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MEMORANDUM

TO: Giorgio Petruzziello

FROM: Kenneth P. Cram, P.E.

DATE: February 16, 2016

RE: Proposed Redevelopment
301-323 Washington Street, Westwood, MA

This traffic memorandum has been prepared to respond to comments raised on the Traffic Impact and Access Study (TIAS) prepared by Bayside Engineering, Inc. (Bayside) and to assess the traffic impacts of a revised project size for the redevelopment project to be located at 301-323 Washington Street in Westwood, Massachusetts. 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 4,850 gsf of commercial space and 12 one-bedroom apartment units on the remaining two floors. The existing driveway to Washington Street will be modified to permit entering movements only and the School Street driveway will be modified to permit exiting movements only. A new driveway to an underground parking facility for 23 vehicles will be provided south of the existing Washington Street driveway and will be for the residential tenants and employees of the commercial space only.

This memorandum will initially present the updated traffic analyses associated with the revised build program and then respond to the peer review comments made by BETA in their November 23, 2015 memorandum.

REVISED FUURE CONDITIONS

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*. Two background projects were also identified (proposed assisted

living facility and Upland Woods[1] in Norwood, MA) and their estimated traffic was included in the future No-Build and Build projections. The revised 2022 No-Build traffic flow networks are shown on Figures 1, 2 and 3 for the respective weekday morning, weekday evening and Saturday midday peak hours.

Build Traffic Volumes

Site generated traffic was based on trip-generation data published by the ITE *Trip Generation* manual[2]. The proposed site redevelopment is expected to include the following:

- 4,850 gsf commercial space
- 12 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[3]. 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 1. The trip generation worksheets are included in the Appendix.

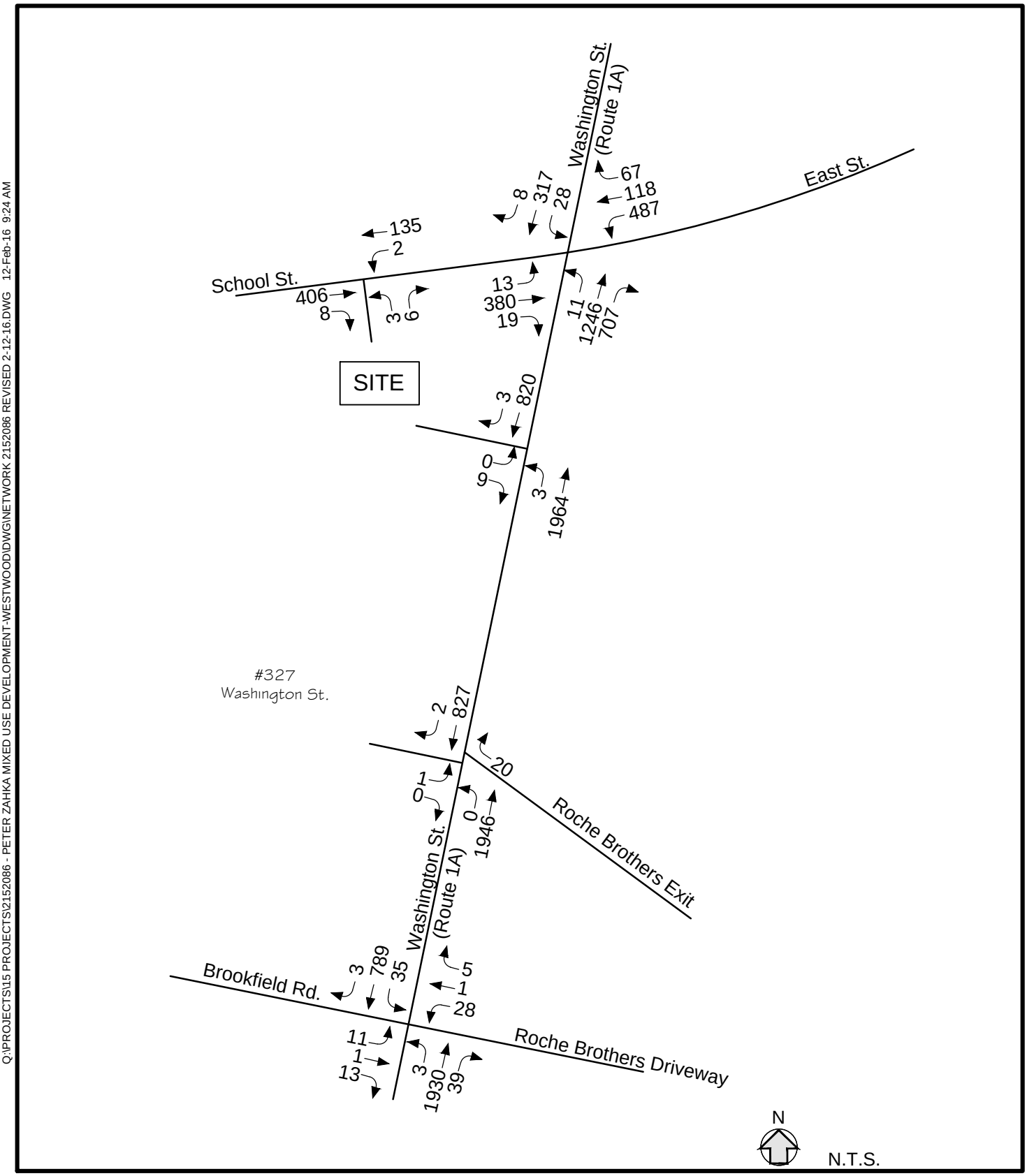
Not all of the trips expected to be generated by the proposed development will represent new trips on the study area roadway system. According to the ITE Trip Generation Handbook, a portion of these trips can be considered pass-by trips. That is, they are not considered primary trips of site generated 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 2 summarizes the pass-by and net new trips.

