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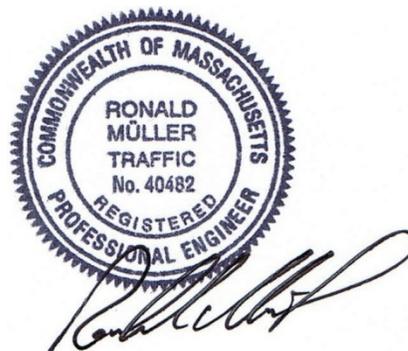
Traffic Impact and Access Study

Old South Road Mixed-Use Development Nantucket, Massachusetts

Prepared for:

Richmond Great Point Development LLC
20 Davkim Lane
Nantucket, MA 02554

August 26, 2016



Quality



Accuracy



Integrity





Traffic Impact and Access Study

To: Richmond Great Point
Development LLC
20 Davkim Lane
Nantucket, MA 02554

Reg: Old South Road
Mixed Use Development
Nantucket, MA

From: Ron Müller, P.E., Principal

Date: August 26, 2016
Project #: 12015

INTRODUCTION

Ron Müller & Associates (RMA) has conducted this Traffic Impact and Access Study (TIAS) to evaluate the traffic impacts of a mixed-use development project proposed by Richmond Great Point Development LLC (the ‘Project Proponent’) on approximately 35 acres of contiguous property located on the south side of Old South Road generally between Lover’s Lane and Daffodil Lane. The proposed development is comprised of a combination of 100 single-family homes, 225 apartment units, and approximately 15,500 square feet of retail and restaurant space (the ‘Project’).

Vehicular access to and from the Project is proposed via a (new) primary access road connecting to Old South Road to be located east of Goldfinch Drive (West), a (new) driveway connecting to Old South Road, primarily intended to serve the proposed retail space, and located further west of Goldfinch Drive (West), and a (new) driveway connecting to Lover’s Lane, that will also primarily serve the proposed retail space. The primary access road and site driveways will all be interconnected to allow travel through and between the various components of the Project, although it is expected that all of the residential units will be accessed via the (new) primary access road. The existing ‘extension’ of Greglen Avenue (which was not plotted or approved as a road, but was constructed by the prior owner of the properties and has been utilized as a means of providing vehicular access to Old South Road for several decades) will be terminated / eliminated between Old South Road and Nancy Ann Lane, once the (new) primary access road is constructed and other portions of Nancy Ann Lane have been relocated and incorporated into the new vehicular circulation system as part of the Project. The Project location in relation to the surrounding street network is shown on Figure 1.



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Figure 1
Site Location and Study Area Map



EXECUTIVE SUMMARY

This study provides an estimate of the expected traffic generation of the Project, evaluates the safety and capacity impacts of that traffic at the site's primary access road, at the site driveways, and on adjacent streets, and determines the necessity for and recommends appropriate improvements / mitigation to the area roadway system to improve traffic conditions.

This study was prepared in conformance with the Massachusetts Environmental Policy Act (MEPA) regulations and Massachusetts Department of Transportation (MassDOT) standards. Aspects of the scope and certain criteria for the study were also established in consultation between RMA staff and the transportation and planning staff of the Town of Nantucket Planning & Land Use Services (PLUS) Department.

- As further described in this study, the Project is expected to generate approximately 210, 293, and 277 new peak hour vehicle trips during the weekday AM peak hour, weekday PM peak hour, and Saturday midday peak hour, respectively, to the adjacent streets (new trips are comprised / defined as total trips after deducting "pass-by" trips that will already be traveling on the local street network, the methodology and calculations for which are documented in detail in the balance of this study).
- Once distributed onto the local roadway network, traffic generated by the Project is expected to increase peak hour volumes on Old South Road in the immediate vicinity of the Project site by a maximum of 198 new trips (during the weekday PM peak hour) or by +/- 14 percent compared to the year 2023 design horizon No-Build volumes.
- As traffic generated by the Project distributes onto the available access routes to and from the west of the site (to and from the Downtown area), peak hour traffic volumes at the Milestone Rotary at the western end of the Old South Road corridor are expected to increase by a maximum of 154 new trips (during the weekday PM peak hour) or by +/- 6 percent compared to the year 2023 design horizon No-Build volumes.
- As traffic generated by the Project distributes to and from the east (to and from the airport area), peak hour traffic volumes at the Macy's Lane (Airport Road) intersection with Old South Road are expected to increase by a maximum 93 new trips (during the weekday PM peak hour) or by +/- 7 percent, compared to the year 2023 design horizon No-Build volumes.

The impacts of these additional volumes (reflected as the decreases in current levels of service and increases in delays experienced by vehicles being driven through these roadway segments and intersections) will be mitigated / improved by the series of traffic improvements that are recommended and described in the balance of this study, to the point where traffic conditions, in almost all cases, will actually be better than those which are experienced under current conditions. This mitigation will include a combination of traffic improvements specifically

funded and constructed by the Project Proponent in conjunction with the development of the Project, as well as those that are already planned and anticipated to be constructed by the Town of Nantucket.

Sight distance analysis at the proposed (new) primary access road and the (new) site driveways indicates that the available sight lines exceed both minimum requirements and desirable distances, such that safe operation can therefore be expected. It is recommended that any proposed landscaping or obstructions in the vicinity of the access road and driveways be set back sufficiently so as not to impede sight distances for drivers exiting the site. It is recommended that the (new) primary access road be constructed providing two exiting lanes and one entering lane, separated by a raised median. The exiting lanes should be under STOP-sign control. The (new) retail driveways connecting to Old South Road and to Lover's Lane should be constructed providing one exiting lane (under STOP-sign control) and one entering lane, separated by a double yellow centerline.

Analysis of future traffic conditions (projected out to a seven-year design horizon to 2023, assuming that the entire Project has been developed and occupied at that time) anticipates that many of the nine (9) individual local intersections in the vicinity of the Project site that were analyzed for the study will operate at level of service (LOS) F by the year 2023 during all three peak hours (AM, PM, and Saturday midday), with or without any additional traffic generated by the Project.

However, several of the nine (9) intersections in the vicinity of the Project site will operate at level of service (LOS) F or at volume-to-capacity (v/c) ratios above 1.0 by the year 2023 specifically as a result of traffic generated by the Project. Accordingly, specific traffic improvements are recommended to be funded and constructed by the Project Proponent in conjunction with the development of the Project to mitigate those impacts. These include improvements to the Old South Road intersections with Lover's Lane, along the segment of Old South Road along and between the (new) retail driveway and the (new) primary access road, to and / or through the vicinity of the Goldfinch Drive (West) intersection, which serves as the exit road from the Naushop residential community on Old South Road, and at the intersection of Old South Road and Macy's Lane (Airport Road).

It is therefore recommended that Old South Road be widened to construct a two-way center-left-turn lane, extending +/- 1,500 feet in length from a point west of Lover's Lane to a point east of the (new) primary access road serving the Project. Construction of this center-left-turn lane will allow acceptable operating conditions at all of these locations as well as the many other driveways on both the north and south sides of this section of Old South Road, including Nantucket Seafood, the Nantucket Emporium, the cluster of existing retail uses owned by the Project Proponent near the intersection of Old South Road and Lover's Lane, and at the driveways providing access to and from the Valero & Sons Garden Center property.

As previously referenced, the existing "extension" of Greglen Avenue (which was not plotted or approved as a road, but was constructed by the prior owner of the surrounding properties and has

been utilized as a means of providing vehicular access to Old South Road for several decades) will also be terminated / eliminated between Old South Road and Nancy Ann Lane once the (new) primary access road is constructed. This will have a significant traffic safety and vehicle capacity benefit along this segment of Old South Road by eliminating the existing conflict that is created by the offset intersection that is currently formed by this “extension” of Greglen Avenue and Goldfinch Drive (West as they intersect with Old South Road.

Project traffic will also have a measurable impact at the Old South Road and Macy’s Lane (Airport Road) intersection during all peak hours (weekday AM, weekday PM, and Saturday midday). To mitigate these impacts, it is recommended that a +/- 250-foot long portion of Old South Road be widened to provide a two-lane approach on Old South Road, heading eastbound (toward Nantucket Municipal Airport) with a shared left/through lane and an exclusive right-turn lane. The ability to widen Old South Road in this area is subject to confirmation by an engineering survey. However, sufficient width appears to exist within the Old South Road right of way to accommodate this additional lane. With these improvements, the eastbound approach of this intersection improves substantially, from LOS F to D or better during all peak hours.

