Needham, Massachusetts

Gould Street – Industrial 1 Zoning Change

Contract No. 20GEN110M

October 2019

Supplemental Traffic Impact Study

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Gould Street – Industrial 1 Zoning Change
Needham, Massachusetts
Contract No. 20GEN110M

SUPPLEMENTAL TRAFFIC IMPACT STUDY

Prepared by: BETA GROUP, INC.

Prepared for: Town of Needham Economic Development/Planning Department

October 2019

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

BETA Group, Inc. (BETA) has prepared this Supplemental Traffic Impact Study (TIS) to determine the traffic impacts of a future build out for the potential rezoning of the Channel 5 and Muzi Ford properties from the Gould Street – Industrial 1 District to a Highway Commercial 1 Zoning District.

This document is a supplement to the December 2015 Gould Street – Industrial 1 and Reservoir Street – Industrial Districts Traffic Impact Study (TIS).

The entire Gould Street Industrial 1 District was originally analyzed in 2015 using a proposed 2,201,830 square feet of build out. This study analyses a square footage reduction of 54% for a total square footage of 1,177,982 square feet specific to the Channel 5/Muzi Ford property limits. This property is located in Needham, Massachusetts and abuts the westerly side of the Route 128/Highland Avenue Interchange

1.2 PROJECT LOCATION

The following signalized and unsignalized intersections are included in the study area and correlate to the locus map shown in Figure 1:

Signalized Intersections
- Highland Avenue/Gould Street

Unsignalized Intersections
- Central Avenue/Reservoir Street
- Central Avenue/River Park Street
- Central Avenue/Hampton Avenue
- Gould Street/Central Avenue
- Gould Street/Ellis Street
- Gould Street/Kearney Road
- Gould Street/Station Street
- Gould Street/Noanett Road
- Gould Street/TV Place
- Gould Street/Muzi Motors Driveway/Wingate Driveway

1.3 ANALYSIS CRITERIA

The 2025 Future Build with the Channel 5/Muzi Ford Highway Commercial 1 Zoning District implemented scenario was evaluated for both the morning (AM) and afternoon (PM) commuting peak periods. The Existing, Future No-Build, and Reservoir Street Industrial District analyses are unchanged from the December 2015 TIS.