During an average weekday, the proposed project is expected to generate a total of 352 *new* vehicle trips (176 vehicles entering and 176 vehicles exiting). During the weekday morning peak hour, the proposed project is expected to generate a total of 13 *new* vehicle trips (4 vehicles entering and 9 vehicles exiting) and during the weekday evening peak hour, a total of 38 *new* vehicle trips (23 vehicles entering and 15 vehicles exiting). During the Saturday midday peak hour, the proposed project is expected to generate a total of 41 *new* vehicle trips (22 vehicles entering and 19 vehicles exiting).

[1] Upland Woods was not identified to be included in the original TIAS.

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

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



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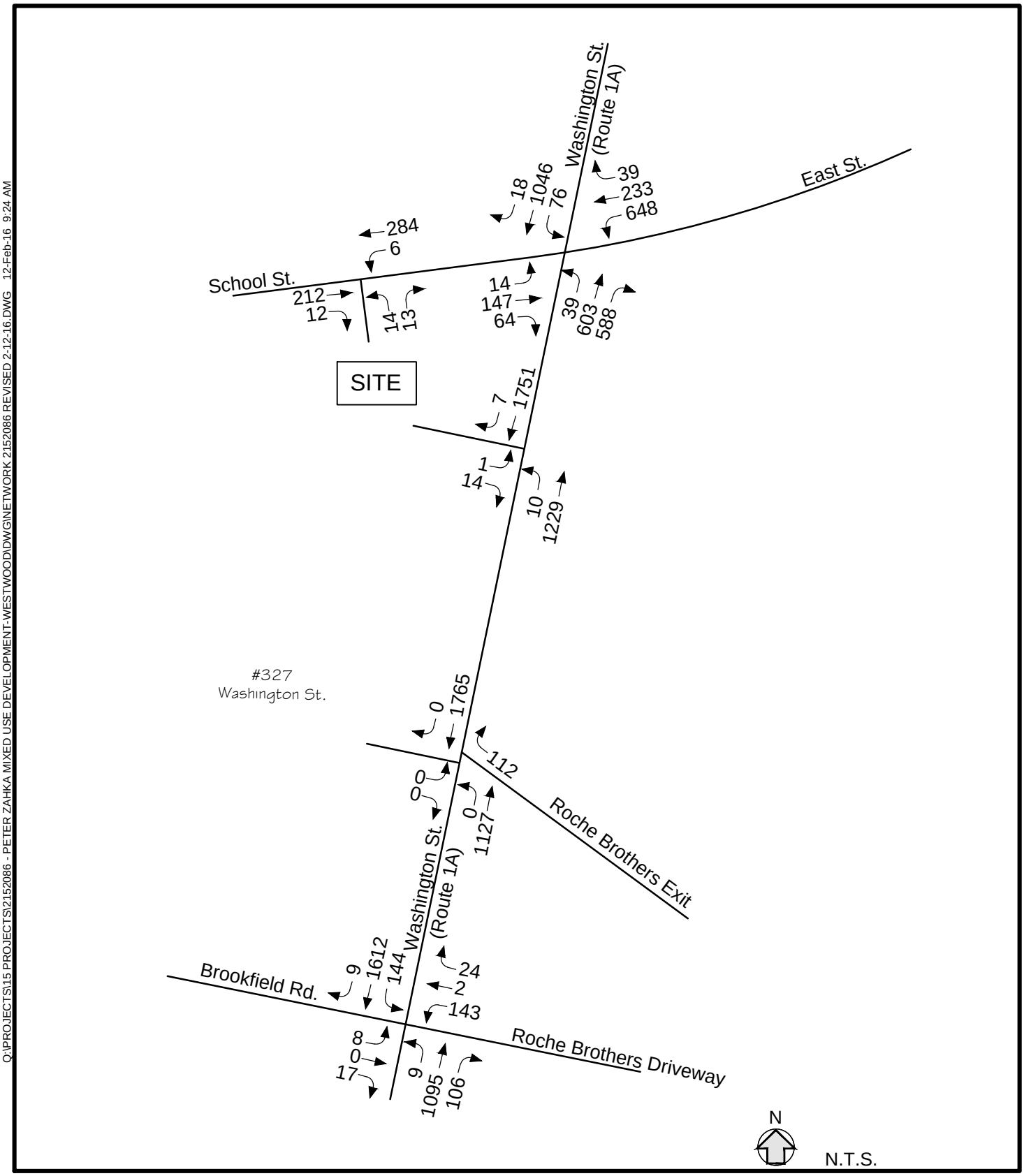
PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 1

