

# Traffic Impact Study

## Melone Residential Development

North Road (Route 117)  
Sudbury, MA

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Prepared for  
**Town of Sudbury**

October 2018



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## INTRODUCTION

McMahon Associates has reviewed the potential traffic impacts associated with a proposed residential development to be located on North Road (Route 117) in Sudbury, Massachusetts. The purpose of this study is to evaluate existing and projected traffic operational and safety conditions in the vicinity of the site and identify if mitigating measures are necessary to offset potential project-related traffic impacts on the surrounding roadways.

The following assessment is based on a review of current traffic volumes and crash data collected for this study, and the anticipated traffic generating characteristics of the proposed residential development. This study examines existing and projected traffic operations (both with and without the proposed development) at key intersections in the vicinity of the project site. The study area was chosen in coordination with the Town of Sudbury and based on a review of the surrounding roadway network. This study provides a detailed analysis of traffic operations during the weekday morning and weekday afternoon peak hours, when the combination of the adjacent roadway volumes and the projected traffic increases would be greatest.

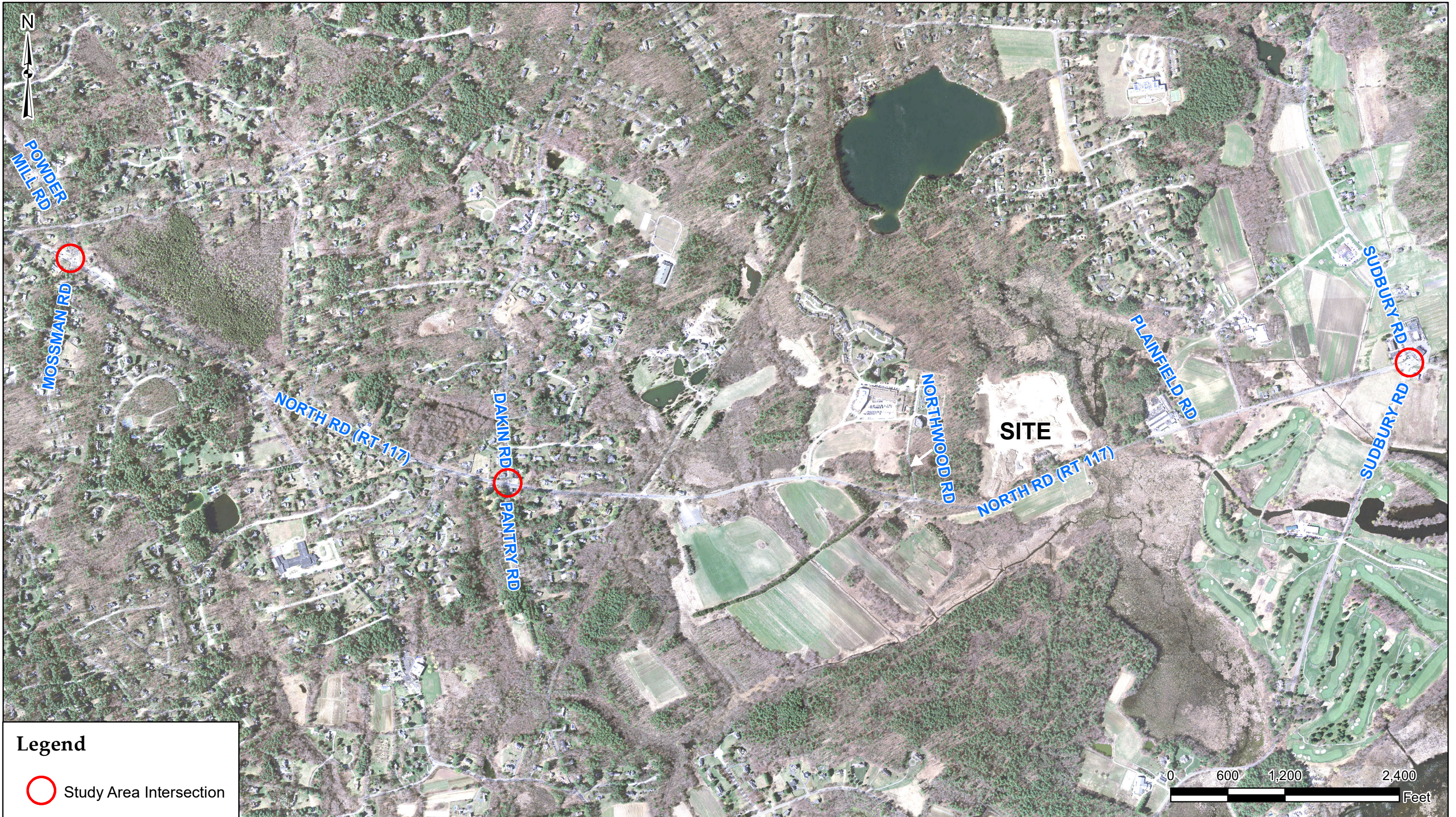
Based on the analysis presented in this study, the projected traffic increases associated with the project-related traffic generated by the development are not expected to have a significant effect on the area roadways and intersections, however, a traffic monitoring program is recommended to be conducted once the development is built and substantially occupied. This report documents the findings of the analysis.

### *Project Description*

The project site is located on North Road in Sudbury, Massachusetts, as shown in Figure 1. The site, commonly referred to as the “Melone property,” is currently owned by the Town of Sudbury, which previously used the site as a gravel pit. The site is bounded by North Road to the south, a residential development to the west, and undeveloped land to the east and north. A portion of the site (approximately 35%) at its northeast corner is owned by the Town of Concord, and is not proposed to be developed as part of the project.

The proposed project calls for the development of approximately 214 apartments and 60 age-restricted townhouses. The residential subdivision would be connected through a series of internal roadways and is proposed to be accessed via a full-access driveway on North Road. Two additional driveways are proposed to the east and west of the main site driveway; however, these driveways are expected to be used only for service access and emergency access, respectively.





**Legend**

○ Study Area Intersection

Figure 1  
Site Location  
Melone Residential Development  
Sudbury, MA



### *Study Methodology*

This study evaluates existing and projected traffic operations at study area intersections for the weekday morning and weekday afternoon peak hour traffic conditions when adjacent roadway volumes would be greatest.

The study was conducted in three steps. The first step involved an inventory of existing traffic conditions in the vicinity of the site. As part of this inventory, traffic counts were collected at key intersections during the weekday morning and weekday afternoon peak periods. Crash data for the study area intersections was obtained from MassDOT to evaluate existing traffic safety within the study area. A field inventory was performed to review the physical characteristics of the study area and to evaluate available sight distance at the location of the proposed site driveways.

The second step of the study builds upon data collected in the first step and establishes the basis for evaluating the transportation impacts associated with the future conditions. In this step, existing 2018 traffic volumes were projected using a seven-year study horizon to the 2025 No Build (without project) condition and the 2025 Build (with project) condition, in accordance with MassDOT traffic impact assessment (TIA) guidelines.

The final step evaluated if measures were necessary to improve existing and future traffic operations and safety, minimize potential traffic impacts, and provide safe and efficient access to the project site.

### *Study Area Intersections*

The area identified for detailed analysis in this study was determined in coordination with the Town and based on a review of the surrounding roadway network serving the project site. The study area intersections include:

- Fitchburg Turnpike (Route 117) at Sudbury Road
- North Road (Route 117) at Dakin Road/Pantry Road
- North Road (Route 117) at Powder Mill Road/Mossman Road
- North Road (Route 117) at proposed site driveway

## EXISTING CONDITIONS

Effective evaluation of potential traffic impacts associated with the proposed development requires a thorough understanding of the existing traffic conditions on the roadways and intersections serving the project site. The assessment of existing conditions consists of an inventory of the roadway and intersection geometries and traffic control devices, collection of peak-period traffic volumes, and a review of recent crash history.

### *Roadway Network*

The project site benefits from excellent access via the local and regional roadway systems. Brief descriptions of the principal roadways serving the project site are presented below.