EXISTING CONDITIONS

Scope and Study Area Locations

Evaluation of the traffic impacts associated with the proposed Project requires an evaluation of existing and projected traffic volumes, the volume of traffic expected to be generated by the Project, and the impact that this traffic will have on the adjacent streets. Based on industry-standard methodology and in consultation with the transportation and planning staff of the Town of Nantucket Planning & Land Use Services (PLUS) Department, it was determined that the following nine (9) local intersections should be specifically analyzed and evaluated:

- Old South Road at Sparks Avenue, Milestone Road, and Orange Street (at the location where these road segments form the Milestone Rotary)
- Old South Road at Fairgrounds Road
- Old South Road at Amelia Drive
- Old South Road at Young's Way
- Old South Road at Lover's Lane and the Nantucket Seafood Driveway
- Old South Road at Goldfinch Drive (West) and the "extension" of Greglen Avenue
- Old South Road at Macy's Lane (Airport Road)
- Old South Road at Nobadeer Farm Road
- Milestone Road at Nobadeer Farm Road

Based on the anticipated traffic generation, as further documented in this study, the Project is expected to have a minimal effect on traffic operations beyond the geographic area comprising this study area. The nine (9) individual study area locations are shown on Figure 1.

Existing Traffic Volumes

Traffic volume information along Old South Road was obtained from the Town of Nantucket PLUS Department, as well as manual turning movement and vehicle classification counts collected by a traffic data collection firm in July of 2014 (during the "peak" local summer visitor and population period) at all nine (9) study area intersections. These counts were conducted during the weekday AM peak period (8:00 to 11:00 AM), the weekday PM peak period (3:00 to 6:00 PM), and the Saturday midday peak period (11:00 AM to 2:00 PM) and are provided in the Appendix. The traffic count data indicate that the weekday AM peak hour generally occurs from 8:15 to 9:15 AM, the weekday PM peak hour from 4:15 to 5:15 PM, and the Saturday peak hour from 11:00 AM to 12:00 PM. However, the actual peak hours observed at the individual intersections were used in this study, in order to present a more conservative analytical scenario.

To determine whether the 2014 traffic count data still represent current (2016) volume conditions, historical traffic data provided by the Town of Nantucket PLUS Department were reviewed. The results from 10 years of traffic counts taken on Old South Road east of

Fairgrounds Road confirmed that traffic has stayed fairly consistent over the past 10 years at an average rate of 0.41 percent per year. In addition, manual turning movement counts were collected by the Town of Nantucket PLUS Department at the Milestone Rotary and at the Old South Road and Fairgrounds Road intersection in August 2015. These counts were compared with the 2014 traffic count data in order to determine whether traffic has changed in a statistically meaningful way since these respective traffic counts were taken. A comparison of these traffic counts is provided in Table 1.

Table 1
Historical Volume Comparison

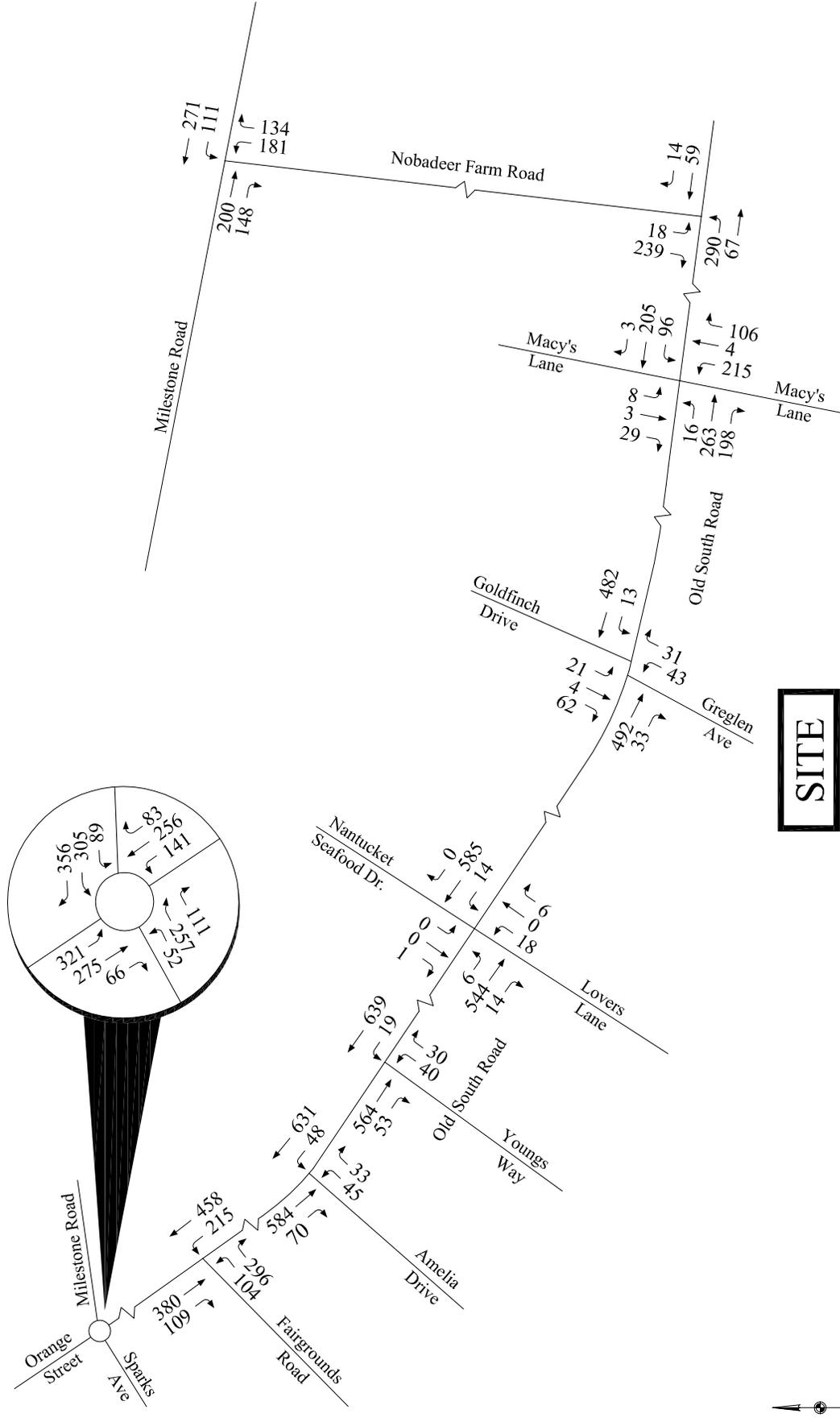
Location	2014 Counts ^a	2015 Counts ^a	Percent Change
Milestone Rotary			
AM Peak Hour	2,239	2,312	+3.3%
PM Peak Hour	2,374	2,369	-0.2%
Old South Road at Fairgrounds Road			
AM Peak Hour	1,598	1,562	-2.3%
PM Peak Hour	1,713	1,636	-4.5%
Total Both Intersections:	7,923	7,879	-0.6%

^a In vehicles per hour. Volumes represent total intersection entering volumes.

As shown, overall traffic volumes have not changed in a statistically meaningful way between the dates of the 2014 and 2015 counts. It is therefore reasonable to conclude that the July 2014 traffic counts are still valid and still represent current traffic volume conditions within the study area. As the Town of Nantucket PLUS Department traffic counts are more recent, these counts were used as the basis for the existing condition traffic volumes in this study. All traffic count data are provided in the Appendix.