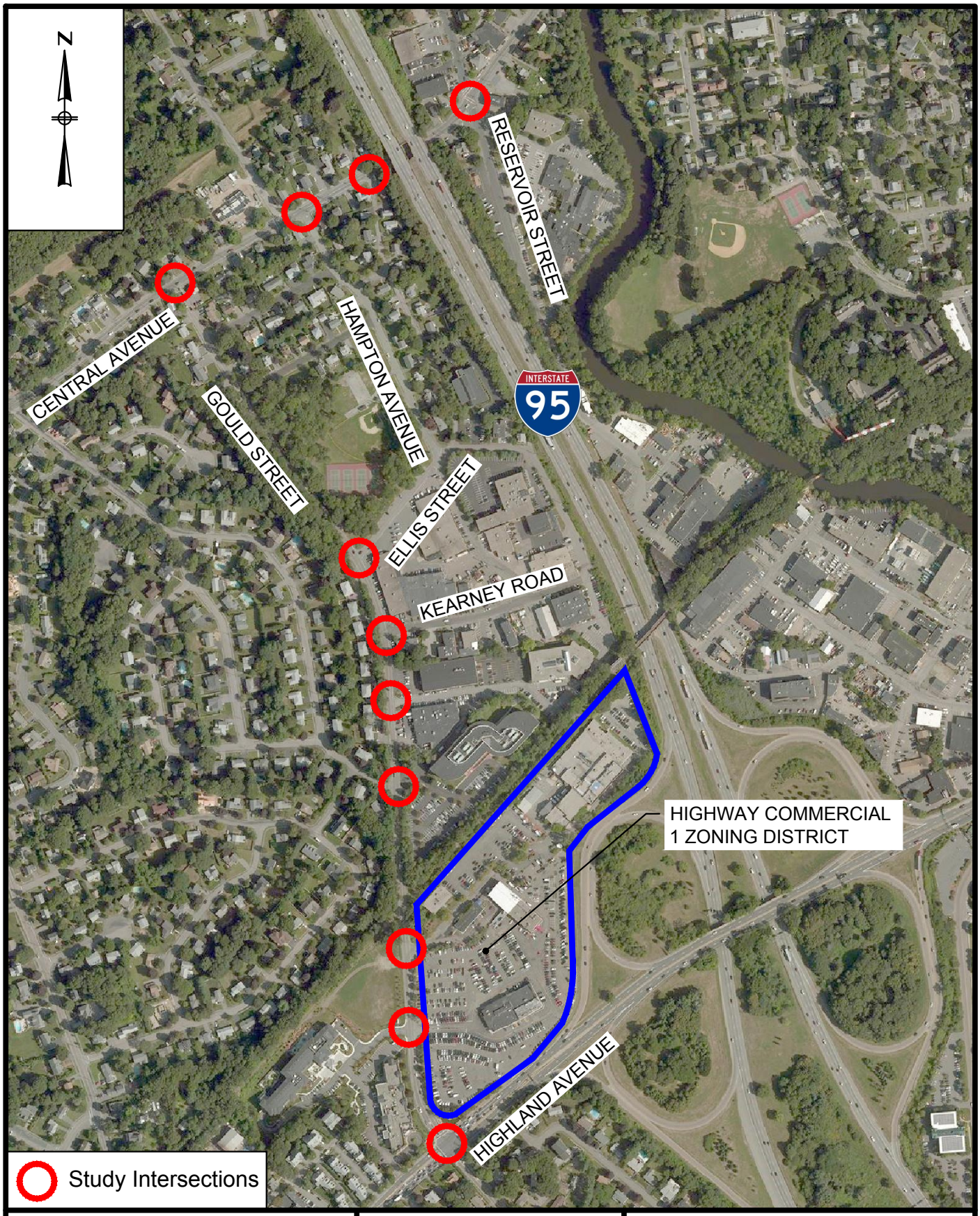

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Figure 1
Locus Map

O:\6800s\6876 - Needham - Gould St Traffic Update\Engineering\Reports\Figures\6876 Project Location Map.dwg Oct 22,2019 10:48am

2.0 EXISTING CRASH DATA

Crash data for key project intersections were obtained from MassDOT Highway Division for the five most recent years available, 2013-2017. A summary of the intersection crash data for the key intersections is shown in Table 1. Complete crash data and crash rate worksheets are included in the Appendix.

The number of crashes which occurred at the intersections range between 5 and 41 crashes per intersection over the five-year period reviewed. The crash rates for the study intersections, expressed in crashes per Million Entering Vehicles (MEV), range between 0.18 and 0.71 MEV. The average crash rate for signalized intersections within MassDOT District 6, is 0.71 and statewide is 0.78. The average crash rate for unsignalized intersections within MassDOT District 6 is 0.52 MEV, and the statewide average is 0.57 MEV. As shown in Table 1, all signalized and unsignalized intersections have a crash rate which is equal to or lower than both the District and statewide averages.

Table 1: MassDOT Crash Data Summary

Year	Collision Type						Accident Type				Ambient Light					Weather Condition					Total Crashes
	Angle	Rear-End	Sideswipe, Same Dir	Sideswipe, Opp. Dir	Single Vehicle Crash	Unknown	Property Damage	Non-Fatal Injury	Fatal Injury	Not Reported	Daylight	Dawn/Dusk	Dark Lighted Roadway	Dark Non-Lighted Roadway	Unknown	Clear	Cloudy	Rain	Snow	Unknown	
Highland Avenue at Gould Street (Signalized)																					Crash Rate: 0.71 MEV
2013	5	3	-	-	-	-	7	1	-	-	6	1	-	-	1	4	3	1	-	-	8
2014	4	2	1	1	-	-	6	2	-	-	5	-	2	-	1	5	-	3	-	-	8
2015	1	6	1	-	-	-	8	-	-	-	5	1	2	-	-	7	-	1	-	-	8
2016	2	1	1	-	4	2	7	2	-	1	7	-	2	-	1	9	1	-	-	-	10
2017	1	4	2	-	-	-	6	1	-	-	4	-	3	-	-	3	2	2	-	-	7
Total	13	16	5	1	4	2	34	6	0	1	27	2	9	0	3	28	6	7	0	0	41
Central Avenue at Gould Street (Unsignalized)																					Crash Rate: 0.40 MEV
2013	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	-	1
2014	1	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	1	-	-	-	1
2015	2	2	-	-	-	-	2	1	-	1	4	-	-	-	-	2	1	-	1	-	4
2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2017	5	1	-	-	-	-	5	1	-	-	5	-	1	-	-	6	-	-	-	-	6
Total	9	3	0	0	0	0	8	3	0	1	10	1	1	0	0	9	2	0	1	0	12
Central Avenue at Reservoir Street (Unsignalized)																					Crash Rate: 0.18 MEV
2013	1	-	-	-	-	-	1	-	-	-	1	-	-	-	-	1	-	-	-	-	1
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2015	1	-	-	-	1	-	2	-	-	-	1	-	-	1	-	1	-	1	-	-	2
2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2017	1	-	-	-	1	-	1	1	-	-	2	-	-	-	-	1	1	-	-	-	2
Total	3	0	0	0	2	0	4	1	0	0	4	0	0	1	0	3	1	1	0	0	5

3.0 FUTURE BUILD CONDITIONS

3.1 TRIP GENERATION

Based on discussions with the Town of Needham, the following Institute of Transportation Engineers (ITE) Land Use Codes (LUC) were used to generate trips for the Build scenario. Land use ratios per LUC were provided by the Town.