2022 No-Build Revised
Weekday Morning
Peak Hour Traffic Volumes



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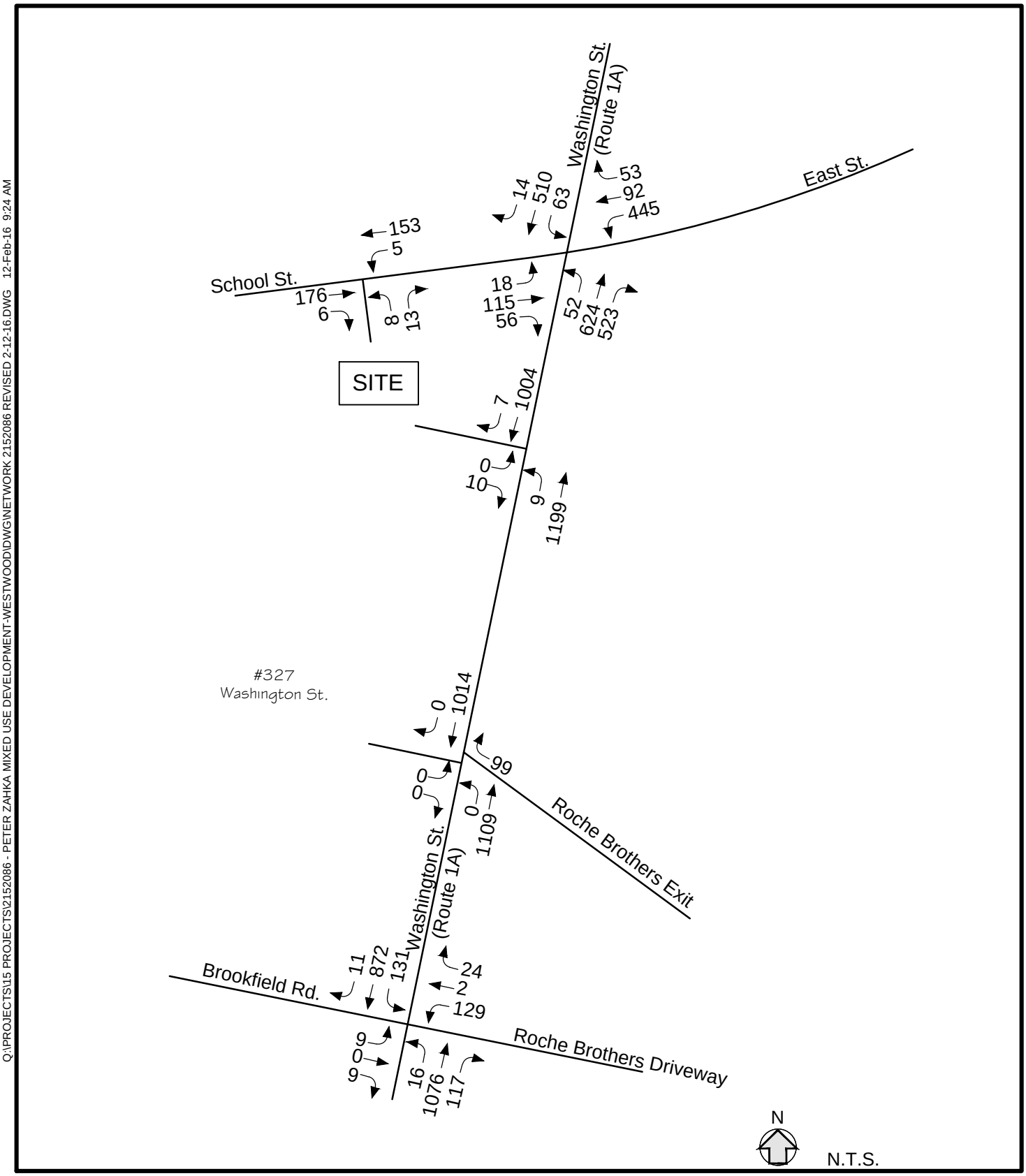
PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 2

2022 No-Build Revised
Weekday Evening
Peak Hour Traffic Volumes



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

Figure 3

2022 No-Build Revised
Saturday Midday
Peak Hour Traffic Volumes

BAYSIDE ENGINEERING

TABLE 1
TRIP-GENERATION SUMMARY

	Proposed Commercial Space[a]	Proposed Apartments[b]	Proposed Project
Daily	208	196	404
Weekday Morning Peak Hour:			
Entering	3	2	5
Exiting	2	8	10
Total	5	10	15
Weekday Evening Peak Hour:			
Entering	9	16	25
Exiting	9	8	17
Total	18	24	42
Saturday	242	76	318
Saturday Midday Peak Hour:			
Entering	12	13	25
Exiting	11	11	22
Total	23	24	47

[a]Based on ITE LUC 820, Shopping Center; 4,850 sf.
[b]Based on ITE LUC 220, Apartments; 12 units.

TABLE 2
TRIP-GENERATION SUMMARY WITH PASS-BY TRIPS

	Proposed Project[a]	Pass-By Trips	Net New Trips
Daily	404	52	352
Weekday Morning Peak Hour:			
Entering	5	1	4
Exiting	10	1	9
Total	15	2	13
Weekday Evening Peak Hour:			
Entering	25	2	23
Exiting	17	2	15
Total	42	4	38
Saturday	318	60	258
Saturday Midday Peak Hour:			
Entering	25	3	22
Exiting	22	3	19
Total	47	6	41

[a]From Table 1.

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 commercial trip distribution pattern. Journey to Work census data was reviewed to determine the trip distribution pattern for the residential component. Table 3 summarizes the expected trip distribution for each component of the project. The trip distribution worksheets are included in the Appendix.