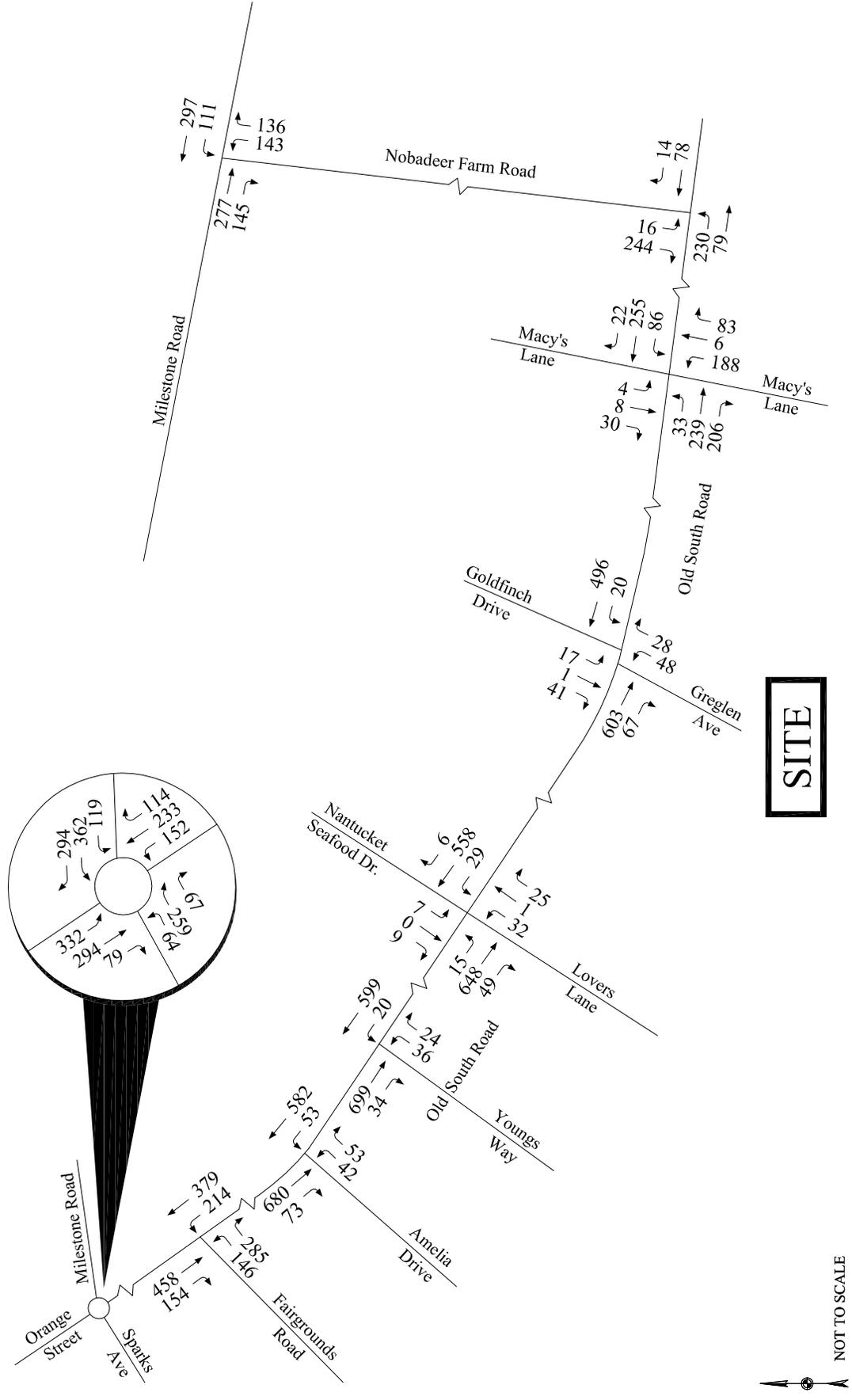
Based on discussions with Town of Nantucket PLUS Department staff, it was confirmed that the months of July and August represent peak-month traffic volume conditions. Therefore, no additional seasonal adjustments were made to the collected data. A summary of the traffic counts on Old South Road is provided in Table 2 and the 2016 Existing peak hour traffic flow networks are shown graphically on Figures 2 through 4.

Figure 2
 2016 Existing Weekday AM
 Peak Hour Traffic Volumes



NOT TO SCALE

Figure 3
 2016 Existing Weekday PM
 Peak Hour Traffic Volumes



NOT TO SCALE

Figure 4
 2016 Existing Saturday
 Peak Hour Traffic Volumes

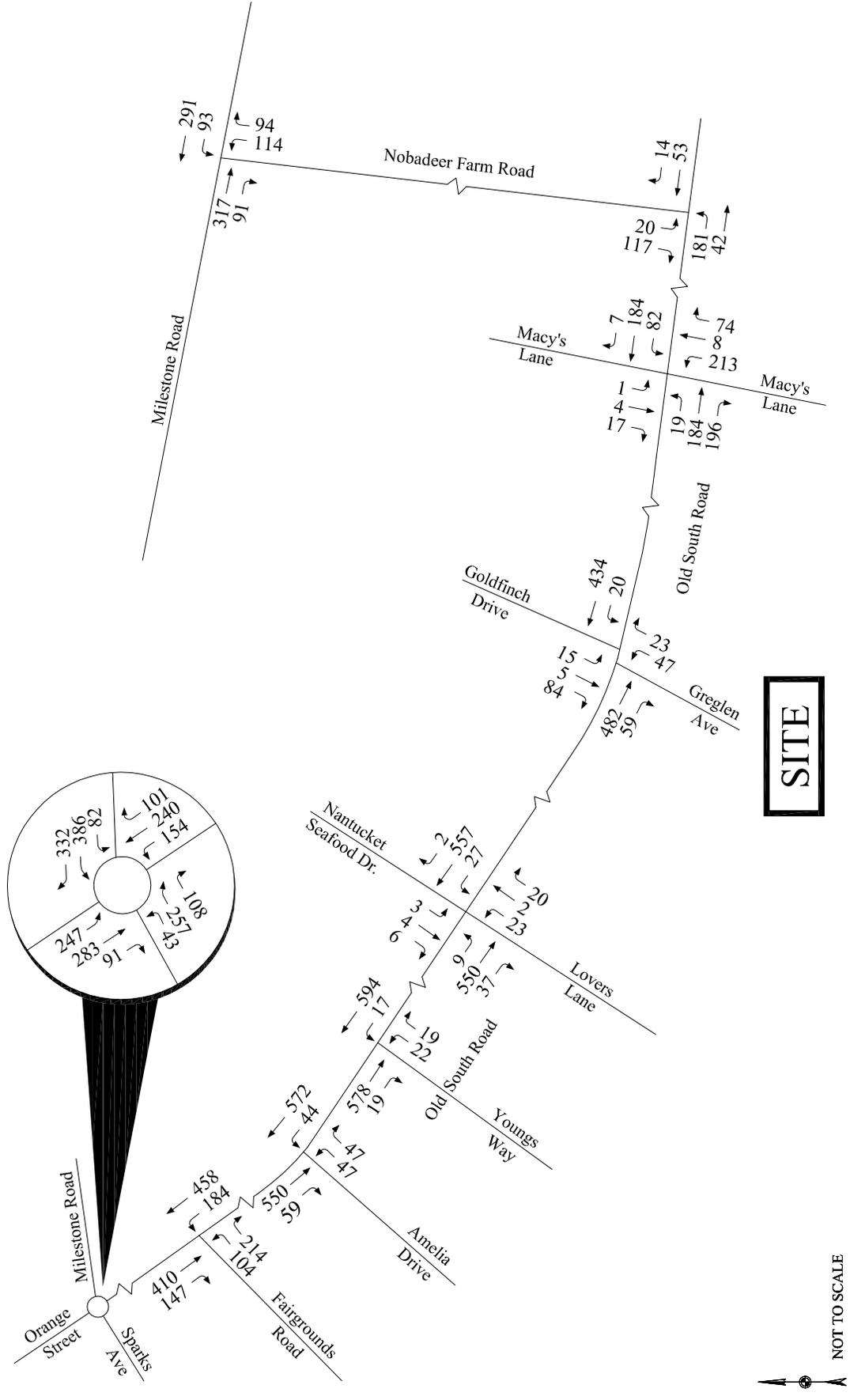


Table 2
Existing Peak Month Traffic Volume Summary

Location	Daily Volume ^a	Peak Hour Volume ^b	K-Factor ^c	Directional Distribution ^d
Old South Road adjacent to the site:				
Weekday	15,970	AM: 1,149 PM: 1,273	7.2% 8.0%	52% WB 53% EB
Saturday	14,840	Midday: 1,159	7.8%	51% WB

^a In vehicles per day. Daily volumes obtained from Nantucket PLUS Department for Old South Road east of Fairgrounds Road.

^b In vehicles per hour.

^c Percentage of daily traffic occurring during the peak hour.

^d EB = Eastbound; WB = Westbound.

Vehicle Accident History

Vehicle accident data for the nine (9) study area intersections were obtained from MassDOT for the period between 2012 and 2014, the latest three years of available data. A summary of the MassDOT accident data is provided in Table 3. In addition to the summary, accident occurrence should also be compared to the volume of traffic through a particular intersection to determine any significance. Accordingly, the accident rate was calculated for the intersections and compared with the statewide and district-wide averages. An intersection accident rate is a measure of the frequency of accidents compared to the volume of traffic through an intersection and is presented in accidents per million entering vehicles (acc/mev). For unsignalized intersections, both the statewide and district-wide (District 5) average accident rate is 0.58 acc/mev. A comparison of the calculated accident rate to the statewide and district-wide averages can be used to establish the significance of accident occurrence and whether or not potential safety problems exist. The crash rate worksheets are provided in the Appendix.