- LUC 714 – Corporate Headquarters Building (50%)
- LUC 760 – Research and Development Center (50%)

Table 2: Trip Generation Summary

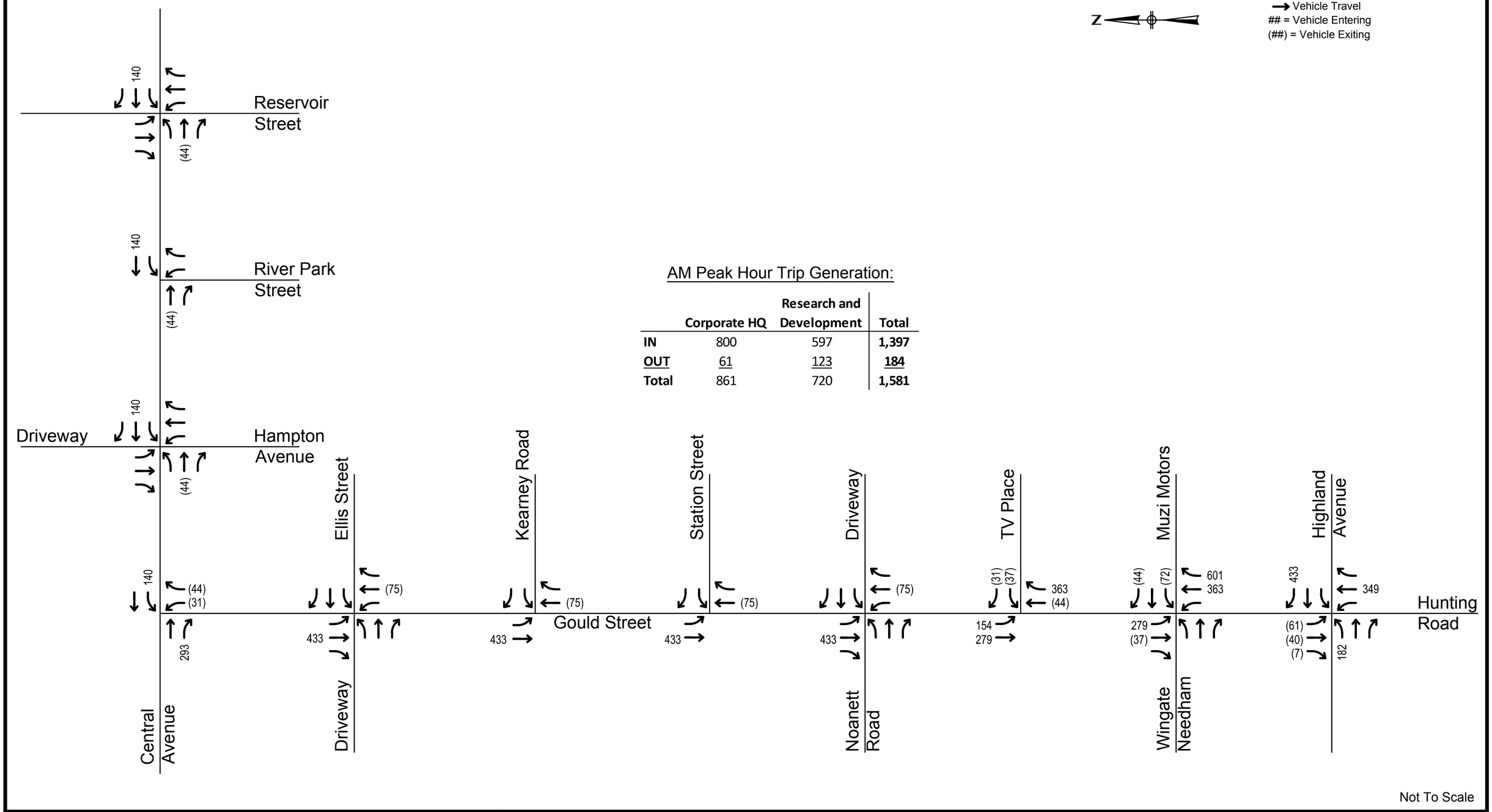
	LUC 714	LUC 760			
	Corporate Headquarters Building	Research and Development Center	Total	2015 Report	Difference
%	50%	50%			
Size (SF)	588,991	588,991	1,177,982	2,201,830	-1,023,848
Weekday AM Peak Hour					
Enter	800	597	1,397	1,750	-353
Exit	61	123	184	255	-71
Total	861	720	1,581	2,005	-424
Weekday PM Peak Hour					
Enter	77	105	182	249	-67
Exit	689	550	1,239	1,506	-267
Total	766	655	1,421	1,755	-334