TABLE 3
PROPOSED TRIP DISTRIBUTION

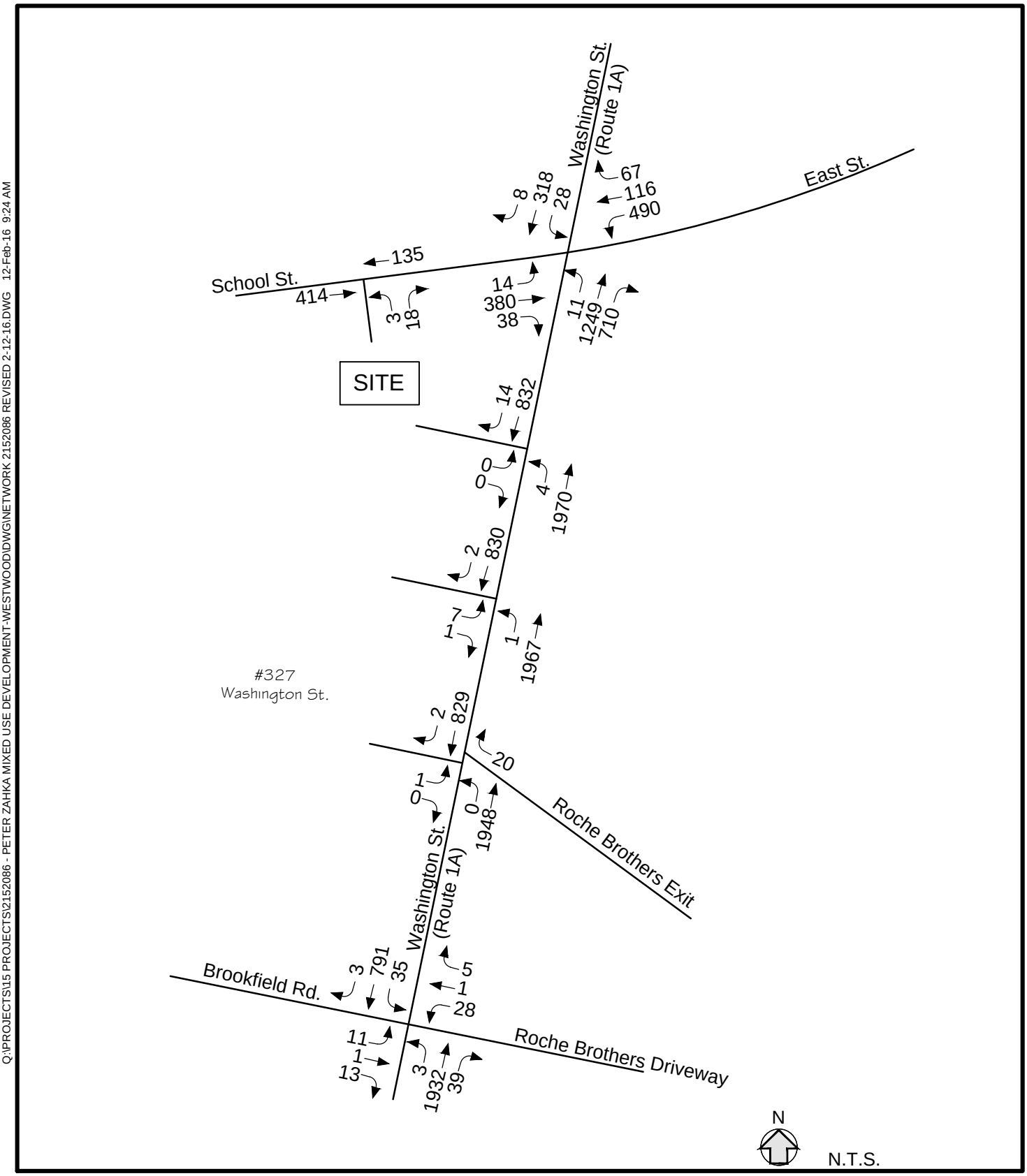
Route	Direction	Percent of Residential Trips	Percent of Commercial Trips
Washington Street	North	49	22
Washington Street	South	15	46
East Street	East	36	23
School Street	West	0	9
TOTAL		100	100

Future Traffic Volumes - Build Condition

The site-generated traffic was distributed within the study area according to the percentages summarized in Table 3. 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 4, 5 and 6. These volumes were used as the basis for all analysis as well as to identify potential mitigation measures to ameliorate the project's impacts.

CAPACITY ANALYSES

Level-of-service analyses were conducted for the revised 2022 No-Build and 2022 Build conditions for the intersections within the study area. The results of the signalized analyses are summarized in Tables 4 and 5 and the unsignalized analyses are summarized in Table 6. Detailed analysis sheets are presented in the Appendix.