#### North Road/Fitchburg Turnpike (Route 117)

North Road (named Fitchburg Turnpike within the Town of Concord) generally runs in the east-west direction through the Town of Sudbury. North Road is a two-lane, two-way roadway classified as an urban minor arterial under Town of Sudbury jurisdiction. In the vicinity of the site, North Road provides approximately 12-foot travel lanes with two-foot shoulders in each direction. Near the site, no sidewalks are provided; to the west of the site, an approximate five-foot sidewalk is provided on the southern side of North Road, extending from the intersection of North Road at Great Road as far east as Davis Field. A speed limit of 40 miles per hour (mph) is posted in both directions.

#### Sudbury Road

Sudbury Road generally runs in the north-south direction through the Town of Concord and is classified as an urban collector under Town jurisdiction. Sudbury Road is a two-lane, two-way roadway providing approximately 12-foot travel lanes in each direction. No sidewalks or marked shoulders are provided along either side of the roadway. The posted speed limit on Sudbury Road near its intersection with Fitchburg Turnpike is 40 mph in the southbound direction and 30 mph in the northbound direction.

#### Dakin Road/Pantry Road

Dakin Road/Pantry Road is a local roadway under Town of Sudbury jurisdiction. It runs in the north-south direction through the Town of Sudbury. The roadway is named Dakin Road north of its intersection with North Road and Pantry Road to the south of the intersection. Dakin Road/Pantry Road is a two-lane, two-way roadway providing access to primarily residential land uses. Approximately ten-foot travel lanes with one-foot shoulders are provided in each direction. No sidewalks are provided along either side of Dakin Road/Pantry Road in the vicinity of North Road. A speed limit of 25 mph is posted in both directions on Dakin Road, while a speed limit of 35 mph is posted in both directions on Pantry Road.

#### Powder Mill Road/Mossman Road

Powder Mill Road/Mossman Road is a local roadway which extends in the north-south direction and is under Town of Sudbury jurisdiction. The roadway is named Powder Mill Road to the north of North Road, and Mossman Road to the south. Powder Mill Road/Mossman Road is a two lane, two-way roadway that provides access to primarily residential land uses. Approximately 12-foot travel lanes are provided in each direction. To the north of North Road, Powder Mill Road also provides approximately one-foot shoulders in each direction, along with an approximately five-foot sidewalk on its east side. No sidewalks or shoulders are provided on Mossman Road to the south of North Road. A speed limit of 30 mph is posted in both directions on Powder Mill Road, while a speed limit of 25 mph is posted in both directions on Mossman Road. Powder Mill Road and Mossman Road are both under stop control at their intersection with North Road.

#### Signalized Intersections

North Road/Fitchburg Turnpike is signalized at its intersection with Dakin Road/Pantry Road and at its intersection with Sudbury Road.

At the signalized intersection of North Road at Dakin Road/Pantry Road, all approaches provide single multi-use lanes. There are two signal phases for vehicular traffic, one for eastbound and westbound traffic along North Road and one for northbound and southbound traffic along Dakin Road/Pantry Road. No pedestrian push-buttons or signals are provided. The Town of Sudbury Fire Department is located on the northeast corner of the intersection, and an additional traffic signal is located at its driveway on North Road. This signal is under flashing yellow operation except when activated by an emergency vehicle exiting the fire station. Under these emergency conditions, the traffic signal at the station driveway prevents westbound traffic from continuing to the Dakin Road/Pantry Road intersection, while the signal at Dakin Road/Pantry Road provides an exclusive phase for westbound vehicular traffic to clear the area in front of the fire station and for emergency vehicles to pass through the intersection.

At the signalized intersection of Fitchburg Turnpike at Sudbury Road, exclusive left-turn lanes are provided on the eastbound, westbound, and southbound approaches. Additionally, yield-controlled channelized right-turn lanes are provided on the eastbound and westbound Fitchburg Turnpike approaches. The northbound Sudbury Road approach provides a single multi-use lane. Two phases are provided for vehicular traffic one for eastbound and westbound traffic along Fitchburg Turnpike and one for northbound and southbound traffic along Sudbury Road. No pedestrian push-buttons or signals are provided.

## *Existing Traffic Volumes*

### Existing Peak Hour Traffic Volumes

To assess peak hour traffic conditions, manual turning movement counts were conducted at the study area intersections. Traffic count data was collected during the weekday morning peak period from 7:00 AM to 9:00 AM on Thursday, September 20, 2018, and during the weekday afternoon peak period from 4:00 PM to 6:00 PM on Thursday, September 27, 2018.

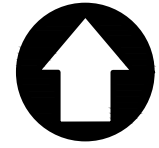
The results of the counts are tabulated by 15-minute periods and are provided in Appendix A of this report. The four highest consecutive 15-minute intervals during each of these count periods constitute the peak hours that are the basis of the traffic analysis provided in this report. Based on a review of the traffic count data, the weekday morning peak hour occurs between 7:45 AM and 8:45 AM and the weekday afternoon peak hour occurs between 5:00 PM and 6:00 PM.

A 24-hour Automatic Traffic Recorder (ATR) count was also conducted on North Road in the vicinity of the proposed site driveway on Thursday, September 27, 2018. The results of the ATR counts, including volumes, speeds, and vehicle class, are provided in Appendix A of this report. According to the ATR, North Road carries a daily volume of approximately 12,400 vehicles per day. The 85<sup>th</sup> percentile vehicle speed on North Road was measured to be 41 mph in the eastbound direction and 45 mph in the westbound direction. Based on a review of the ATR data, traffic volumes on North Road may peak earlier than the typical commuter peak periods, but the intersection turning movement counts conducted captured the overall commuter peak periods of the study area intersections.

### Seasonal Variation

In order to determine seasonal variation in this area, a MassDOT continuous count station (Local ID: 403) located on Elm Street (Route 2) in Concord, MA, was reviewed. Based on the data provided, traffic volumes collected during the month of September are shown to be higher than traffic volumes for the average month. Therefore, to provide a conservative analysis, the peak hour traffic volumes were not seasonally adjusted. The Existing 2018 peak hourly traffic flows are depicted in Figure 2 and Figure 3 for the weekday morning and weekday afternoon peak hours, respectively.





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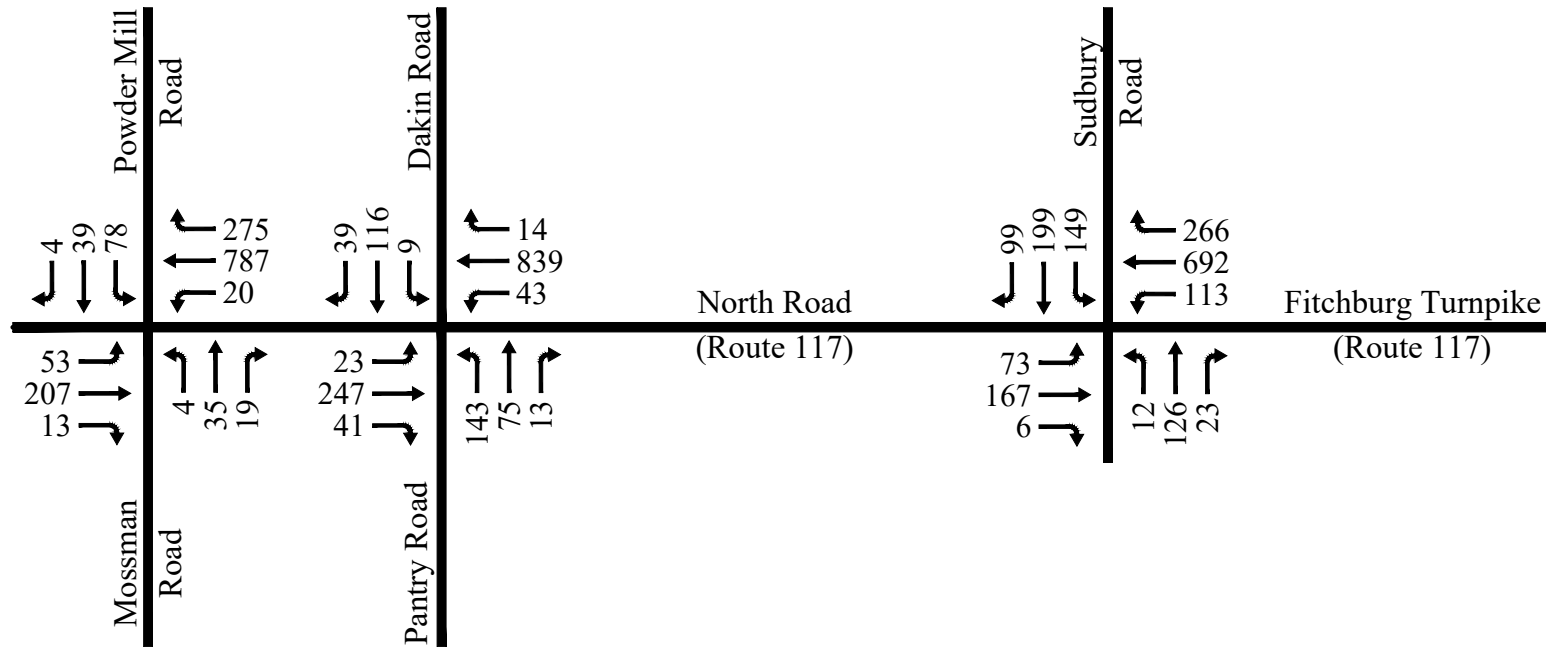