As summarized in Table 2, the currently proposed Build scenario is anticipated to produce between 334 and 424 fewer trips during the peak hours than the original 2015 build out scenario. Based on conversations with the Town, the Planning Board anticipates that a retail component will be ancillary to the proposed office land use. Therefore, prior to any retail component approval, the Planning Board would require a professional traffic study be conducted for the specific retail component in order to monitor the number and impact of retail vehicle trips generated by this development.

The peak hour trip generation calculations for the Build scenario is provided in the Appendix.

3.2 TRIP DISTRIBUTION, ASSIGNMENT & BUILD VOLUMES

The distribution of site-generated trips were assigned to and from the Channel 5 (TV Place) and Muzi driveways via the local roadway network based on existing traffic patterns. The assignment of AM and PM peak hour trips is presented in Figures 2 and 3, respectively. The distributed trips were added to the 2025 No-Build volumes (provided in the Appendix) to generate the AM and PM peak hour traffic volumes for the Build scenario. The 2025 Build volumes as shown in Figure 4.



AM Peak Hour Trip Generation:

	Corporate HQ	Research and Development	Total
IN	800	597	**1,397**
OUT	61	123	**184**
Total	861	720	**1,581**

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Figure 2
AM Peak Hour Trip Assignment

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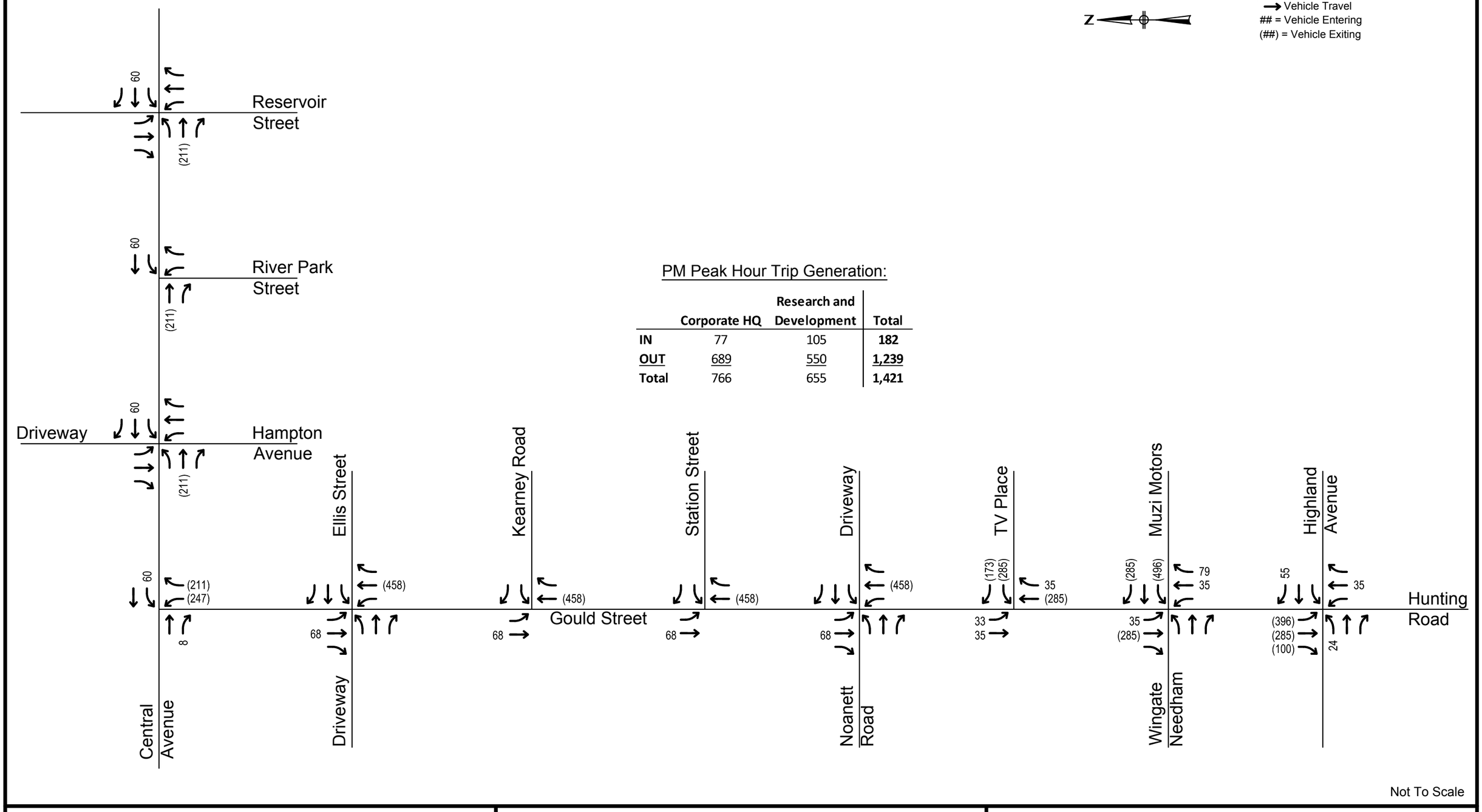