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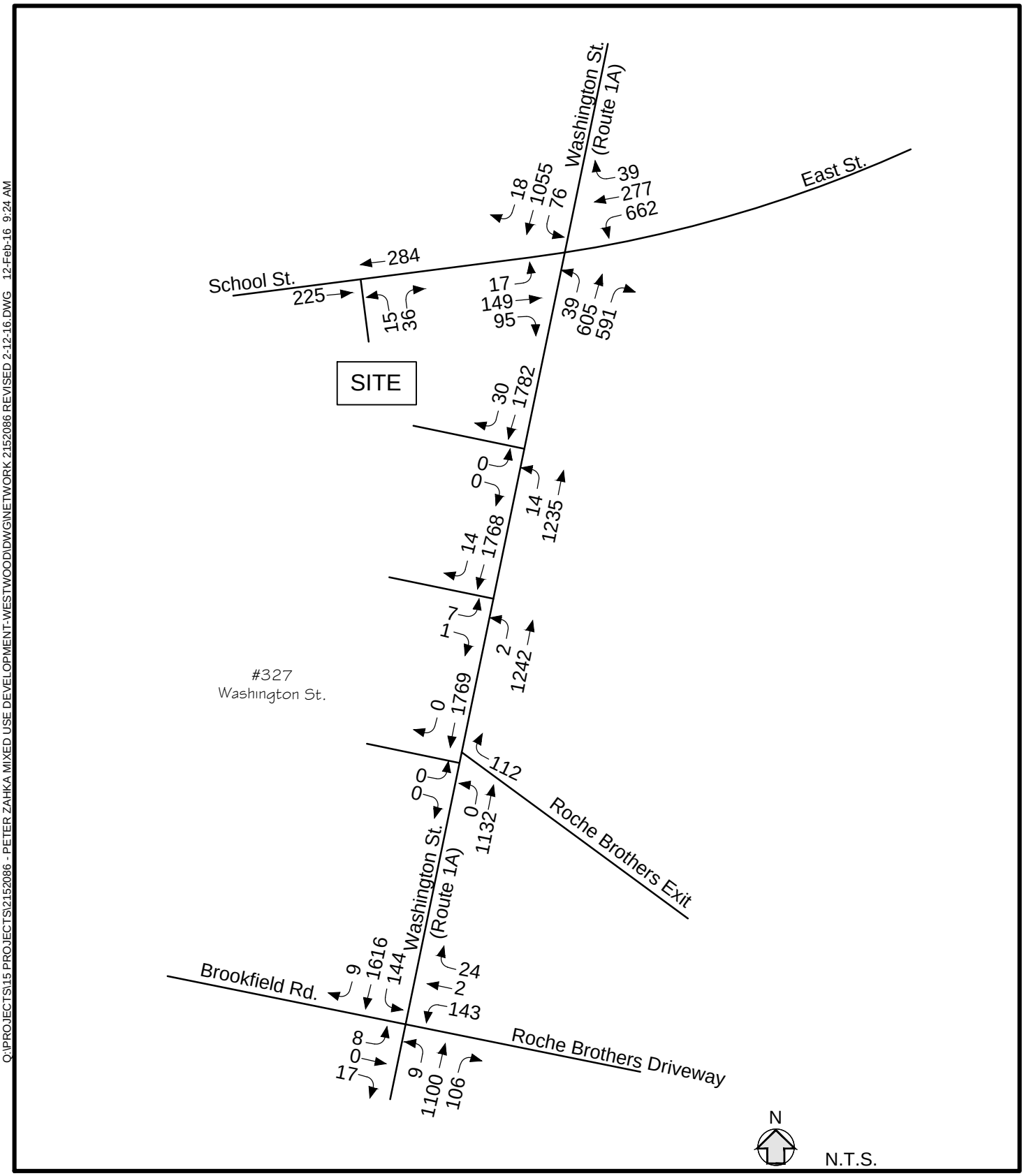
PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 4

2022 Build Revised
Weekday Morning
Peak Hour Traffic Volumes



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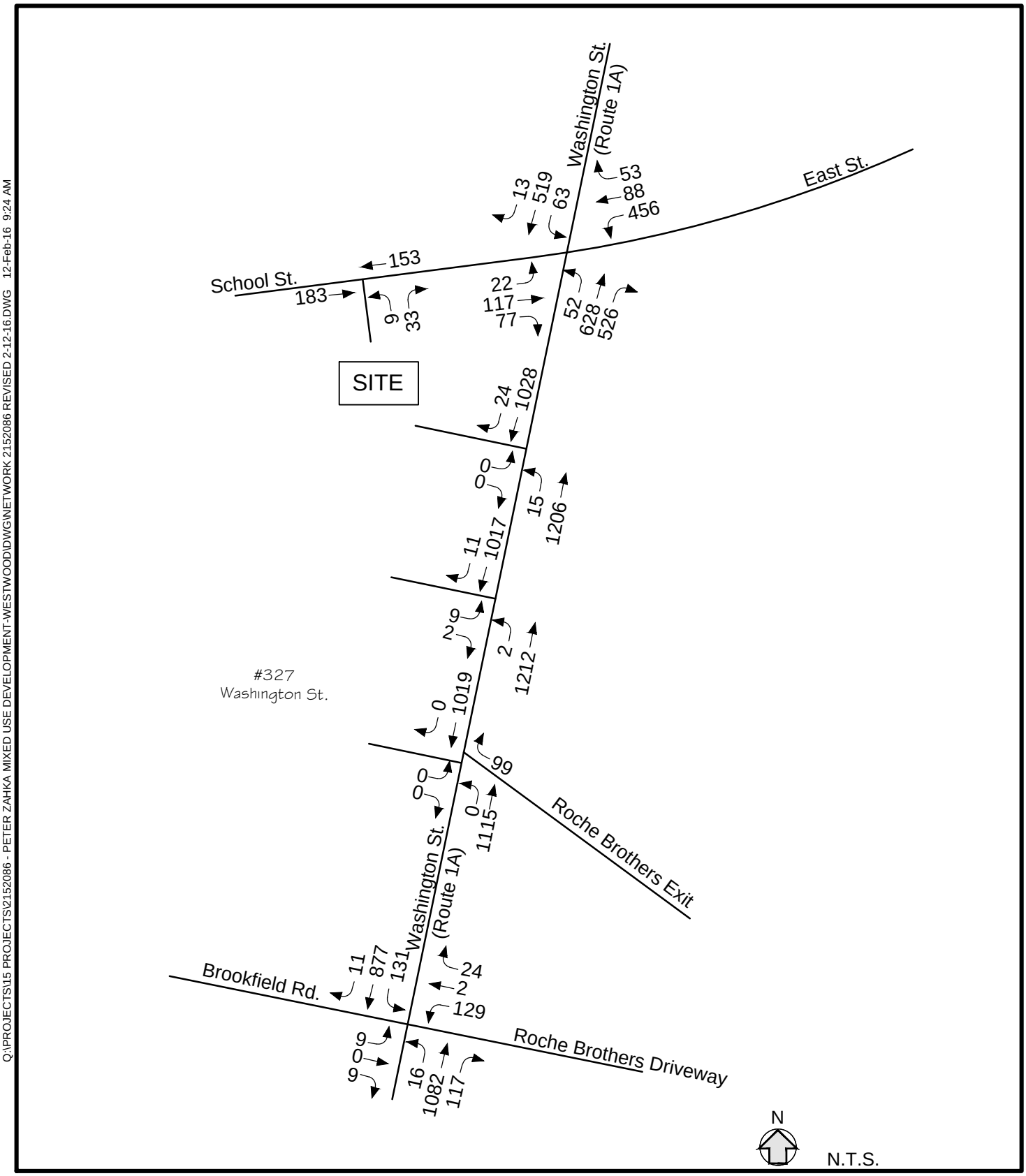
PROPOSED MIXED-USE DEVELOPMENT
301-323 WASHINGTON STREET
WESTWOOD, MA