As shown in Table 3, the Milestone Rotary, the Old South Road and Fairgrounds Road intersection, and the Milestone Road and Nobadeer Farm Road intersection experienced the highest number of accidents among the nine (9) study area intersections over the three year analysis period, with an average of approximately two to three accidents per year. However, the calculated crash rates are lower than the statewide and district-wide average and no particular trends are apparent in accident occurrence. All other study intersections experienced far fewer accidents with crash rates well below the state average. Given the low calculated crash rates, there are no particular trends or concerns apparent in accident incidence within the study area. It should be pointed out that nearly 70 percent of all accidents occurred during the summer months of June, July, and August, which is expected given the surge in traffic during these peak seasonal months.

Table 3
Accident Summary

Location	Number of Accidents			Severity ^a			Accident Type ^b						% During Wet/Icy Conditions
	Total	Avg./Year	Accident Rate ^c	PD	PI	F	CM	RE	HO	FO	Ped	Other	
Milestone Rotary	9	3.0	0.28	5	4	0	1	6	0	0	2	0	0%
Old South Road at Farigrounds Road	10	3.3	0.45	5	5	0	1	8	0	0	1	0	33%
Old South Road at Amelia Drive	3	1.0	0.15	2	1	0	0	2	0	0	0	1	0%
Old South Road at Young's Way	0	0.0	0.00	0	0	0	0	0	0	0	0	0	0%
Old South Road at Lover's Lane	1	0.3	0.05	0	1	0	0	1	0	0	0	0	100%
Old South Road at Goldfinch/Greglen	3	1.0	0.17	2	1	0	2	0	1	0	0	0	0%
Old South Road at Macy's Lane	0	0.0	0.00	0	0	0	0	0	0	0	0	0	0%
Old South Road at Nobadeer Farm	1	0.3	0.11	1	0	0	0	1	0	0	0	0	0%
Milestone Road at Nobadeer Farm	7	2.3	0.47	4	3	0	2	1	1	0	1	2	14%

Source: MassDOT Traffic Operations Safety Management System – 2012 through 2014 data.

^a PD = property damage only; PI = personal injury; F = fatality.

^b CM = cross movement/angle; RE = rear end; HO = head on; FO = fixed object; Ped = pedestrian or bicyclist.

^c Measured in accidents per million entering vehicles.

Vehicle Speeds

Vehicle speed measurements were conducted along Old South Road adjacent to the Project site to determine the minimum sight distance requirements as discussed further below. Vehicle speeds were recorded by measuring the elapsed time for vehicles traveling a short, pre-measured distance between two checkpoints and the speed is derived by dividing the elapsed time into the measured distance between checkpoints. The results of the vehicle speed measurements are summarized in Table 4 and the vehicle speed data are provided in the Appendix.

Table 4
Observed Travel Speeds ^a

<u>Location/Direction</u>	<u>Posted Speed Limit</u>	<u>Average Speed</u>	<u>85th Percentile Speed ^b</u>
Old South Road			
Eastbound	35	36	40
Westbound	35	35	38

^a In miles per hour (mph).

^b Speed at, or below which 85 percent of all observed vehicles travel.

As shown, the recorded average speeds are consistent with the posted speed limit, while 85th percentile speeds are approximately 5 miles per hour faster than the posted limit. These higher speeds were used as the basis for determining minimum sight distance requirements, as discussed below.

Sight Distance

To identify potential safety concerns associated with site access and egress, sight distances have been evaluated at the proposed site driveways and the (new) primary access road to determine if the available sight distances for vehicles exiting the site meet or exceed the minimum distances required for approaching vehicles to safely stop. The available sight distances were compared with minimum requirements, as established by the American Association of State Highway and Transportation Officials (AASHTO)¹. AASHTO is the national standard by which vehicle sight distance is calculated, measured, and reported. The MassDOT and the Executive Office of Energy and Environmental Affairs (EEA) require the use of AASHTO sight distance standards when preparing traffic impact assessments and studies, as stated in their guidelines for traffic impact assessment.

Sight distance is the length of roadway ahead that is visible to the driver. Stopping Sight Distance (SSD) is the minimum distance required for a vehicle traveling at a certain speed to safely stop before reaching a stationary object in its path. The values are based on a driver perception and reaction time of 2.5 seconds and a braking distance calculated for wet, level pavements. When the roadway is either on an upgrade or downgrade, grade correction factors are applied. Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2 feet above street level, equivalent to the taillight height of a passenger car. The SSD is measured along the centerline of the traveled way of the major road.

¹A *Policy on Geometric Design of Highways and Streets*; American Association of State Highway and Transportation Officials (AASHTO); 2004.

Intersection sight distance (ISD) is provided on minor street approaches to allow the drivers of stopped vehicles a sufficient view of the major roadway to decide when to enter the major roadway. By definition, ISD is the minimum distance required for a motorist exiting a minor street to turn onto the major street, without being overtaken by an approaching vehicle reducing its speed from the design speed to 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet above street level. The use of an object height equal to the driver eye height makes intersection sight distances reciprocal (i.e., if one driver can see another vehicle, then the driver of that vehicle can also see the first vehicle). When the minor street is on an upgrade that exceeds 3 percent, grade correction factors are applied.

SSD is generally more important as it represents the minimum distance required for safe stopping while ISD is based only upon acceptable speed reductions to the approaching traffic stream. However, the ISD must be equal to or greater than the minimum required SSD in order to provide safe operations at the intersection. In accordance with the AASHTO manual, *“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 sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.”* Accordingly, ISD should be at least equal to the distance required to allow a driver approaching the minor road to safely stop.

The available SSD and ISD at the proposed site driveways on Old South Road and on Lover’s Lane and at the (new) primary access road were measured and compared to minimum requirements as established by AASHTO. Since the requirements are based on the speed of traffic on the adjacent street, the 85th percentile speeds as shown in Table 4 were used for this purpose. The required minimum sight distances for these speeds are compared to the available distances, as shown in Table 5.

Table 5
Sight Distance Summary

Direction	Intersection Sight Distance (feet)		
	Measured	Minimum Required ^a	Desirable ^b
Old South Road at Main Site Driveway			
East of Intersection	500+	305	390
West of Intersection	500+	305	390
Old South Road at Retail Driveway			
East of Intersection	500+	305	390
West of Intersection	445	305	390
Lover's Lane at Site Driveway			
North of Intersection	300	155	280
South of Intersection	300+	155	280

^a Values based on AASHTO SSD requirements for 85th percentile speeds on Old South Road of 40 mph and an assumed speed of 25 mph on Lover's Lane.

^b Values based on AASHTO ISD requirements for posted speed limit of 35 mph on Old South Road and an assumed speed limit on Lover's Lane of 25 mph.

As shown in the table, ample sight distances exist at all proposed site driveway locations and at the (new) primary access road, exceeding minimum requirements as well as desirable distances, and safe operation can therefore be expected. At the proposed retail driveway, the sight distance for drivers looking west, toward Fairgrounds Road, is limited by the existing topography of Old South Road. To more specifically assess the available sight distance in this direction, as shown in Table 5, a sight line plan and profile was prepared, which confirms that this sight distance in this direction exceeds the stated requirements. This plan is provided in the Appendix. It is recommended, however, that any proposed landscaping, signs, or any other obstructions in the vicinity of the driveways be set back outside the sight triangles (as defined by AASHTO) so as not to impede sight distances for drivers in vehicles exiting the site.

FUTURE TRAFFIC CONDITIONS

Future traffic conditions within the study area were projected out to the year 2023, representing a seven (7) year design horizon consistent with state guidelines for traffic impact assessment. To project traffic conditions within this design horizon, two distinct components of future traffic growth were included. First, an annual traffic growth rate was determined to account for additional traffic that will be generated as a result of general population growth as well as by smaller development projects that may impact traffic within the study area. Based on historical traffic volume data on Old South Road supplied by the Town of Nantucket PLUS Department for the period 2007 through 2016, traffic volumes have remained fairly consistent over the years. A summary of the historical count data is provided in the Appendix. These data show an average growth in traffic of 0.41 percent per year over this ten year period. However, given that this trend may not continue into the future and based on discussions with Town of Nantucket PLUS Department staff, a one percent (1.00%) per year traffic growth rate was used in this study, to ensure a more conservative analytical methodology.