Figure 3  
2018 Existing Weekday Afternoon  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts

### *Crash Summary*

Crash data for the study area intersections was obtained from MassDOT for the most recent five-year period available. This data includes complete yearly crash summaries for 2012, 2013, 2014, 2015, and 2016. A summary of the crash data is presented in Appendix B.

The intersection of Fitchburg Turnpike at Sudbury Road is shown to have a total of 26 reported crashes over the five-year period from 2012 through 2016. The resulting crash rate of 0.74 crashes per million entering vehicles is below both the statewide average of 0.78 crashes per million entering vehicles and the District 3 average of 0.89 crashes per million entering vehicles for signalized intersections. Of the 26 reported crashes, half were angle collisions, while six were rear-end collisions. Angle and rear-end collisions are typical at signalized intersections with permitted left turns. Four of the reported crashes resulted in personal injury, while the other 22 resulted in property damage only. A high percentage (46%) of the crashes were shown to occur during the typical weekday morning and weekday afternoon commuter peak periods, and are likely related to traffic operational issues when traffic volumes are highest at the intersection.

The intersection of North Road at Pantry Road/Dakin Road is shown to have a total of 16 reported crashes from 2012 through 2016, resulting in a crash rate of 0.55 crashes per million entering vehicles, below both the statewide and District 3 averages for a signalized intersection. Fourteen of the 16 crashes reported were angle or rear-end collisions which is typical for a signalized intersection, and the other two were single-vehicle collisions. Two crashes were reported to result in personal injury, while the other 14 resulted in property damage only.

The intersection of North Road at Powder Mill Road/Mossman Road is shown to have a total of seven reported crashes over the five-year period analyzed. The resulting crash rate of 0.25 crashes per million entering vehicles is below both the statewide average of 0.57 crashes per million entering vehicles and the District 3 average of 0.61 crashes per million entering vehicles for unsignalized intersections. A majority of crashes (four of seven) reported at the intersection were angle collisions, and all seven reported crashes resulted in property damage only.

Crash data on North Road in the vicinity of the proposed site driveway was also reviewed. The area of North Road within 500 feet of the site in both directions is shown to have experienced four reported crashes between 2012 and 2016, three of which were single vehicle collisions. One of the reported crashes resulted in personal injury (a single vehicle collision with a guardrail), while the other three resulted in property damage only.

Intersection crash rates are less than the statewide and District 3 averages at each of the study area intersections and therefore the study area is not considered to have any significant existing safety concerns.



## **FUTURE CONDITIONS**

To determine future traffic demands on the study area roadways, the 2018 Existing traffic volumes were projected to the future-year 2025 when the proposed development is expected to be fully built and occupied. Independent of the proposed project, traffic volumes on the roadways in 2025 are assumed to include all existing traffic, as well as new traffic resulting from general growth in the study area. The potential background traffic growth unrelated to the proposed project was considered in the development of the 2025 No Build (without project) peak hour traffic volume networks. The anticipated traffic increases associated with the proposed development were then added to the 2025 No Build volumes to reflect the 2025 Build (with project) traffic condition. A more detailed description of the projection of the 2025 No Build and 2025 Build traffic volume networks is presented below.

### *Future Roadway Improvements*

Planned roadway improvement projects can affect area travel patterns and future traffic operations. To develop a clearer understanding of future area roadway operations, the planning departments of Sudbury and Concord were consulted and available MassDOT information was reviewed. Based on this information, no roadway improvement projects are planned in the vicinity of the study area.

### *Background Traffic Growth*

Traffic growth is primarily a function of changes in motor vehicle use and expected land development in the region. To predict a rate at which traffic on the roadways in the vicinity of the site can be expected to grow during the seven-year forecast period (2018 to 2025), both planned area developments and historic traffic growth were examined.

#### Historic Traffic Growth

In order to forecast increases in traffic volumes on the study area roadways and intersections for the future analyses, a background growth rate of one percent per year was identified using data from a MassDOT continuous count station on Elm Street (Route 2) in Concord and discussed with the Sudbury Planning Department. This rate captures growth associated with general changes in population and accounts for other small developments in the vicinity of the study area that may be unknown at this time.

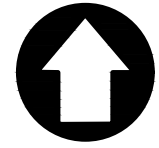
#### Site-Specific Growth

Based on information provided by the Sudbury Planning Department, one planned development that might have an impact on traffic volumes in the study area was identified, the Maynard Crossing mixed-use development project at 129 Parker Street in Maynard, MA. McMahan obtained a traffic impact study prepared by Green International Affiliates, Inc. for the Maynard Crossing project from the Town of Maynard website. Weekday morning and

afternoon peak hour trips within this report distributed onto the Melone project study area roadway network based existing traffic flows. Several other small residential developments were also identified as under construction or not fully occupied yet, but those additional volumes would be expected to be included in the background growth rate.

#### ***2025 No Build Traffic Volumes***

The 2018 Existing peak hour traffic volumes were grown by one percent per year over the seven-year study horizon (2018 to 2025) and expected vehicle trips from the Maynard Crossing development were added to establish the 2025 future year base traffic volumes. The resulting 2025 No Build weekday morning and weekday afternoon peak hour traffic volume networks are illustrated in Figure 4 and Figure 5, respectively, and are documented in the traffic projection model presented in Appendix C of this report.



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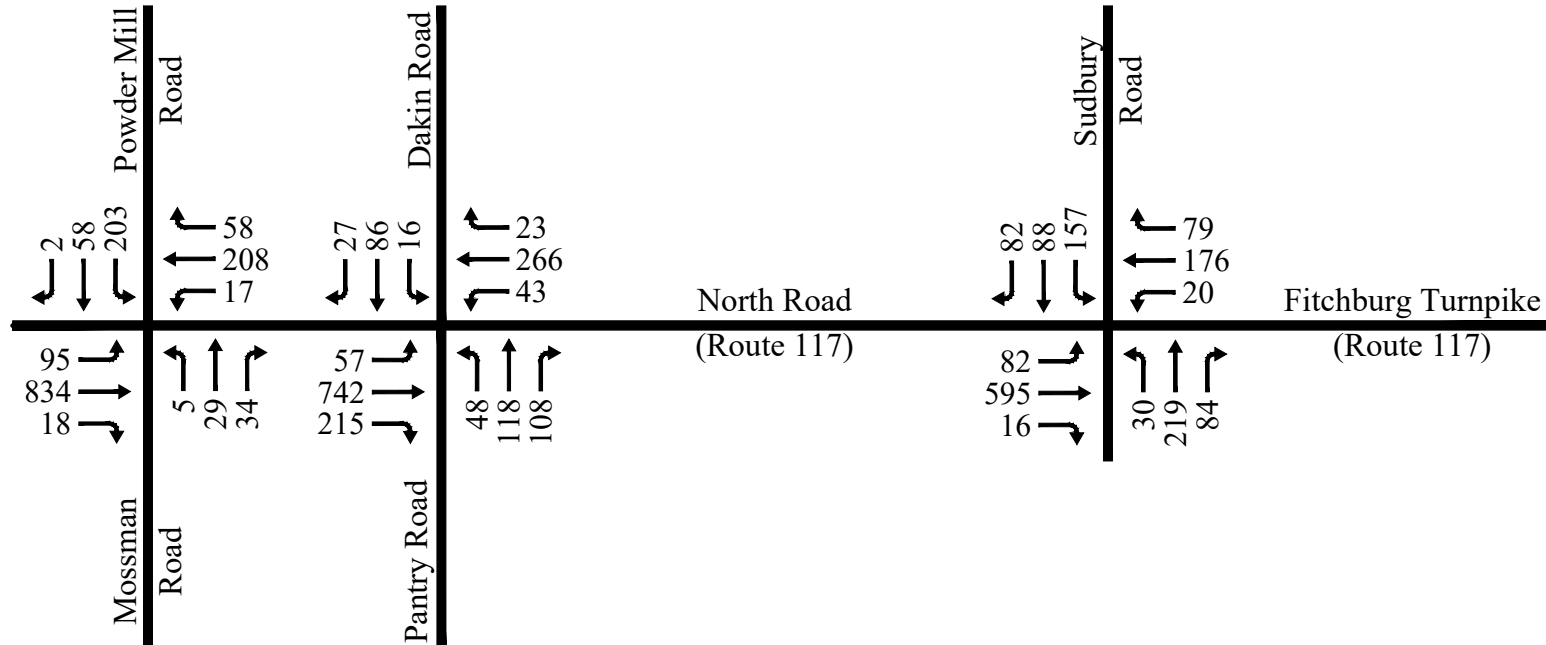
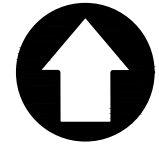