PM Peak Hour Trip Generation:

	Corporate HQ	Research and Development	Total
IN	77	105	**182**
OUT	689	550	**1,239**
Total	766	655	**1,421**

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Figure 3
PM Peak Hour Trip Assignment

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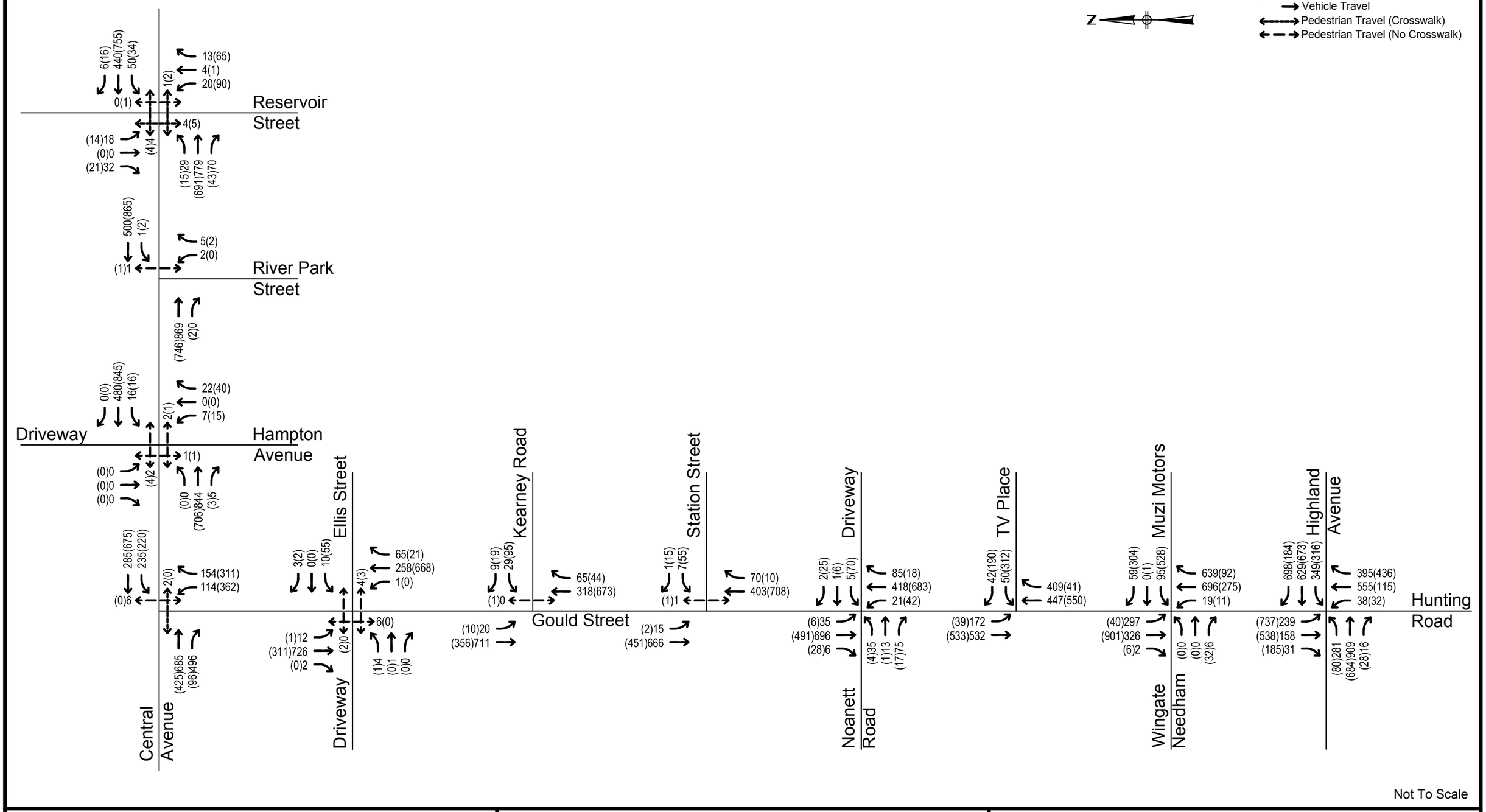