Second, any planned or approved specific development projects in the area that would be expected to generate a statistically meaningful volume of traffic on study area roadways within the seven (7) year design horizon period were investigated. Based on discussions with Town of Nantucket PLUS Department staff, traffic to be generated by the following specific development projects were calculated and included in the traffic projections:

1. **Stop & Shop Supermarket Redevelopment (31 Sparks Avenue)** - although this project was completed and occupied in May of 2015, the traffic generated by this project was not included when the traffic counts utilized for this study were collected. Accordingly, the projected traffic volumes to be added through the study intersections as a result of this project were taken from the traffic study² conducted for this project.
2. **Nantucket Emporium (54 Old South Road)** - since collection of the traffic count data, this property has been redeveloped from 12,100 square feet of retail space to a combination of 1,700 square feet of retail, 2,350 square feet of office, and 7,750 square feet of self storage space. Based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual*,³ the traffic generation of the current uses on the site are less than the prior use. However, to present a more conservative analytical methodology, no reduction in traffic was assumed from redevelopment of this site.
3. **John Reedy Trust Project (21 Old South Road)** - the currently vacant parcel is proposed be developed with 4,900 square feet of grocery store space and one apartment unit. The traffic to be generated by this project was estimated using the ITE *Trip Generation Manual* for Land Use Code 850 (Supermarket) and assigned to the roadway

² *Traffic Impact and Access Study, Proposed Stop & Shop Redevelopment, Nantucket, MA*; prepared for The Stop & Shop Supermarket Company; prepared by VHB, Inc.; January 2014.

³ *Trip Generation Manual, 9th Edition*; Institute of Transportation Engineers; Washington, DC, 2012.

network based on the retail and residential trip distribution patterns described later in this study.

4. **EZIA Athletic Club (86-88 Old South Road)** - the currently vacant parcel is proposed to be developed with a 21,700 square foot health/fitness club. The traffic to be generated by this project was estimated using the ITE *Trip Generation Manual* for Land Use Code 492 (Health/Fitness Club) and assigned to the roadway network based on the retail trip distribution pattern described later in this study.
5. **Shepley Wood Products, Inc. Development (6-8 Lovers Lane)** - the existing single family home site is being redeveloped into a 7,500 square foot lumber yard. The traffic to be generated by this project was estimated using the ITE *Trip Generation Manual* for Land Use Code 812 (Building Materials and Lumber Store) and assigned to the roadway network based on the retail trip distribution pattern described later in this study. No trip reduction was assumed for the elimination of the existing residential home.
6. **Richmond Great Point Development LLC Residential Development (1-3-5 Greglen Avenue and 11-13 Greglen Avenue)** - the six existing single family homes on these properties are being redeveloped into 28 apartment units and 8 condominium units (comprised of 4 duplex units). The traffic to be generated by this project was estimated using the ITE *Trip Generation Manual* for Land Use Code 220 (Apartment) and assigned to the roadway network based on the residential trip distribution pattern described later in this study. No trip reduction was assumed for the elimination of the existing occupied residential homes. (It is noted that the properties upon which the 8 condominium units are being developed, the 11-13 Greglen Avenue properties, have since been sold by Richmond Great Point Development LLC to individual buyers who are developing the properties for these uses).

The trip-generation worksheets and assignment of the specific traffic volumes that are expected to be generated from these development projects are detailed in the Appendix.

Previously Planned Study Area Roadway / Intersection Improvements

The Milestone Rotary: This rotary / intersection is proposed to be reconfigured by the Town of Nantucket to create a modern roundabout. The current approaches to the rotary do not provide sufficient deflection and allow higher than desired entry speeds, and do not provide adequate pedestrian and bicycle crossings. The Sparks Avenue and Old South Road approaches provide only single approach lanes that are not adequate to accommodate the existing or projected level of traffic. There are also access and parking conflicts, particularly in the southwest corner of the rotary between Old South Road and Sparks Avenue. The Town of Nantucket commissioned a study⁴ of this rotary / intersection to evaluate improvements. The initial plan is to add a

⁴ *Roundabout Implementatioin Report, Milestone Rotary*; prepared for NP&EDC; prepared by Ourston Roundabout Engineering; September 2006.

pedestrian crossing across the Milestone Road approach to improve pedestrian safety. The ultimate plan is to reconfigure the rotary to provide adequate deflection to reduce entry speeds, provide two lanes of traffic on every approach, provide safe pedestrian/bicycle crossings across all four approaches, and eliminate the access conflicts by controlling site access to the property in the southwest corner. Based on discussions with Town of Nantucket PLUS Department staff, these improvements are not expected to be implemented by the 2023 design year horizon and, accordingly, were not assumed to be completed within the design horizon of this study.

The Old South Road and Fairgrounds Road Intersection: This intersection is proposed to be modified by the Town of Nantucket into a modern roundabout. The existing STOP-sign controlled intersection is under significant capacity constraints due to the current volume of traffic on both roads, resulting in long delays and queues on the Fairgrounds Road approach, which currently operates at a level F. The Town of Nantucket has appropriated capital funds in Fiscal Year 2018 for the design of improvements that would replace the existing T-type intersection with a modern roundabout with single-lane approaches. Based on a study⁵ commissioned by the Town in 2006, these improvements would allow the intersection to operate at level C or better during all peak hours. As no time-frame has been established yet for construction of the improvements, they are not assumed to be completed by the 2023 design year horizon of this study.

Old South Road Corridor Improvements: Modifications in this area are contemplated to be made in the near future by the Town of Nantucket, including multi-modal access and congestion improvements. The Town of Nantucket Planning and Economic Development Commission (NP&EDC) will be initiating a study of the Old South Road corridor this coming winter in order to develop and evaluate various design alternatives. For the purpose of this study, no corridor improvements are assumed to be implemented by the 2023 design year horizon.

No-Build Traffic Conditions (Without the Project)

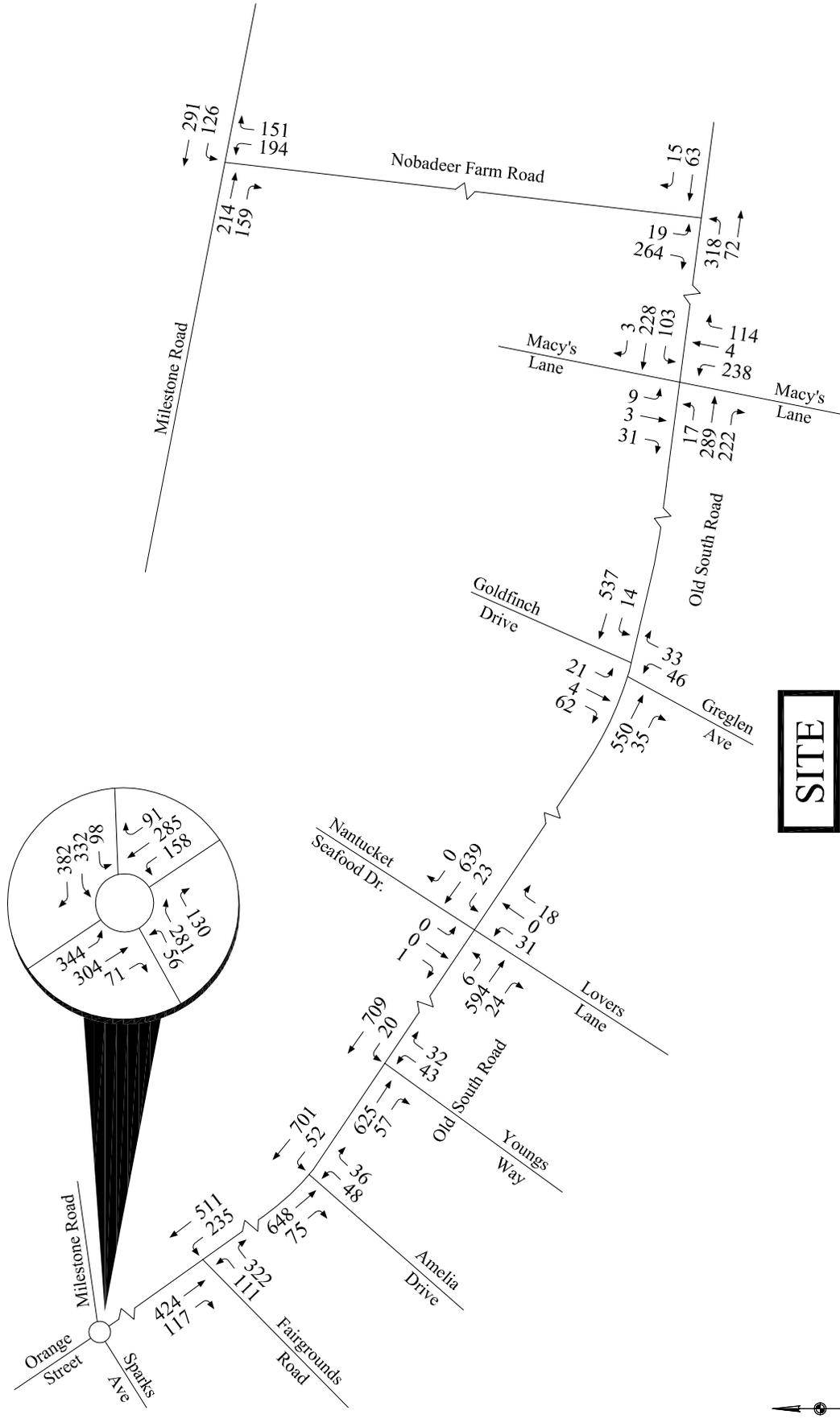
As described above, the 2023 year No-Build traffic volume networks were developed by applying a compounded one percent (1.00%) annual growth rate (equal a 7.2 percent increase over seven years) to the existing volumes, as well as by adding the traffic that is expected to be generated by the six (6) individual above-mentioned development projects. The 2023 No-Build peak-hour traffic-flow networks are shown on Figures 5 through 7.