Figure 4  
2025 No Build Weekday Morning  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts



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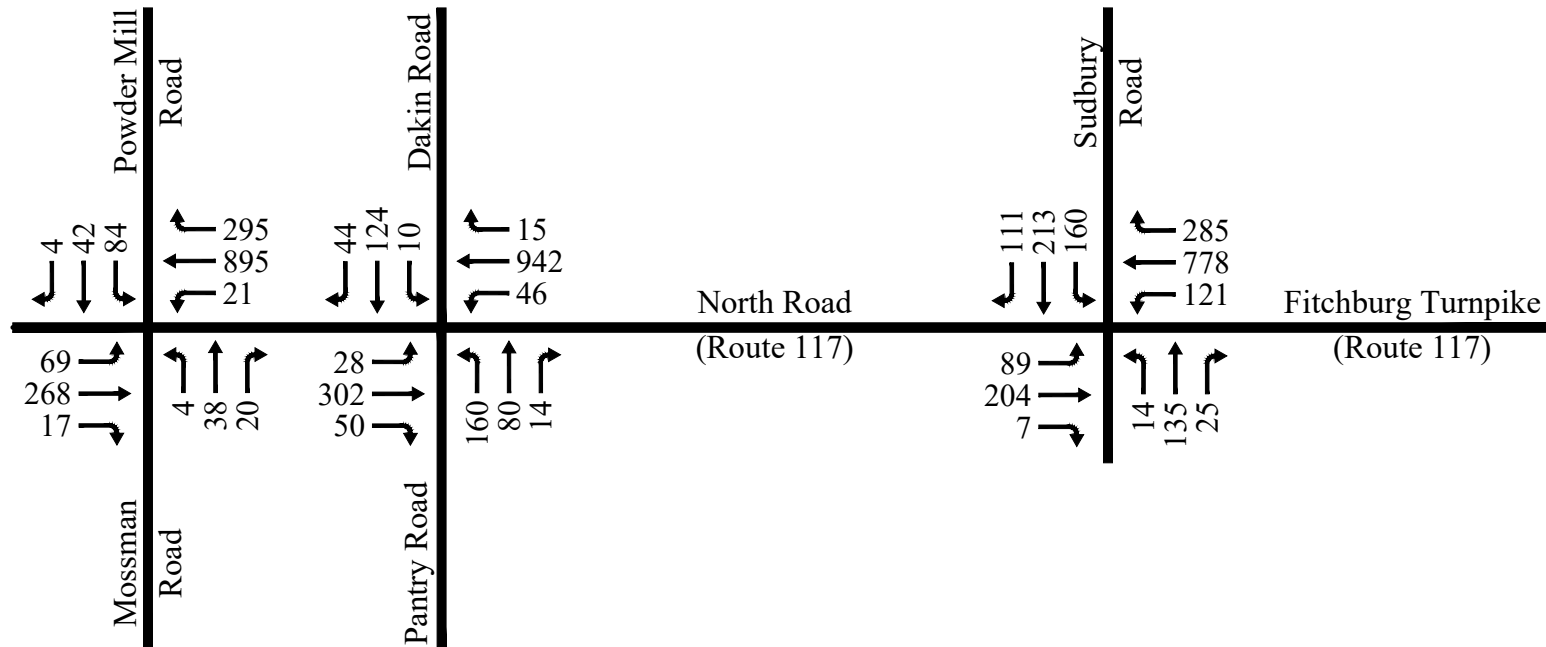


Figure 5  
2025 No Build Weekday Afternoon  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts

**Site-Generated Traffic**

The Institute of Transportation Engineers (ITE) is a national research organization of transportation professionals. Their publication, *Trip Generation Manual, 10<sup>th</sup> Edition* provides traffic generation information for various land uses compiled from studies conducted by members nationwide. Vehicle trip estimates for the proposed residential development project were developed based on data presented in this publication for Land Use Code (LUC) 220 (Multifamily Housing (Low Density)) and LUC 252 (Senior Adult Housing (Attached)). These references establish vehicle trip rates (in this case expressed in trips per unit) based on actual traffic counts conducted at similar existing facilities. Table 1 presents the number of vehicle trips projected to be generated by the proposed 274-unit residential development on the Melone property during the typical weekday morning and weekday afternoon peak hours.

**Table 1: Vehicular Trip Generation**

Description	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
Apartments <sup>1</sup>	214 Dwelling Units	23	75	98	76	44	120
Age-Restricted Townhomes <sup>2</sup>	60 Dwelling Units	4	8	12	9	7	16
<b>Total Proposed Project Trips</b>		<b>27</b>	<b>83</b>	<b>110</b>	<b>85</b>	<b>51</b>	<b>136</b>

<sup>1</sup> ITE Land Use Code 220 (Multifamily Housing (Low Density)), based on 214 dwelling units.

<sup>2</sup> ITE Land Use Code 252 (Senior Adult Housing (Attached)), based on 60 dwelling units.

As shown in Table 1, the proposed residential development is estimated to result in approximately 110 new vehicle trips (27 entering vehicles and 83 exiting vehicles) during the weekday morning peak hour and approximately 136 new vehicle trips (85 entering vehicles and 51 exiting vehicles) during the weekday afternoon peak hour.

**Project Trip Distribution and Assignment**

The additional traffic projected to be generated by the proposed development was distributed onto the study area roadways and intersections based on a review of 2010 Census Commuting and Employment data for the Town of Sudbury, provided in Appendix D of this report. The resulting arrival and departure patterns are presented in Figure 6 and are documented in the traffic projection model found in Appendix D. The resulting distributed new project trips during the weekday morning and afternoon peak hours are shown in Figure 7 and Figure 8.

### *2025 Build Peak Hour Traffic Volumes*

To establish the 2025 Build peak hour traffic volumes, the distributed new project trips were assigned to the surrounding roadway network based on the project distribution patterns shown in Figure 6. These project trips were then added to the 2025 No Build peak hour traffic volumes to reflect the 2025 Build peak hour traffic volumes. The resulting 2025 Build weekday morning and weekday afternoon peak hour traffic volumes are presented in Figure 9 and Figure 10, respectively.