Figure 5

2022 Build Revised
Weekday Evening
Peak Hour Traffic Volumes



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

Figure 6

2022 Build Revised
Saturday Midday
Peak Hour Traffic Volumes

TABLE 4
SIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY
WASHINGTON STREET, EAST STREET AND SCHOOL STREET

Signalized Intersection/	2022 No-Build			2022 Build		
Peak Hour/Lane Group	V/C[a]	Delay[b]	LOS[c]	V/C	Delay	LOS
Weekday Morning						
Eastbound Lt/Th/Rt	1.09	109.7	F	1.16	134.0	F
Westbound Lt	0.99	60.2	E	1.00	61.8	E
Westbound Th/Rt	0.24	14.6	B	0.24	14.6	B
Northbound Lt/Th	1.41	219.7	F	1.41	221.7	F
Northbound Th/Rt	1.67	336.6	F	1.68	339.1	F
Southbound Lt/Th	0.74	50.2	D	0.74	550.1	D
Southbound Th/Rt	0.41	21.2	C	0.41	21.2	C
Overall	--	**185.3**	**F**	--	**189.6**	**F**
Weekday Evening						
Eastbound Lt/Th/RT	0.74	41.2	D	0.80	46.0	D
Westbound Lt	1.14	106.9	F	1.21	134.2	F
Westbound Th/Rt	0.34	15.9	B	0.32	15.5	B
Northbound Lt/Th	2.14	548.9	F	2.38	663.4	F
Northbound Th/Rt	1.12	100.8	F	1.16	116.7	F
Southbound Lt/Th	2.90	898.8	F	3.05	968.0	F
Southbound Th/Rt	0.98	54.5	D	1.01	64.3	F
Overall	--	**273.0**	**F**	--	**309.1**	**F**
Saturday Midday						
Eastbound Lt/Th/RT	0.67	38.0	D	0.72	40.2	D
Westbound Lt	0.86	34.2	C	0.89	39.0	D
Westbound Th/Rt	0.22	15.3	B	0.20	14.9	B
Northbound Lt/Th	0.93	44.2	D	0.99	58.7	E
Northbound Th/Rt	0.91	42.1	D	0.95	48.9	D
Southbound Lt/Th	1.10	113.6	F	1.26	176.1	F
Southbound Th/Rt	0.52	20.0	B	0.54	21.5	C
Overall	--	**42.7**	**D**	--	**54.5**	**D**

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

TABLE 5
SIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY
WASHINGTON STREET, BROOKFIELD ROAD AND ROCHE BROTHERS DRIVEWAY

Signalized Intersection/	2022 No-Build			2022 Build		
Peak Hour/Lane Group	V/C[a]	Delay[b]	LOS[c]	V/C	Delay	LOS
Weekday Morning						
Eastbound Lt/Th/RT	0.20	27.2	C	0.20	27.2	C
Westbound Lt	0.17	26.8	C	0.17	26.8	C
Westbound Th/Rt	0.10	26.5	C	0.10	26.5	C
Northbound Lt/Th	0.74	6.8	A	0.74	6.8	A
Northbound Th/Rt	0.77	8.1	A	0.77	8.1	A
Southbound Lt/Th	0.39	3.0	A	0.39	3.0	A
Southbound Th/Rt	0.40	3.0	A	0.40	3.0	A
Overall	--	**6.5**	**A**	--	**6.5**	**A**
Weekday Evening						
Eastbound Lt/Th/RT	0.12	23.9	C	0.12	23.9	C
Westbound Lt	0.52	27.4	C	0.52	27.4	C
Westbound Th/Rt	0.13	23.9	C	0.13	23.9	C
Northbound Lt/Th	0.55	6.3	A	0.55	6.3	A
Northbound Th/Rt	0.57	6.8	A	0.58	6.8	A
Southbound Lt/Th	1.13	87.0	F	1.14	89.6	F
Southbound Th/Rt	0.84	14.1	B	0.84	14.2	B
Overall	--	**30.5**	**C**	--	**31.1**	**C**
Saturday Midday						
Eastbound Lt/Th/RT	0.09	23.9	C	0.09	23.9	C
Westbound Lt	0.50	27.3	C	0.50	27.3	C
Westbound Th/Rt	0.14	24.2	C	0.14	24.2	C
Northbound Lt/Th	0.52	5.7	A	0.52	5.7	A
Northbound Th/Rt	0.54	6.2	A	0.55	6.2	A
Southbound Lt/Th	0.64	10.8	B	0.65	10.9	B
Southbound Th/Rt	0.59	6.7	A	0.59	6.7	A
Overall	--	**8.5**	**A**	--	**8.5**	**A**