Project Trip Generation

The proposed Project will consist of a combination of 225 apartment units, 100 single family homes, and approximately 15,500 square feet of retail and quality restaurant space. The traffic to be generated by the residential portion of the Project was estimated based on the ITE *Trip*

⁵ *Technical Memorandum, Alternative Traffic Control Analysis, Surfside Road and Old South Road at Fairgrounds Road, Nantucket, MA*; prepared for NP&EDC; prepared by Greenman-Pedersen, Inc.; September 12, 2006.

Figure 5
 2023 No-Build Weekday AM
 Peak Hour Traffic Volumes



NOT TO SCALE

Figure 6
 2023 No-Build Weekday PM
 Peak Hour Traffic Volumes

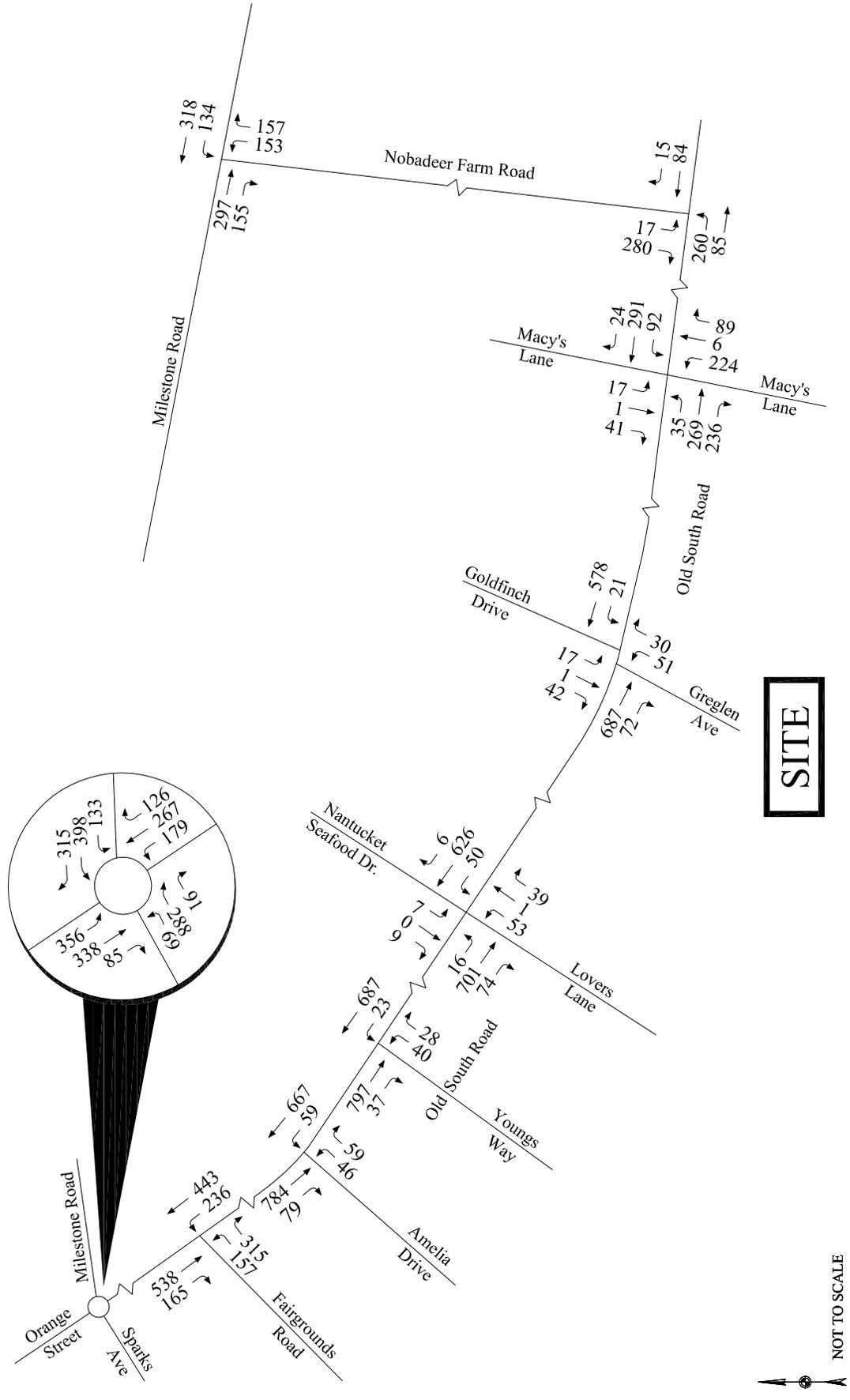
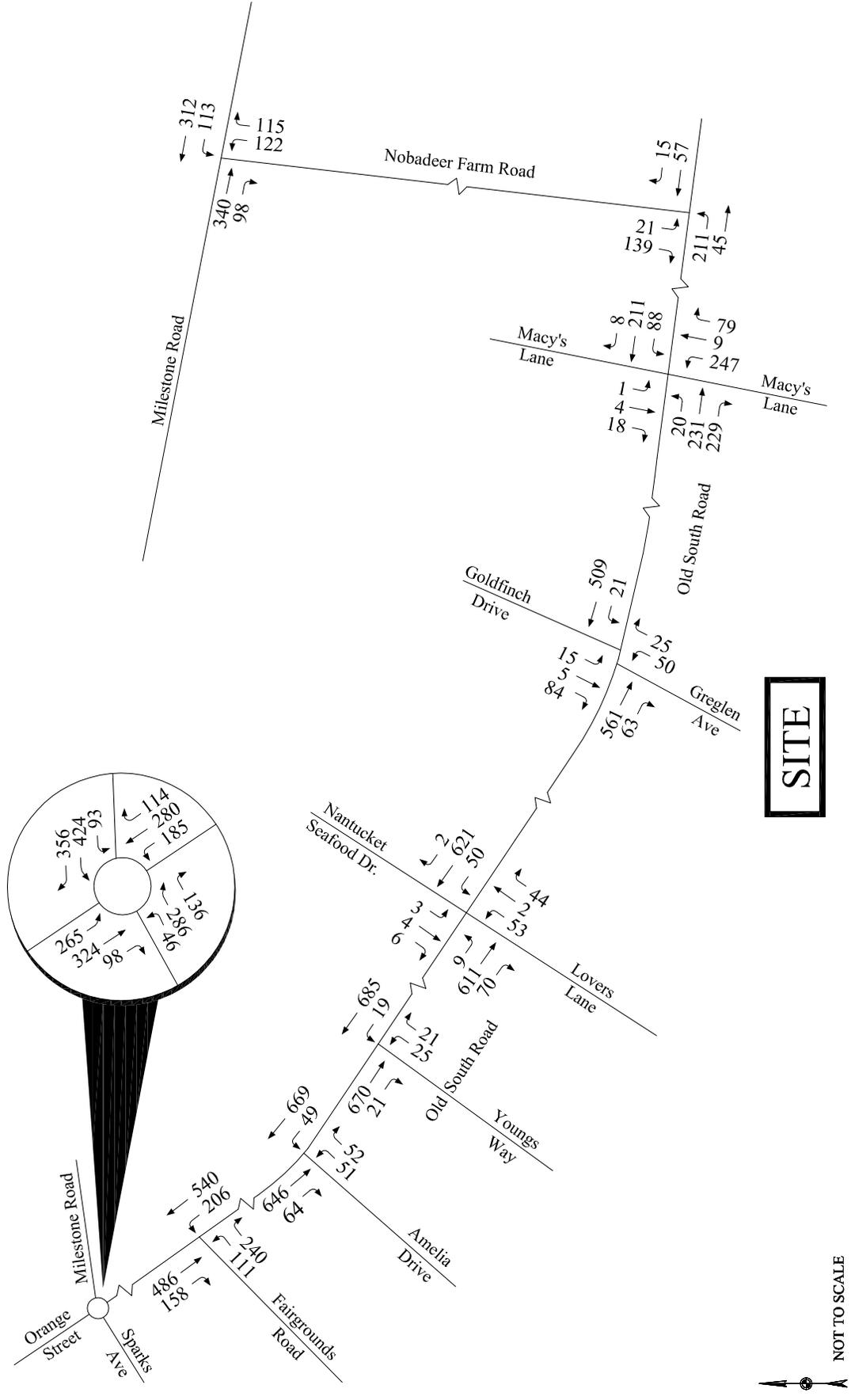