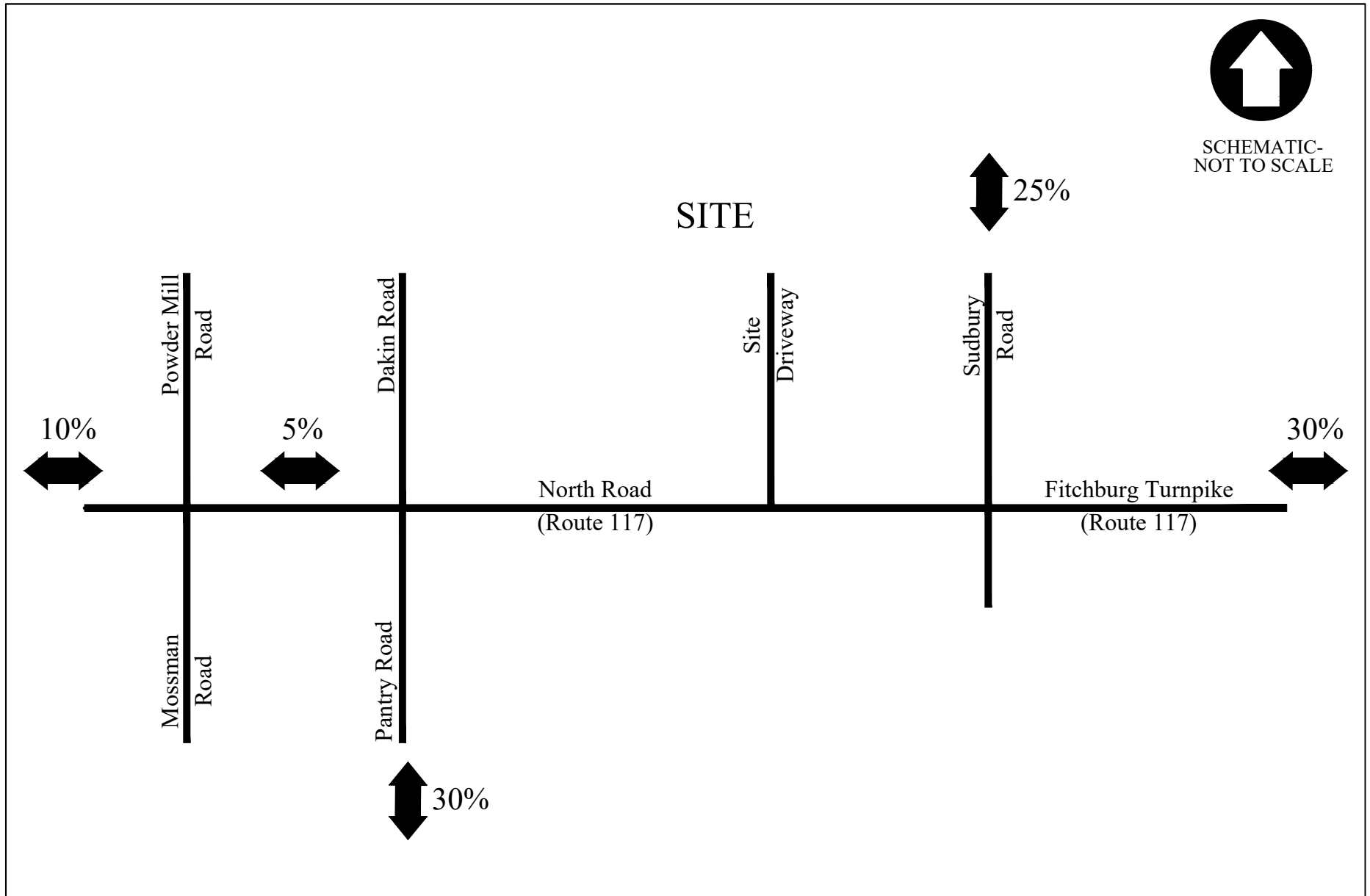
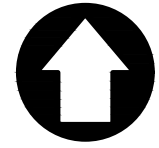


Figure 6  
Direction of Arrivals and Departures  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts



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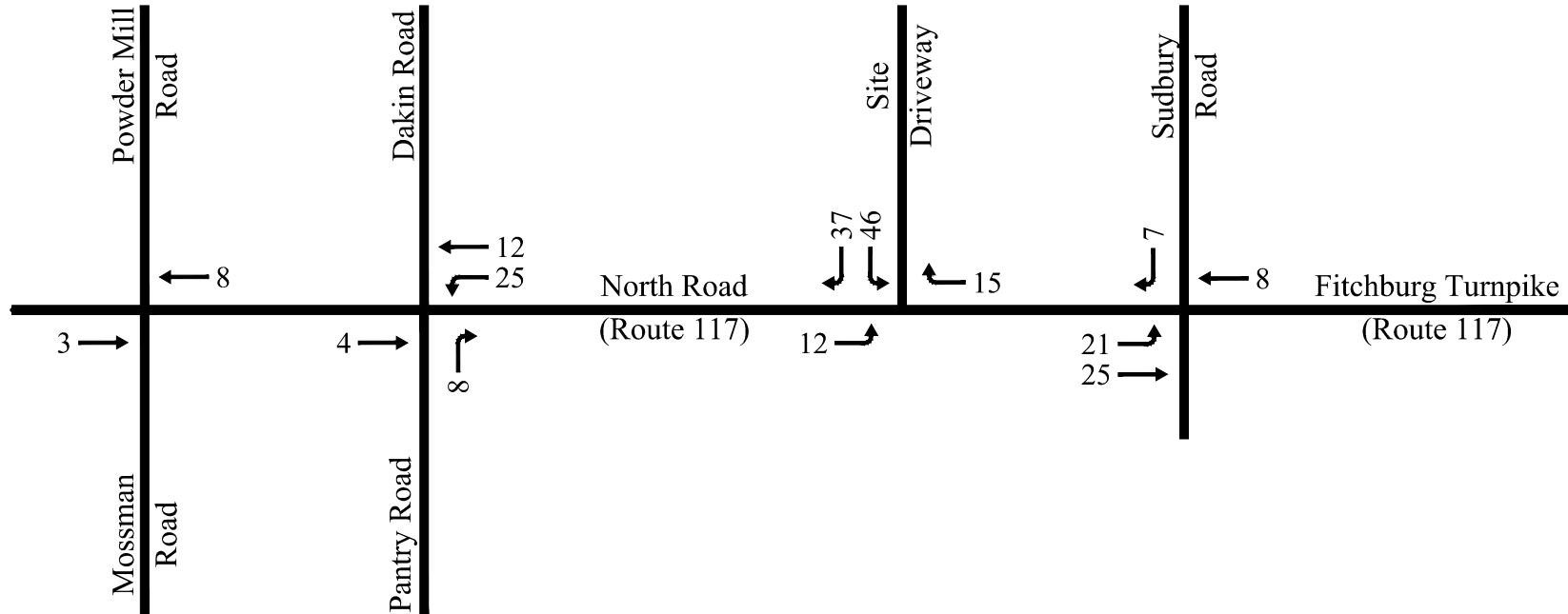
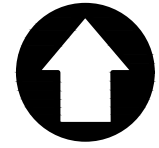


Figure 7  
Weekday Morning Peak Hour  
New Project Trips  
Residential Development  
Sudbury, Massachusetts





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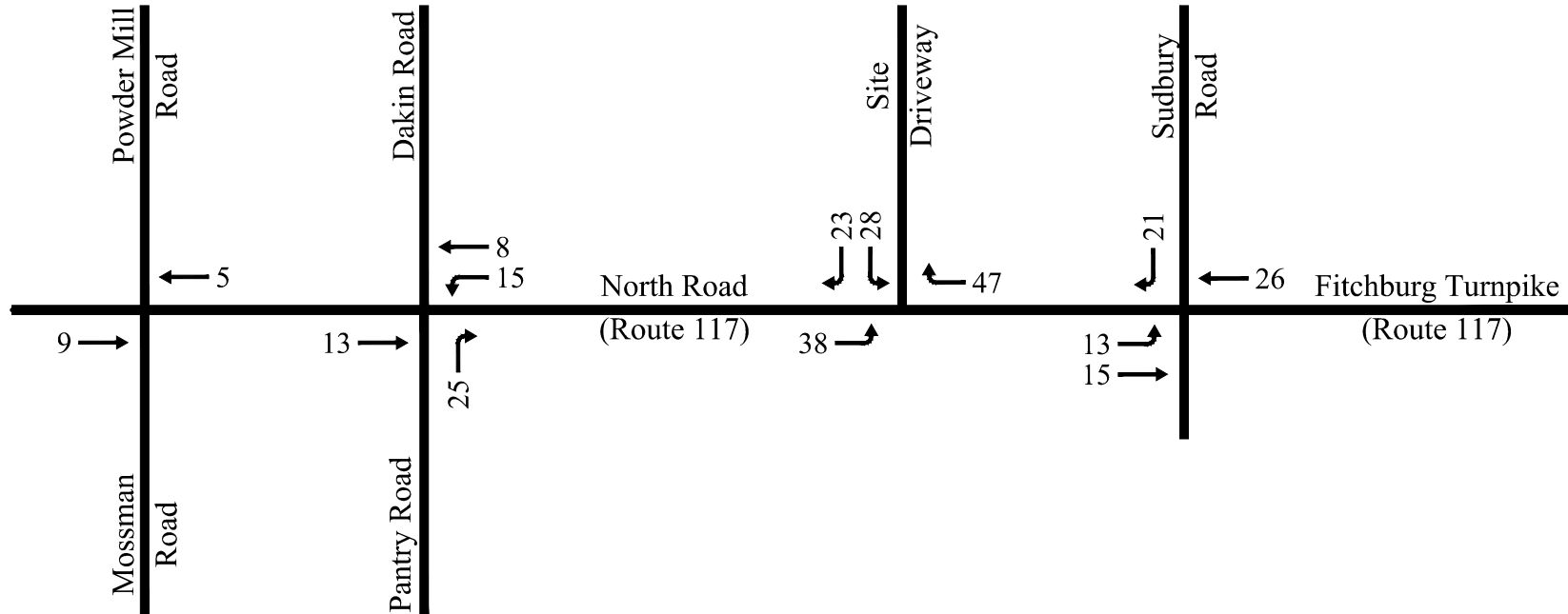
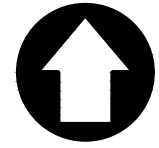