Not To Scale

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Figure 4
AM(PM) Peak Hour Volumes
2025 Build

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3.3 Future Level-Of-Service Analysis

In order to evaluate the "Build" traffic conditions, a capacity (level of service) analysis was performed. This analysis was performed using methods of the Highway Capacity Manual published by the Transportation Research Board. For intersections, six levels of service, "A"-"F", have been established with "A" representing very good operation and "F" representing very poor operation. For signalized intersections, level of service is defined in terms of total delay and is computed for individual intersection turning movements. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

A delay and level of service (LOS) analysis was performed for the existing intersections using Synchro (version 10) computer software. The evaluation criteria for unsignalized and signalized intersections are defined as shown in Table 3.

Table 3: Level of Service Criteria

LOS	Signalized Control Delay (Sec/Veh)	Unsignalized Control Delay (Sec/Veh)	General Description
A	<= 10	<= 10	Free flow
B	>10 and <=20	>10 and <=15	Stable flow (slight delays)
C	>20 and <=35	>15 and <=25	Stable flow (acceptable delays)
D	>35 and <=55	>25 and <=35	Approaching unstable flow (tolerable delay)
E	>55 and <=80	>35 and <=50	Unstable flow (intolerable delay)
F	>80	>50	Forced flow (jammed)

The 2025 Build level-of-service analyses were performed for the study intersections using the projected (2025) No-Build volumes from the 2015 TIS (provided in the Appendix) and adding trips associated with the development scenario under existing geometry and traffic control.

3.4 Build Level-Of-Service Analysis

A delay and LOS analysis was performed for the Build condition scenario under existing geometry and traffic control. Results of the Build capacity analyses are provided in Tables 4 and 5. As shown in the tables, the Build results are compared to the No-Build capacity analysis results from the 2015 TIS for reference. Complete analyses results are provided in the Appendix.

As can be seen in Tables 4 and 5, many of the unsignalized intersection movements degrade in following the build out when compared to the No-Build.

During the AM peak hour, some of the side streets along Gould Street at and adjacent to the study site would degrade to LOS F.

During the PM peak hour, Gould Street would continue to operate at LOS A or B, however, the majority of side streets would operate at LOS F, including the streets and accessing the site. This is a result of the lack of acceptable gaps in traffic along Gould Street, combined with the increase in traffic.

The Reservoir Street northbound approach to Central Avenue would degrade to LOS F during the AM peak, and the Reservoir Street southbound approached would degrade to LOS F during the PM peak while the northbound approach would continue to operate at LOS F.

The Gould Street approach to Central Avenue would continue to operate at a LOS F during both No-Build and Build conditions.