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

TABLE 6
UNSIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY

Critical Movement/ Peak Hour	2022 No-Build				2022 Build			
	Demand[a]	V/C[b]	Delay[c]	LOS[d]	Demand	V/C	Delay	LOS
School Street and Site Driveway								
All movements from driveway:								
Weekday Morning	9	0.05	12.0	B	21	0.12	12.1	B
Weekday Evening	27	0.07	11.6	B	51	0.12	11.2	B
Saturday Midday	21	0.04	10.3	B	42	0.08	10.2	B
Washington Street and Site Driveway								
All movements from driveway:								
Weekday Morning	9	0.02	12.0	B	--[e]	--	--	--
Weekday Evening	15	0.20	37.0	E	--	--	--	--
Saturday Midday	10	0.04	12.7	B	--	--	--	--
Washington Street and New Site Driveway								
All movements from driveway:								
Weekday Morning	--	--	--	--	8	0.14	73.6	F
Weekday Evening	--	--	--	--	8	0.38	236.6	F
Saturday Midday	--	--	--	--	11	0.13	51.0	F
Washington Street and Roche Brothers Exit								
All movements from exit:	20	0.16	23.7	C	20	0.16	24.1	C
Weekday Morning	112	0.37	19.4	C	112	0.37	19.1	C
Weekday Evening	99	0.26	15.7	C	99	0.26	15.7	C
Saturday Midday								

[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]Driveway changed to one-way in only under Build conditions.

Washington Street, East Street and School Street

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

School Street and Site Driveway

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

Washington Street and Site Driveway

Under future 2022 No-Build conditions, the critical movements are projected to operate at LOS B during the weekday morning peak hour, at LOS E during the weekday evening peak hour and at LOS B during the Saturday midday peak hour. Under 2022 Build conditions, with the project, this driveway becomes a one-way in only driveway.

Washington Street and New Site Driveway

Under 2022 Build weekday morning conditions, the critical movements at this unsignalized intersection (all movements out of the driveway) are modeled to operate at LOS F during the peak hours. However, the critical movements will operate well below capacity and the projected 95th percentile vehicle queue on the driveway approach is projected to be one (1) vehicle.

Washington Street and Roche Brothers Exit Driveway

Under future 2022 No-Build conditions, the critical movements are projected to operate at LOS C during the weekday morning, weekday evening and Saturday midday peak hours. Under 2022 Build conditions, with the project, the critical movements are projected to continue to operate at LOS C during the weekday morning, weekday evening and Saturday midday peak hours.

Washington Street, Brookfield Road and Roche Brothers Driveway

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 continue to 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.

Vehicle Speeds

Existing speed data for Washington Street and School Street were also collected using the ATRs. The speed data is summarized in Table 7.

TABLE 7
OBSERVED VEHICLE SPEEDS

Direction	Posted Speed Limit (mph)	Average Observed Speed[a] (mph)	85th Percentile Speed (mph)
Washington Street Northbound[a]	30	28	33
Washington Street Southbound[a]	30	29	35
School Street Westbound[a]	30	26	29
School Street Eastbound[a]	30	23	27

[a]Based on speed data compiled on October 14 and 15, 2015.

As shown in Table 7, the average speed of vehicles travelling northbound or southbound on Washington Street was found to be 28 to 29 mph, respectively on Washington Street. The 85th percentile speed was found to be 33 mph for northbound vehicles and 35 mph for southbound vehicles. The average speed of vehicles travelling westbound or eastbound on School Street was found to be 26 to 23 mph, respectively. The 85th percentile speed was found to be 29 mph for westbound vehicles and 27 mph for eastbound vehicles on School Street. The 85th percentile speed is the speed at which sight distances are typically evaluated.

Sight Distance Assessment

Sight distance measurements were performed at the intersection of the proposed site access roadway along Washington Street in accordance with MassDOT standards. Stopping sight distance (SSD) 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 MassDOT standards, at a minimum, sufficient SSD must be provided to the intersection.

Table 8 presents the measured SSD at the intersections of the Washington Street and the proposed site access roadway. The sight distance calculations are included in the Appendix.