Figure 8  
Weekday Afternoon Peak Hour  
New Project Trips  
Residential Development  
Sudbury, Massachusetts



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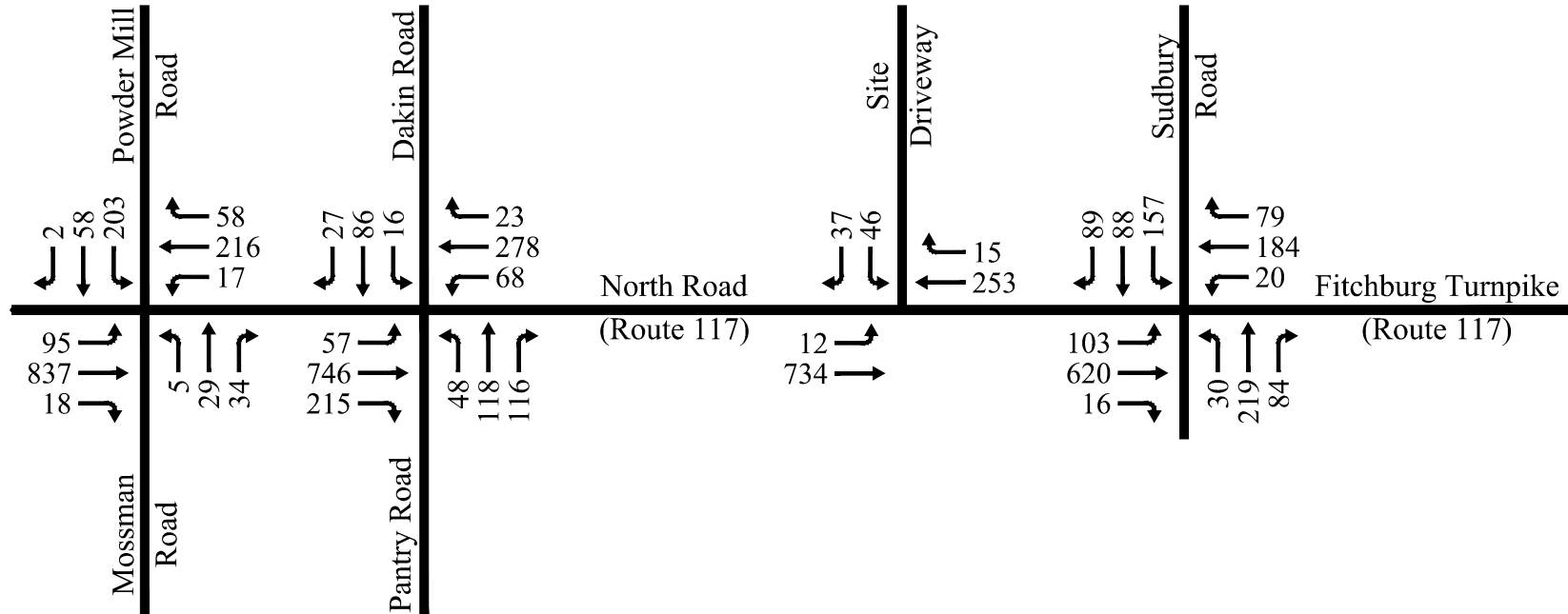
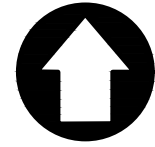


Figure 9  
2025 Build Weekday Morning  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts



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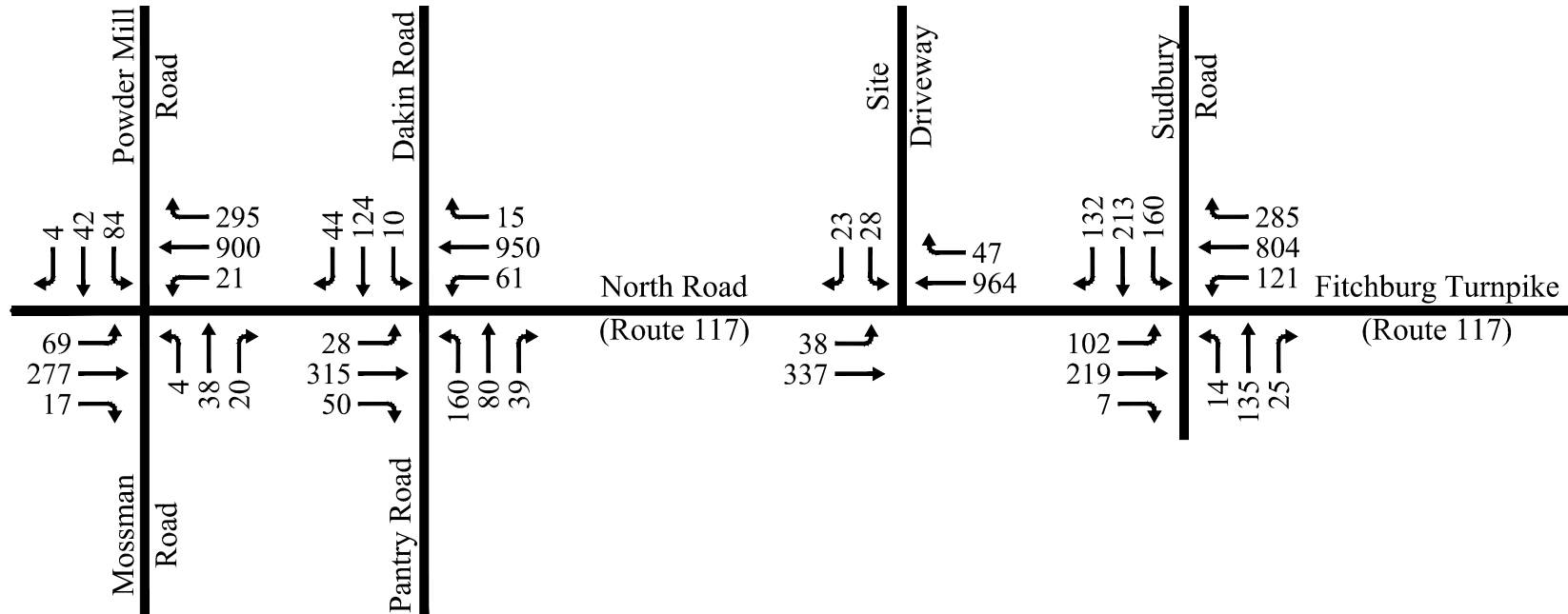


Figure 10  
2025 Build Weekday Afternoon  
Peak Hour Traffic Volumes  
Residential Development  
Sudbury, Massachusetts

## **TRAFFIC OPERATIONS ANALYSIS**

In previous sections of this report, the quantity of traffic on the study area roadways was described. The following section describes the quality of traffic flow at the study area intersections for the given travel demands. As a basis for this assessment, intersection capacity analyses were conducted using Synchro capacity analysis software for the study area intersections under the 2018 Existing, 2025 No Build, and 2025 Build peak hour traffic conditions. This analysis is based on procedures contained in the 2010 Highway Capacity Manual (HCM), which are summarized in Appendix E. A discussion of the evaluation criteria and a summary of the results of the capacity analyses are presented below.