Figure 7
 2023 No-Build Saturday
 Peak Hour Traffic Volumes



Generation Manual using Land Use Codes 220 (Apartment) and 210 (Single Family Detached Housing).

Although specific tenants for the retail portion of the Project have not yet been identified, it is anticipated that the retail liner buildings will be occupied by general merchandise stores, a variety store, and a print shop. Similarly, no specific tenant or operator has been selected for the proposed restaurant space at this time; as a result, the size of this space (3,200 square feet) and the traffic volumes that are generated by the restaurant space are expected to be a maximum / worst-case scenario; the size may well be smaller and may well generate less traffic, but the trip generation utilized in the study have been calculated at the higher levels, in order to ensure a more conservative analytical methodology.

Accordingly, ITE Land Use Code 826 (Specialty Retail Center) trip rates were applied to 12,300 square feet of the retail space and ITE Land Use Code 931 (Quality Restaurant) trip rates were applied to the 3,200 square foot restaurant building. The volume of traffic to be generated by each of the above uses is summarized in Table 6 and the ITE trip-generation worksheets are provided in the Appendix.

Table 6
Trip Generation Summary

Time Period	225 Apartments ^a	100 Homes ^b	12,300 sf Retail ^c	3,200 sf Restaurant ^d	Total Trips
Weekday Daily	1,490	1,050	560	290	3,390
Weekday AM Peak Hour					
Enter	23	20	8	2	53
Exit	<u>91</u>	<u>60</u>	<u>5</u>	<u>1</u>	157
Total	114	80	13	3	210
Weekday PM Peak Hour					
Enter	92	66	22	16	196
Exit	<u>49</u>	<u>39</u>	<u>29</u>	<u>8</u>	125
Total	141	105	51	24	321
Saturday Peak Hour					
Enter	56	52	34	20	162
Exit	<u>55</u>	<u>46</u>	<u>32</u>	<u>14</u>	147
Total	111	98	66	34	309

^a ITE Land Use Code 220 (Apartment).

^b ITE Land Use Code 210 (Single Family Detached Housing).

^c ITE Land Use Code 826 (Specialty Retail Center).

^d ITE Land Use Code 931 (Quality Restaurant).

As shown, the Project will generate a total of 3,390 vehicle trips on a typical weekday (average daily trips) with half (1,695 vehicles) entering and half exiting the site over the course of the entire day. During the peak hours, the Project will generate 210 vehicle trips during the AM peak hour (53 entering and 157 exiting), 321 vehicles trips during the PM peak hour (196 entering and 125 exiting), and 309 vehicles trips during the Saturday peak hour (162 entering and 147 exiting). These vehicle trips will be realized at the (new) site driveways.

It is noted, however, that not all of the retail and restaurant trips will be new to the adjacent streets. Studies have shown that retail developments and in particular restaurants generate a substantial portion of their business from the traffic already present on the adjacent roadway. This traffic is referred to as “pass-by” trips. Based on data published in the ITE *Trip Generation Handbook*,⁶ an average of 44 percent of the total traffic generated by quality restaurants is typically pass-by traffic. For retail establishments, the ITE average pass-by rate is 34 percent for weekday conditions and 26 percent for Saturday conditions. Therefore, while the total traffic generated by the Project will be experienced at the site driveways, the impact of that traffic on the adjacent streets will be incrementally less than this (total) traffic. It should be noted that no pass-by adjustments were made to the retail and restaurant traffic generated during the weekday AM peak hour. Table 7 summarizes the expected volume of pass-by trips and the resulting new trips to be added to the surrounding roadways.

Table 7
New vs. Pass-By Trips

Time Period	Total Trips ^a	Pass-By Trips ^b	New Trips ^c
Weekday Daily	3,390	320	3,070
Weekday AM Peak Hour			
Enter	53	0	53
Exit	157	0	157
Total	210	0	210
Weekday PM Peak Hour			
Enter	196	14	185
Exit	125	14	111
Total	321	28	293
Saturday Peak Hour			
Enter	162	16	146
Exit	147	16	131
Total	309	32	277

^a From Table 6.

^b Volumes represent 44% of the restaurant trips identified in Table 6 for the weekday PM peak hour and Saturday peak hour plus 34 percent of the weekday PM peak hour retail trips and 26% of the Saturday peak hour trips.

^c Total trips less pass-by trips.

⁶ *Trip Generation Handbook; 3rd Edition*; Institute of Transportation Engineers; Washington, DC; August 2014.

As shown, the Project is expected to distribute increments of 210, 277, and 293 new peak hour vehicle trips to the adjacent streets during the weekday AM peak, weekday PM peak, and Saturday Midday peak hours (respectively) with the remaining traffic generated by the Project already present in the adjacent traffic stream, representing the increment of “pass-by” traffic.

Project Trip Distribution

The distribution of new traffic generated by the Project on the area roadways is based on an analysis of existing travel patterns, area employment opportunities, population densities, and turning movement counts collected at nearby residential roads and retail driveways. Two different trip distribution patterns were developed for the purposes of the analysis: one for the residential portion of the Project and one for the retail portion. A summary of the expected distribution of traffic is provided in Table 8.

Table 8
Trip Distribution Pattern

<u>Route</u>	<u>Residential Distribution</u>	<u>Retail Distribution</u>
Orange Street	30%	20%
Sparks Avenue	20%	13%
Milestone Road (East of the Rotary)	5%	5%
Fairgrounds Road	15%	10%
Amelia Drive	0%	3%
Young’s Way	0%	2%
Lover’s Lane	0%	2%
Old South Road residential streets (between Goldfinch Dr. and Macy’s Ln.)	0%	5%
Macy’s Lane (Airport Road)	15%	20%
Nobadeer Farm Rd. residential streets (between Old South Rd. and Milestone Rd.)	0%	5%
Milestone Road (East of Nobadeer Farm Rd.)	15%	15%
Total	100%	100%

As previously referenced, the existing “extension” of Greglen Avenue (which was not plotted or approved as a road, but was constructed by the prior owner of the surrounding properties and has been utilized as a means of providing vehicular access to Old South Road for several decades) will also be terminated / eliminated, between Old South Road and Nancy Ann Lane, once the (new) primary access road is constructed. Accordingly, the traffic currently using this portion of Greglen Avenue was re-distributed onto either Lover’s Lane or the (new) primary access road, depending on the anticipated direction of travel.

Build Traffic Conditions (With the Project)

Based on the traffic generation and distribution estimates as described above, the residential trips generated by the Project were assigned to the local roadway network as shown on Figures 8 through 10 and the retail trips were assigned to the local roadway network as shown on Figures 11 through 13. These traffic volumes and the re-distributed Greglen Avenue traffic volumes were added to the 2023 No-Build traffic volumes to develop the 2023 Build traffic volumes, which are shown graphically on Figures 14 through 16.

Traffic Increases (Resulting from the Project)

Development of the proposed Project will result in a range of different increases in traffic volumes on different portions of the study area roadways. The text description provided in the Executive Summary of this study and the data which are shown graphically in Figures 8 through 16 of the study depict the traffic volumes which are expected to be added by the development of the Project and the Build (year 2023 design horizon) traffic volumes that are expected to occur at the nine (9) study area intersections during all three of the peak traffic hours (weekday AM, weekday PM, and Saturday midday). The anticipated impacts of these additional (Build) traffic volumes on the nine (9) study area intersections (in terms of level of service, volume-to-capacity, queue, and delay) are summarized in the *Capacity Analysis* section of this study.