Table 4: 2025 No-Build vs. Build Level of Service Summary – AM Peak Hour

INTERSECTIONS	2025 No-Build			2025 Build		
	LOS	Delay (s/veh)	95%ile Queue (ft)	LOS	Delay (s/veh)	95%ile Queue (ft)
Central Avenue at Reservoir Street [UNSIGNALIZED]						
Central - EB	A	8.1	2.5	A	8.5	2.5
Central - WB	A	9.7	5	A	9.9	5
Reservoir - NB	E	40.0	30	F	60.4	42.5
Reservoir - SB	C	24.4	25	D	34.4	35
Central Avenue at River Park Street [UNSIGNALIZED]						
Central - WB	A	9.7	0	A	9.9	0
River Park - NB	C	19.4	2.5	C	21.9	5
Central Avenue at Hampton Avenue [UNSIGNALIZED]						
Central - WB	A	9.7	2.5	A	9.9	2.5
Hampton - NB	C	19.6	12.5	C	22.6	15
Central Avenue at Gould Street [UNSIGNALIZED]						
Central - WB	B	11.1	12.5	C	18.4	70
Gould - NB	F	201.9	342.5	F	*	982.5
Gould Street at Ellis Street [UNSIGNALIZED]						
Driveway - EB	C	15.0	2.5	D	0.2	5
Ellis - WB	B	14.3	5	D	0.4	10
Gould - NB	A	8.0	0	A	9.8	0
Gould - SB	A	7.9	0	A	8.1	0
Gould Street at Kearney Road [UNSIGNALIZED]						
Kearney - WB	B	14.5	10	D	30.6	25
Gould - SB	A	8.0	2.5	A	8.2	2.5
Gould Street at Station Street [UNSIGNALIZED]						
Station - WB	B	13.5	2.5	C	23	7.5
Gould - SB	A	8.2	0	A	8	0
Gould Street at Noanett Street [UNSIGNALIZED]						
Noanett - EB	C	18.1	42.5	F	87.2	160
Driveway - WB	C	21.0	5	F	62.7	17.5
Gould - NB	A	7.9	2.5	A	9.6	2.5
Gould - SB	A	8.3	2.5	A	8.6	2.5
Gould Street at TV Place [UNSIGNALIZED]						
TV - WB	C	17.3	7.5	F	*	252.5
Gould - SB	A	9.3	2.5	C	17.1	45
Gould Street at Muzi Drive/Wingate Drive [UNSIGNALIZED]						
Wingate - EB	B	10.2	0	B	10.5	0
Muzi - WB	C	15.7	7.5	F	*	385
Gould - NB	A	8.0	2.5	A	0.1	2.5
Gould - SB	A	8.2	2.5	B	16.2	162.5
Highland Avenue at Gould Street/Hunting Road [SIGNALIZED]						
Highland - EBL	F	83.3	#182	F	208.6	#577
Higland - EBTR			#597			#597
Highland - WBL	D	48.2	#505	E	60.9	#505
Highland - WBTR			386			#662
Hunting - NBTL	D	46.7	#354	F	*	#1068
Hunting - NBR			307			341
Gould - SBL	D	46.7	220	E	56.8	#321
Gould - SBLTR			217			#303
OVERALL	E	58.8	-	F	167.7	-
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is max after 2 cycles.					* Delay > 300 seconds	

Table 5: 2025 No-Build vs. Build Level of Service Summary – PM Peak Hour

INTERSECTIONS	2025 No-Build			2025 Build		
	LOS	Delay (s/veh)	95%ile Queue (ft)	LOS	Delay (s/veh)	95%ile Queue (ft)
Central Avenue at Reservoir Street [UNSIGNALIZED]						
Central - EB	A	9.3	2.5	A	9.5	2.5
Central - WB	A	8.7	2.5	A	9.6	2.5
Reservoir - NB	F	*	522.5	F	*	677.5
Reservoir - SB	E	37.4	27.5	F	71.8	50
Central Avenue at River Park Street [UNSIGNALIZED]						
Central - WB	A	8.6	0	A	9.3	0
River Park - NB	B	12.0	0	B	14.4	2.5
Central Avenue at Hampton Avenue [UNSIGNALIZED]						
Central - WB	A	8.6	2.5	A	9.3	2.5
Hampton - NB	C	21.2	27.5	D	32.8	45
Central Avenue at Gould Street [UNSIGNALIZED]						
Central - WB	A	9.4	17.5	A	9.9	27.5
Gould - NB	F	*	600	F	*	2457.5
Gould Street at Ellis Street [UNSIGNALIZED]						
Driveway - EB	B	14.4	0	D	31.9	2.5
Ellis - WB	C	16.2	17.5	F	55.7	65
Gould - NB	A	0.0	0	A	0.0	0
Gould - SB	A	7.8	0	A	9.4	0
Gould Street at Kearney Road [UNSIGNALIZED]						
Kearney - WB	C	22.1	47.5	F	257.5	240
Gould - SB	A	7.8	0	B	11.5	2.5
Gould Street at Station Street [UNSIGNALIZED]						
Station - WB	C	16.4	22.5	F	55	77.5
Gould - SB	A	7.9	0	A	10	0
Gould Street at Noanett Street [UNSIGNALIZED]						
Noanett - EB	C	16.7	7.5	D	31.0	15
Driveway - WB	E	43.4	95	F	*	307.5
Gould - NB	A	9.1	5	A	9.5	5
Gould - SB	A	7.8	0	A	9.4	0
Gould Street at TV Place [UNSIGNALIZED]						
TV - WB	C	17.5	15	F	*	1730
Gould - SB	A	7.9	0	A	9.3	5
Gould Street at Muzi Drive/Wingate Drive [UNSIGNALIZED]						
Wingate - EB	B	14.3	7.5	C	20.5	12.5
Muzi - WB	C	23.2	22.5	F	*	2150
Gould - NB	A	9.2	0	A	0.3	2.5
Gould - SB	A	7.8	0	A	0.3	2.5
Highland Avenue at Gould Street/Hunting Road [SIGNALIZED]						
Highland - EBL	E	63.7	#132	E	75.8	#192
Higland - EBTR			#425			#425
Highland - WBL	D	41.5	#425	D	42.0	#425
Highland - WBTR			360			390
Hunting - NBTL	D	44.5	#188	E	57.5	#270
Hunting - NBR			411			448
Gould - SBL	D	48.0	387	F	360.3	#1154
Gould - SBLTR			#516			#1429
OVERALL	D	48.6	-	F	167.2	-
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is max after 2 cycles.					* Delay > 300 seconds	