### *Level-of-Service Criteria*

Average total vehicle delay is reported as level-of-service (LOS) on a scale of A to F. LOS A represents delays of 10 seconds or less and LOS F represents delays in excess of 50 seconds for unsignalized movements and greater than 80 seconds for movements at signalized intersections.

### *Capacity Analysis Results*

Intersection capacity analyses were conducted for the study area intersections to evaluate the 2018 Existing, 2025 No Build, and 2025 Build peak hour traffic conditions. Based on the intersection traffic counts, the weekday morning peak hour of the adjacent street traffic is shown to occur between 7:45 AM and 8:45 AM and the weekday afternoon peak hour of the adjacent street traffic is shown to occur between 5:00 PM and 6:00 PM.

The detailed capacity analysis results for the 2018 Existing, 2025 No Build, and 2025 Build conditions are presented in Appendix F, Appendix G, and Appendix H, respectively. The operations of the study area intersections are presented in Table 2 below and detailed traffic operations for the intersections are summarized in Appendix I.

**Table 2: Peak Hour Intersection Capacity Analysis**

Intersection	Movement	Weekday Morning Peak Hour									Weekday Afternoon Peak Hour								
		2018 Existing			2025 No Build			2025 Build			2018 Existing			2025 No Build			2025 Build		
		LOS <sup>1</sup>	Delay <sup>2</sup>	V/C <sup>3</sup>	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C
Fitchburg Turnpike (Route 117) at Sudbury Road	EB L	A	8.4	0.15	A	8.2	0.16	A	8.6	0.20	B	11.5	0.31	B	19.8	0.50	C	31.1	0.64
	T	B	16.1	0.70	B	16.8	0.73	B	17.3	0.75	A	7.3	0.18	A	7.7	0.22	A	7.8	0.23
	R	A	3.7	0.02	A	3.8	0.03	A	3.8	0.02	A	1.8	0.01	A	2.3	0.01	A	2.3	0.01
	WB L	A	8.3	0.09	A	8.4	0.10	A	8.6	0.11	A	7.7	0.18	A	8.1	0.20	A	8.2	0.20
	T	A	8.6	0.19	A	8.5	0.21	A	8.4	0.22	B	14.0	0.70	B	17.1	0.77	B	18.5	0.80
	R	A	2.3	0.11	A	2.2	0.11	A	2.2	0.11	A	4.8	0.30	A	5.3	0.32	A	5.4	0.32
	NB LTR	C	24.8	0.66	C	30.0	0.74	C	31.2	0.76	C	20.7	0.37	C	21.8	0.41	C	22.4	0.43
	SB L	C	34.5	0.64	D	51.4	0.79	E	57.3	0.83	C	29.3	0.57	C	32.5	0.64	C	32.3	0.63
	TR	B	12.9	0.29	B	14.2	0.33	B	14.2	0.35	C	29.1	0.73	C	32.5	0.78	D	35.4	0.82
	Overall	B	17.5	0.70	C	20.6	0.79	C	21.3	0.83	B	16.0	0.73	B	18.3	0.78	B	20.0	0.82
North Road (Route 117) at Site Driveway	EB LT	-	-	-	-	-	-	A	0.1	0.01	-	-	-	-	-	-	A	1.1	0.07
	WB TR	-	-	-	-	-	-	A	0.0	0.00	-	-	-	-	-	-	A	0.0	0.00
	SB L	-	-	-	-	-	-	E	36.3	0.31	-	-	-	-	-	-	E	44.5	0.25
	R	-	-	-	-	-	-	B	10.5	0.06	-	-	-	-	-	-	C	19.1	0.09
North Road (Route 117) at Dakin Road/Pantry Road	EB LTR	C	34.1	0.96	E	60.8	1.06	E	63.5	1.07	A	8.5	0.37	A	9.0	0.43	A	9.0	0.43
	WB LTR	A	7.4	0.37	A	8.1	0.43	A	9.8	0.52	C	27.9	0.91	D	35.2	0.96	D	39.5	0.98
	NB LTR	D	46.1	0.87	E	60.8	0.95	E	65.8	0.98	D	49.5	0.83	F	>100	1.11	F	>100	1.22
	SB LTR	C	24.3	0.48	C	25.1	0.51	C	25.3	0.52	C	23.6	0.39	C	26.6	0.46	C	27.2	0.48
	Overall	C	30.6	0.96	D	47.8	1.06	D	49.8	1.07	C	27.1	0.91	D	41.4	1.11	D	51.1	0.22
North Road (Route 117) at Powder Mill Road/Mossman Road	EB LTR	A	0.8	0.07	A	0.8	0.08	A	0.8	0.08	A	2.3	0.10	A	2.5	0.14	A	2.5	0.14
	WB LTR	A	0.7	0.02	A	0.6	0.03	A	0.6	0.03	A	0.1	0.02	A	0.1	0.02	A	0.1	0.02
	NB LTR	E	38.5	0.42	F	65.2	0.60	F	68.0	0.62	F	64.7	0.57	F	>100	0.98	F	>100	1.02
	SB LTR	F	>100	2.99	F	>100	4.60	F	>100	4.67	F	>100	1.88	F	>100	4.88	F	>100	5.40

1 Level-of-Service  
2 Average vehicle delay in seconds  
3 Volume to capacity ratio

#### Fitchburg Turnpike at Sudbury Road

As shown in Table 2, the signalized intersection of Fitchburg Turnpike at Sudbury Road is shown to currently operate at overall LOS B during the weekday morning and weekday afternoon peak hours, with all movements during both periods operating at LOS C or better. Under 2025 No Build conditions, the signalized intersection is expected to decrease to overall LOS C during the weekday morning peak hour and continue to operate at LOS B during the weekday afternoon peak hour, with all movements during both periods operating at LOS C or better, except for the southbound left turn movement which is expected to decrease to LOS D during the weekday morning peak hour.

With the proposed project in place, the intersection of Fitchburg Turnpike at Sudbury Road is expected to continue to operate at overall LOS C during the weekday morning peak hour and at overall LOS B during the weekday afternoon peak hour, with all movements continuing to operate at LOS C or better, except for the southbound left turn movement which is expected to decrease to LOS E during the weekday morning peak hour and the southbound through movement which is expected to decrease to LOS D during the weekday afternoon peak hour.

Based on our review, revising the signal timings would likely address the changes in levels of service and generally offset the impacts of the proposed project. Specific mitigation proposed for this intersection is identified in the Mitigation section of this report.

#### North Road at Dakin Road/Pantry Road

The signalized intersection of North Road at Dakin Road/Pantry Road is shown to currently operate at overall LOS C during both the weekday morning and weekday afternoon peak hours, with all movements operating at LOS D or better. Under 2025 No Build conditions, the signalized intersection is expected to decrease to overall LOS D during both peak hours as a result of the general background traffic growth in the area. During the 2025 No Build weekday morning peak hour, the northbound and eastbound movements are expected to both decrease to LOS E, while during the weekday afternoon peak hour the northbound movement is expected to decrease to LOS F and operate over capacity.

Under 2025 Build conditions, the intersection of North Road at Dakin Road/Pantry Road is expected to continue to operate at overall LOS D during both peak hours. Increased vehicle delays are most notably expected for the northbound movement which is expected to continue to operate at LOS F and over capacity under 2025 weekday afternoon Build conditions.

Based on our review, revising the signal timings at this intersection would generally offset the impacts of the proposed project. Specific mitigation proposed is identified in the Mitigation section of this report.

#### North Road at Powder Mill Road/Mossman Road

At the unsignalized intersection of North Road at Powder Mill Road/Mossman Road, the critical southbound stop-controlled Powder Mill Road approach is shown to currently operate at LOS F and well over capacity during both the weekday morning and weekday afternoon peak hours. The northbound approach on Mossman Road is also shown to currently operate with poor operations at LOS E and LOS F during the weekday morning and weekday afternoon peak hours, respectively.

