMMENDATIONS

The final phase of the analysis process is to identify the mitigation measures necessary to minimize the impact of the project on the transportation system. The proponent has made a commitment to implement the mitigation measures listed below.

The capacity analyses performed for the unsignalized study area intersections indicate that generally, the new project trips will not significantly impact intersection operations. There is no reduction in levels of service at the study area intersections (except for the proposed site driveways).

As a result of the additional traffic generation being relatively low, it is not expected that the project will not have a significant impact on intersection operations in the study area. However, in order to provide the best circulation on the site, the parking has been designed to modify the existing School Street driveway to permit exiting movements only.

At the existing Washington Street driveway, this driveway should continue to permit entering movements form both directions on Washington Street. The Washington Street driveway should permit right-turns out only.

Crosswalks and ADA compliant pedestrian ramps should be provided across the site driveways.

CONCLUSION

Review of the proposed project and the access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will meet safety standards and have a minimal impact on existing traffic conditions. With the proposed access, in conjunction with the mitigation measures described above and maintaining sight distances from the driveway (clear sight lines along frontage), safe and efficient access can be provided to the residents of the proposed project and to the motoring public in the area.