4.0 Traffic Signal Warrant Analyses

In order to justify the installation of a traffic signal, one or more of the signal warrants in the Manual on Uniform Traffic Control Devices (MUTCD) must be met. If one or more of the warrants is met and the installation of a signal will improve the overall safety and operation of the intersection, then installation of a signal operation is justified.

Given the data collected as part of this study, two of the eight traffic signal warrants were examined in accordance with the procedures and criteria described in the MUTCD. The signal warrants evaluated are as follows:

Warrant 2 - Four Hour Vehicular Volume

Vehicular volumes during each hour for any four (4) hours of an average day on the major street (total of both directions) and on the minor street in one direction (with higher volume) are plotted on a standard graph provided in the MUTCD. If the intersecting points fall above the respective curve in terms of number of approach lanes, the warrant is met.

Warrant 3 - Peak Hour

Vehicular volumes during one (1) hour of any average weekday on the major street (total of both directions) and on the minor street in one direction (with higher volume) are plotted on a standard graph provided in the MUTCD. If the intersecting point falls above the respective curve in terms of number of approach lanes, the warrant is met.

4.1 Warrant Analysis Results

Signal warrant analyses were performed in accordance with the procedures and criteria described in the MUTCD for the intersections of the Central Avenue at Reservoir Street and Central Avenue at Gould Street intersections. The results of this analysis, which were conducted for No-Build (provided in the Appendix) and Build scenario volumes, are summarized in Table 6. Details pertaining to signal warrant analysis are included in the Appendix.

Table 6: Traffic Signal Warrant Analysis Summary

Intersection	No-Build		Build	
	Warrant 2: 4 Hour	Warrant 3: Peak Hour	Warrant 2: 4 Hour	Warrant 3: Peak Hour
Central Avenue at Reservoir Street	No	Yes	No	Yes
Central Avenue at Gould Street	Yes	Yes	Yes	Yes

As can be seen in the table, at least one traffic signal warrant is met for both unsignalized intersections analyzed during both the No-Build and Build conditions. MassDOT guidelines prefer an intersection satisfy an 8-hour signal warrant for the installation of a traffic signal. Meeting the 4-hour warrant criteria is a minimum requirement in many situations, therefore, further data collection could be performed in order to determine if the intersection of Central Avenue and Gould Street meet the 8-hour traffic signal warrant criteria.

5.0 Proposed Future Mitigations & Cost Estimate

As can be seen in the analysis results for the Build conditions, the most significantly impacted intersections include Central Avenue at Reservoir Street and Central Avenue at Gould Street, in addition to the TV Place and Muzi Drive intersections with Gould Street, which provide primary access to the development area.

In order to mitigate the impact of the build out, the following additional data collection, analysis and mitigations are recommended:

- Additional data collection should be performed in order to determine if the Central Avenue at Gould Street intersection meets the 8-hour traffic signal warrant criteria.

- Additional data collection should be performed at TV Place and Muzi Drive intersections with Gould Street in order to determine if they would meet the 8-hour traffic signal warrant criteria.

- Consolidate and signalize the TV Place and Muzi Motors driveway intersections. Install a southbound left turn bay at the intersection. ($500,000)

The intersection of Central Avenue and Gould Street would benefit from both a left-turn lane and a right-turn lane on Central Avenue. Since the existing right-of-way is limited, the following is recommended:

- Install an approximate 100’ left turn lane on the Central Avenue westbound approach to Gould Street. The left-turn lane should be able to be accomplished within the existing limits of pavement. ($5,000)

- If sufficient right-of-way is available, install an approximate 100’ right-turn lane on the Central Avenue eastbound approach to Gould Street. (Approx. $120,000)

Installing an additional Gould Street southbound left-turn lane approaching Highland Avenue as well as another lane on the Hunting Road northbound approach to Highland Avenue would help alleviate the existing and future traffic capacity impacts at the intersection; however, right-of-way constraints limit the potential for mitigation. It should also be noted that the intersection is under MassDOT jurisdiction, and as such improvements would require review and permit approval from MassDOT.