Under 2025 No Build and Build conditions, the southbound approach on Powder Mill Road is expected to continue to operate at LOS F and over capacity during both peak hours. The northbound Mossman Road approach is expected to operate at LOS F during both peak hours and over capacity during the weekday afternoon peak hour.

The proposed project is not expected to have a significant impact on the operations of the intersection, but due to already poor operations improvements at this intersection should be explored.

#### North Road at Proposed Site Driveway

The proposed site driveway would provide separate lanes for left- and right-turning traffic exiting the site. The left-turn lane is expected to operate at LOS E during the weekday morning and weekday afternoon peak hours. The right-turn exiting lane is projected to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday afternoon peak hour. The proposed project site driveway is expected to have a negligible impact to the traffic operations on North Road. No turning lanes on North Road are expected to be required based on projected traffic volumes.

#### *Site Access/Circulation*

Access to the proposed site is proposed to be provided by a primary site driveway on North Road, as well as an emergency access driveway to the west of the site driveway and a service driveway to the east. The site driveway is proposed to be located approximately 4,000 feet west of Sudbury Road, just to the west of the residence at 36 North Road and is proposed to have two exiting lanes. Interior to the site, access to the homes would be provided via proposed internal roadways, which connect to the proposed site driveway at a roundabout in the center of the development. It is recommended that internal sidewalks be provided to connect the internal roadways serving the residences to the North Road primary driveway.

#### *Sight Distance*

A field review of the available sight distance was conducted for the proposed site driveway locations. The posted speed limit along North Road is 40 mph in both directions in the vicinity of the site. The ATR performed on North Road determined that the 85<sup>th</sup> percentile speeds are 41 mph in the eastbound direction and 45 mph in the westbound direction.

The American Association of State Highway and Transportation Officials' (AASHTO) publication, *A Policy on Geometric Design, 2011 Edition*, defines minimum and desirable sight distances at intersections. The minimum sight distance is based on the required stopping sight distance (SSD) for vehicles traveling along the main road, while the desirable sight distance, referred to as intersection sight distance (ISD), allows vehicles to enter the main street traffic flow without requiring mainline traffic to slow to less than 70% of their speed. According to AASHTO, "If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient time to anticipate and avoid collisions." The following table summarizes the available sight distances at the proposed site driveways, including the emergency access and service driveway.

**Table 3: Sight Distance Requirements**

Location	Looking	85th % Speed (mph)	SSD <sup>1</sup> Required	ISD <sup>2</sup> Recommended	Sight Distance <sup>3</sup> Measured (ft)	Meets Required?
Site Driveway	Left (East)	45	360	430	500+	Yes
	Right (West)	41	312	452	500+	Yes
Emergency Access	Left (East)	45	360	430	200	No
	Right (West)	41	312	452	220	No
Service Driveway	Left (East)	45	360	430	500+	Yes
	Right (West)	41	312	392	500+	Yes

1 AASHTO stopping sight distance (see AASHTO Table 3-1) for the 85th percentile speed in each direction, in

2 AASHTO intersection sight distance (see AASHTO Tables 9-5 and 9-7) for the 85th percentile speed in each direction, in feet.

3 Sight distance at 14.5 feet back limited by existing vegetation. Sight distance measured from approximately four feet back.

Sight lines at the proposed primary driveway are currently limited by thick trees and vegetation at the AASHTO recommended setback of 14.5 feet from the edge of the travel lane. This limitation would likely be improved through the construction of the proposed site driveway, but may require landscaping efforts to provide adequate sight lines in both directions. Sight distance measurements were taken at a setback of approximately four feet from the travel lane to estimate available sight distance under optimal conditions. As shown in Table 3, available sight distance for vehicles looking either direction from the proposed primary site driveway may exceed 500 feet and satisfy the required SSD and recommended ISD for the 85<sup>th</sup> percentile speeds. However, available sight distance should be verified by the project development team (the Proponent) to ensure that landscaping will provide for safe sight lines.



The available sight distance for vehicles exiting the project site via the service driveway are similarly limited by existing vegetation. As with the primary site driveway, the available sight distance at the service driveway may exceed 500 feet and satisfy the required SSD and recommended ISD for the 85<sup>th</sup> percentile speeds if proper landscaping is provided.

Vehicles exiting the site via the emergency access driveway are limited to approximately 200 feet of sight distance looking east and 220 feet of sight distance looking west due to horizontal curves in the roadway, the surrounding vegetation, and the slope of the land. Required SSD and recommended ISD are not met in either direction. However, this driveway is proposed to only be used by emergency vehicles needing to access the site on rare occasions, and these vehicles could then exit the site via the primary site driveway. The Proponent should verify sight distance measurements at this location and should ensure this driveway remains a gated access for emergency vehicles only.

In general, adequate sight distance is expected to be provided for the proposed residential development based on the 85<sup>th</sup> percentile speeds of North Road, but these measurements should be verified by the Proponent and vegetation removal and landscaping will likely be required to ensure safe sight lines will be provided.

### *Mitigation*

As part of the proposed project, we recommend the Proponent conduct a traffic monitoring program to fully assess the traffic impacts of the development after occupancy. The traffic monitoring program should be completed approximately one year after the project is substantially occupied. The program should include a review of traffic volumes, intersection observations, the completion of capacity analysis at the study area intersections and a review of recent crash history. Based on the results of the monitoring program, the Proponent should work with the Town of Sudbury to make appropriate signal timing adjustments at the signalized study area intersections.

At the proposed site driveway intersection on North Road, we recommend the Proponent ensure safe sight lines be provided for the driveways and recommend vegetation removal and/or landscaping as required. In addition, an intersection warning sign (W2-2) should also be installed on North Road in both directions to warn motorists of turning vehicles ahead.

Based on our review, the North Road and Powder Mill Road/Mossman Road intersection currently meets warrants for a traffic signal installation based on existing traffic volumes. The intersection currently experiences long delays during both peak periods and meets the four-hour and peak hour signal warrant based on guidelines set forth by the latest edition of the *Manual of Uniform Traffic Control Devices (MUTCD)*. Although the impacts from the proposed development at this intersection are limited, we recommend this intersection be evaluated for a future traffic signal with the Town to address existing operational issues. The Proponent should



## CONCLUSION

The proposed residential development is to be located on North Road in Sudbury, Massachusetts on the site of the former Melone property. The project proposes the construction of approximately 214 apartments and 60 age-restricted townhouses. The site is proposed to be accessed via an internal roadway system with a full-access driveway located on North Road, just west of 36 North Road. An emergency access driveway is proposed to the west of the primary site driveway, along with a service driveway to the east.

Based on the latest ITE standards, the proposed development is projected to result in approximately 110 new vehicle trips (27 entering vehicles and 83 exiting vehicles) during the weekday morning peak hour, and approximately 136 new vehicles trips (85 entering vehicles and 51 exiting vehicles) during the weekday afternoon peak hour.

The capacity analysis indicates that the proposed residential subdivision is expected to have a modest impact on the traffic operations of the study area intersections. All of the intersections analyzed are expected to continue to operate at the same overall LOS in the 2025 Build and No Build scenarios, with some minor decreases in LOS for specific movements. The capacity analysis at the unsignalized intersection of North Road at Powder Mill Road/Mossman Road shows poor operations under 2018 Existing conditions at the stop-controlled approaches, which are expected to continue to operate poorly under 2025 conditions.

It is recommended that the Proponent perform a traffic monitoring program to assess the traffic impacts of the project after substantial occupancy of the development. The traffic monitoring program should include a review of traffic volumes, intersection observations, a safety review and completion of capacity analysis at the study area intersections to assess if further mitigation would be required. Based on the monitoring program, the Proponent should work with the Town of Sudbury to optimize traffic signal timings at the signalized study area intersections. In addition, the Proponent should consider revised signal timings and short-term signage and striping improvements that can be provided at the study area intersections. TDM measures should be implemented to offset single occupancy vehicles to/from the site. It is recommended that the Town further evaluate the need for a potential traffic signal installation at the North Road and Powder Mill Road/Mossman Road intersection, which meets traffic signal warrants based on existing traffic volumes today. The Proponent should verify that adequate sight distances will be met for all proposed site driveways and should commit to vegetation removal and landscaping as necessary.

Based on the analysis results presented in this report, the proposed residential development is not expected to have a significant impact on the operations of the study area roadways.