TABLE 8
SIGHT DISTANCE SUMMARY

	Required Minimum (Feet)[a]	Measured (Feet)
Site Driveway and Washington Street		
Stopping Sight Distance:		
Site Driveway approaching from the north	246	300+
Site Driveway approaching from the south	226	300+
Intersection Sight Distance:		
Exiting Site Driveway looking to the north	334[b]/364[c]	340
Exiting Site Driveway looking to the south	334[b]/364[c]	500+
New Site Driveway and Washington Street		
Stopping Sight Distance:		
Site Driveway approaching from the north	246	300+
Site Driveway approaching from the south	226	300+
Intersection Sight Distance:		
Exiting Site Driveway looking to the north	334[b]/364[c]	400
Exiting Site Driveway looking to the south	334[b]/364[c]	500+
Site Driveway and School Street		
Stopping Sight Distance:		
Site Driveway approaching from the east	187	187[d]
Site Driveway approaching from the west	169	283[e]
Intersection Sight Distance:		
Exiting Site Driveway looking to the east	258[b]/320[c]	187[d]
Exiting Site Driveway looking to the west	258[b]/298[c]	100

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*; American Association of State Highway and Transportation Officials (AASHTO); 2010, and based on the 85th percentile speed.
[b]Recommended minimum value for vehicles turning right exiting a roadway under STOP-sign control.
[c]Recommended minimum value for vehicles turning left exiting a roadway under STOP-sign control.
[d]Distance to middle of intersection of Washington Street and School Street.
[d]Distance to middle of intersection of Schaefer Avenue and School Street.

As can be seen in Table 8, the SSD measurements performed at the site access roadway intersections with Washington Street and School Street indicate that the intersections will exceed the recommended

minimum requirements based on the 85th percentile speeds observed. At the site access roadway intersection with School Street, the intersection sight distance is impacted by an existing row of landscaping (which is on the subject property). This landscaping can be cut back and sight distance improved to meet the AASHTO requirements. Along the site frontage and within the existing Washington and School street layouts, it is recommended that proposed landscaping be designed to maintain these sight lines.

Recommendations

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 Washington Street and School Street driveway to permit entering movements only (Washington Street) and exiting movements only (School Street).

At the new Washington Street driveway, this driveway should permit entering and exiting movements from both directions on Washington Street. The new driveway should be under STOP sign control.

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

Gap Acceptance Analysis

An ATR on Washington Street was placed to record the length of time between vehicles. Typical values for "time gap acceptance" for vehicles departing a minor roadway and entering a major roadway are given in the AASHTO *A Policy on Geometric Design of Highways and Streets*. In the case of vehicles turning left from a minor road, a typical acceptable gap for a passenger vehicle is 7.5 seconds. For a vehicle turning right from a minor road, a typical acceptable gap for a passenger vehicle is 6.5 seconds. These values for acceptable gap times are consistent with the ISD calculations in the previous section, and would allow for most major road drivers to not reduce their travel speed to less than 70% of their initial speed. For vehicles wishing to turn left from the site driveway, the number of "combined gaps" were evaluated (i.e. the number and length of gaps in the traffic flow that occur in both directions simultaneously). For vehicles wishing to turn right from the site driveway, only the number/length of gaps in the westbound traffic on High Street were evaluated. The gap traffic counts are included in the Appendix. Table 9 summarizes the results of this gap acceptance analysis for vehicles exiting the project site.

TABLE 9
GAP ACCEPTANCE ANALYSIS SUMMARY

Time Period	7 to 14 Second Gaps	15 to 19 Second Gaps	Maximum Number of Turning Exiting Vehicles that could be Accommodated	Anticipated Demand for Turning Exiting Time Period Vehicles
Washington Street				
Weekday Morning Peak Hour	70	16	102	8
Weekday Evening Peak Hour	63	13	89	8
School Street				
Weekday Morning Peak Hour	71	24	119	17
Weekday Evening Peak Hour	50	24	98	51

[a]Based on speed data compiled on December 15 and 16, 2015.

As indicated in Table 9, there are more than a sufficient number of gaps in the flow of traffic on Both Washington Street and School Street during the weekday peak periods to safely allow vehicles to exit the site driveways. The complete gap data reports are included with the traffic count data in the Appendix.

RESPONSES TO COMMENTS

This section addresses the specific comments made on the TIAS by the Town's Peer review consultant in their January 7, 2016 comment letter.

Comment T1: Existing volumes illustrate commuter patterns in the weekday morning and weekday evening peak hours. Apartment-related trips should be distributed consistent with these commuting patterns.

Response: The trip distribution pattern was revised within this memorandum. The commercial trips were distributed according to existing flows in the study area and a new pattern, based on Journey to Work census data was used to establish the revised residential trip pattern, as summarized in Table 3.

Comment T2: The proponent should quantify sight distance for the two site access drives to verify that adequate sight distance exists based on American Association of State Highway and Transportation Officials (AASHTO) guidelines. Sight distance requirements should be based on the design speed of the roadway.

Response: Sight distances were assessed and the results summarized in Table 8 of this memorandum. At the site access roadway intersection with School Street, the intersection sight distance is impacted by an existing row of landscaping (which is on the subject property). This landscaping can be cut back and sight distance improved to meet the AASHTO requirements. Along the site frontage and within the existing Washington Street and School Street layouts, it is recommended that proposed landscaping be designed to maintain these sight lines.

Comment T3: Gap analysis should be provided for the two site access drives, as required by the Planning Board *Rules and Regulations*.

Response: A gap analysis was performed and the results are summarized in Table 9 of this memorandum.

Comment T4: Provide signage reinforcing the restriction of left turns exiting onto Washington Street.

Response: As the existing driveway will now be an entrance only driveway, NO LEFT TURN signs are not required. Appropriate signage will be provided on site directing motorists to use the School Street driveway to exit the site.