In addition to the information provided in the *Capacity Analysis* section of this study, Table 9 below summarizes the No-Build and Build traffic volumes on segments of the study area roadways which are located beyond the strict limits of the traffic study area. These data reflect the traffic volume increases that are expected to occur on these particular roadway segments further “downstream” and outside the study area intersections as a result of the development of the Project.

Figure 8
 Residential Trip Distribution
 AM Peak Hour Traffic Volumes

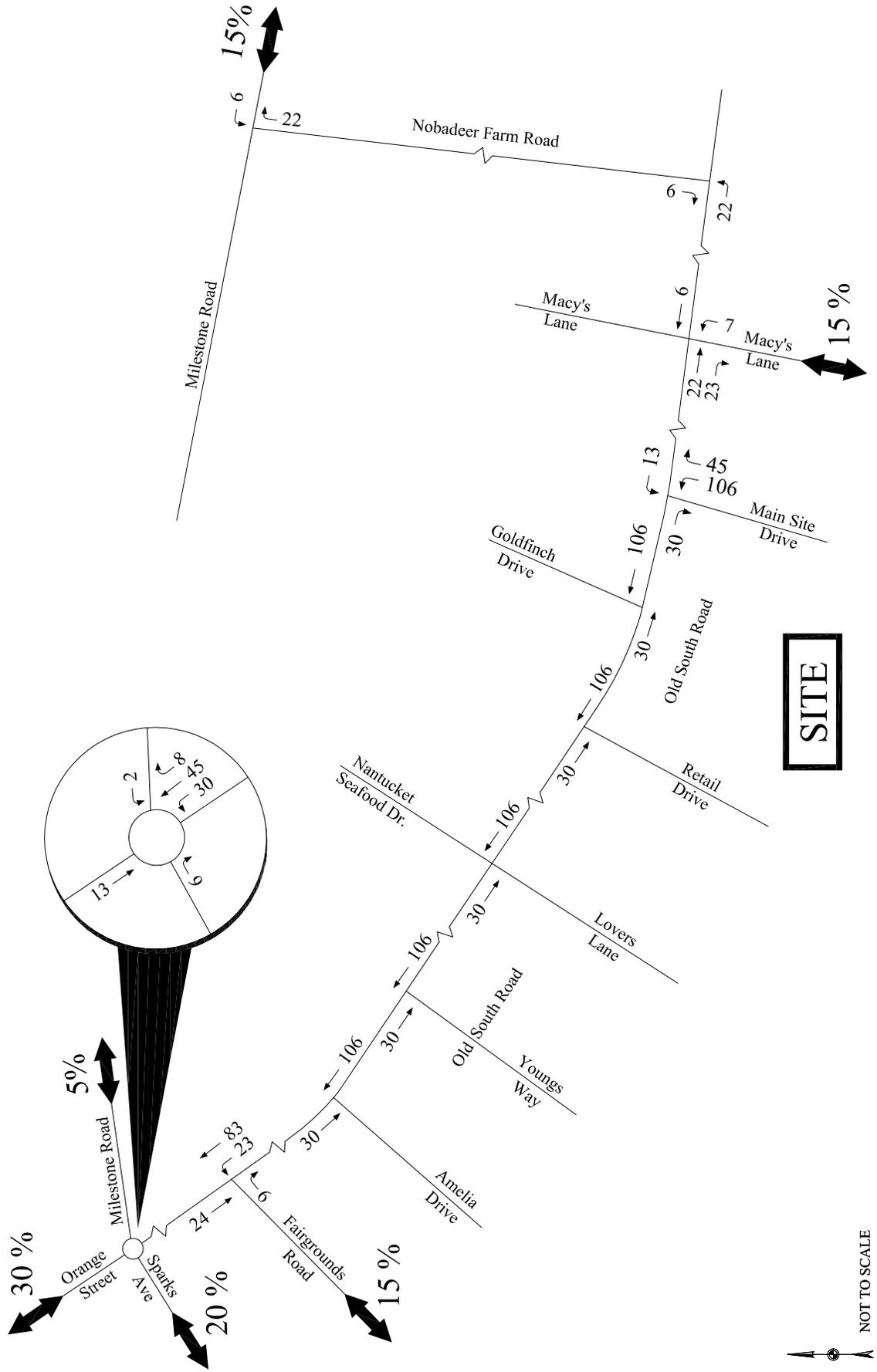
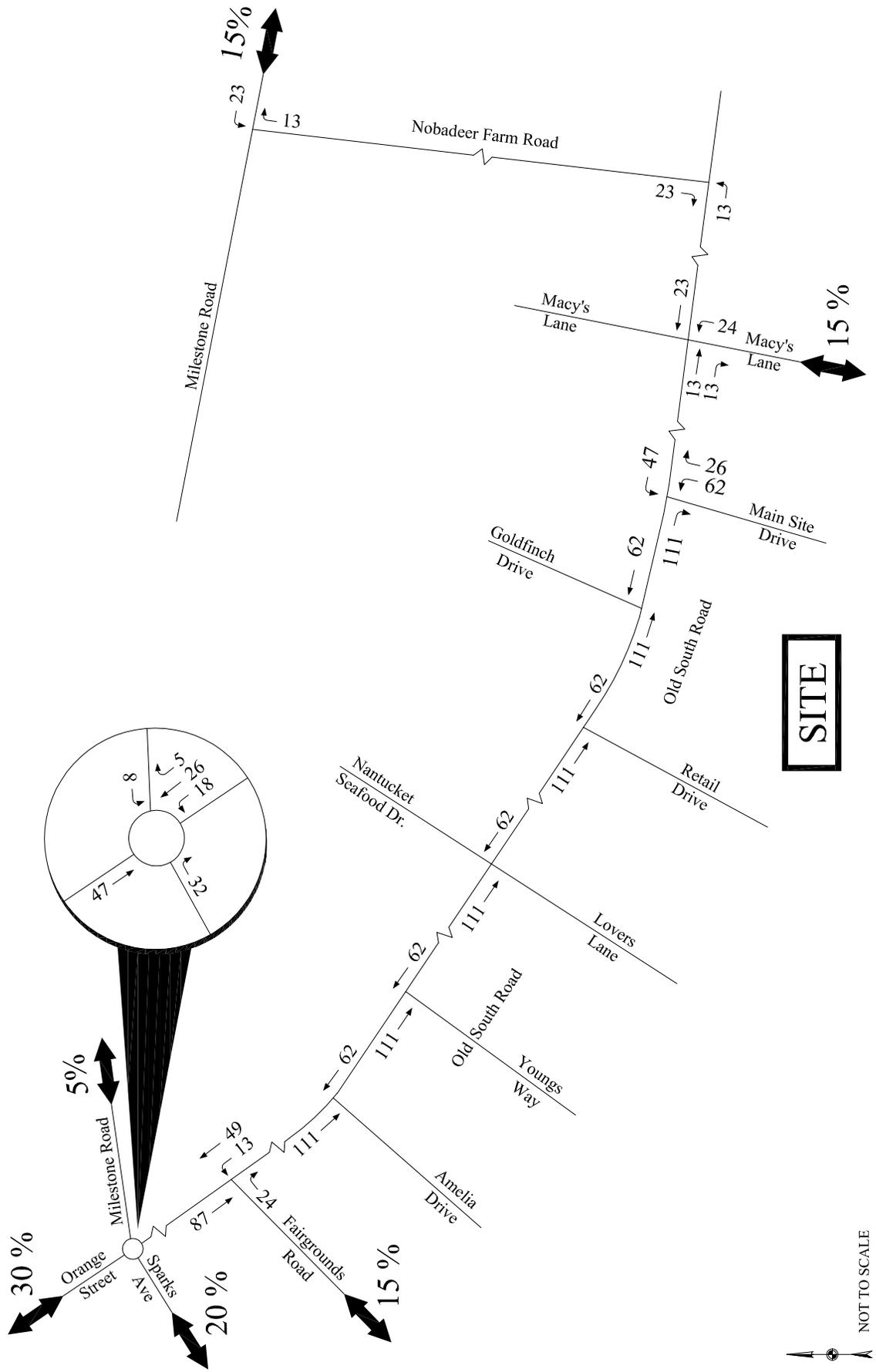
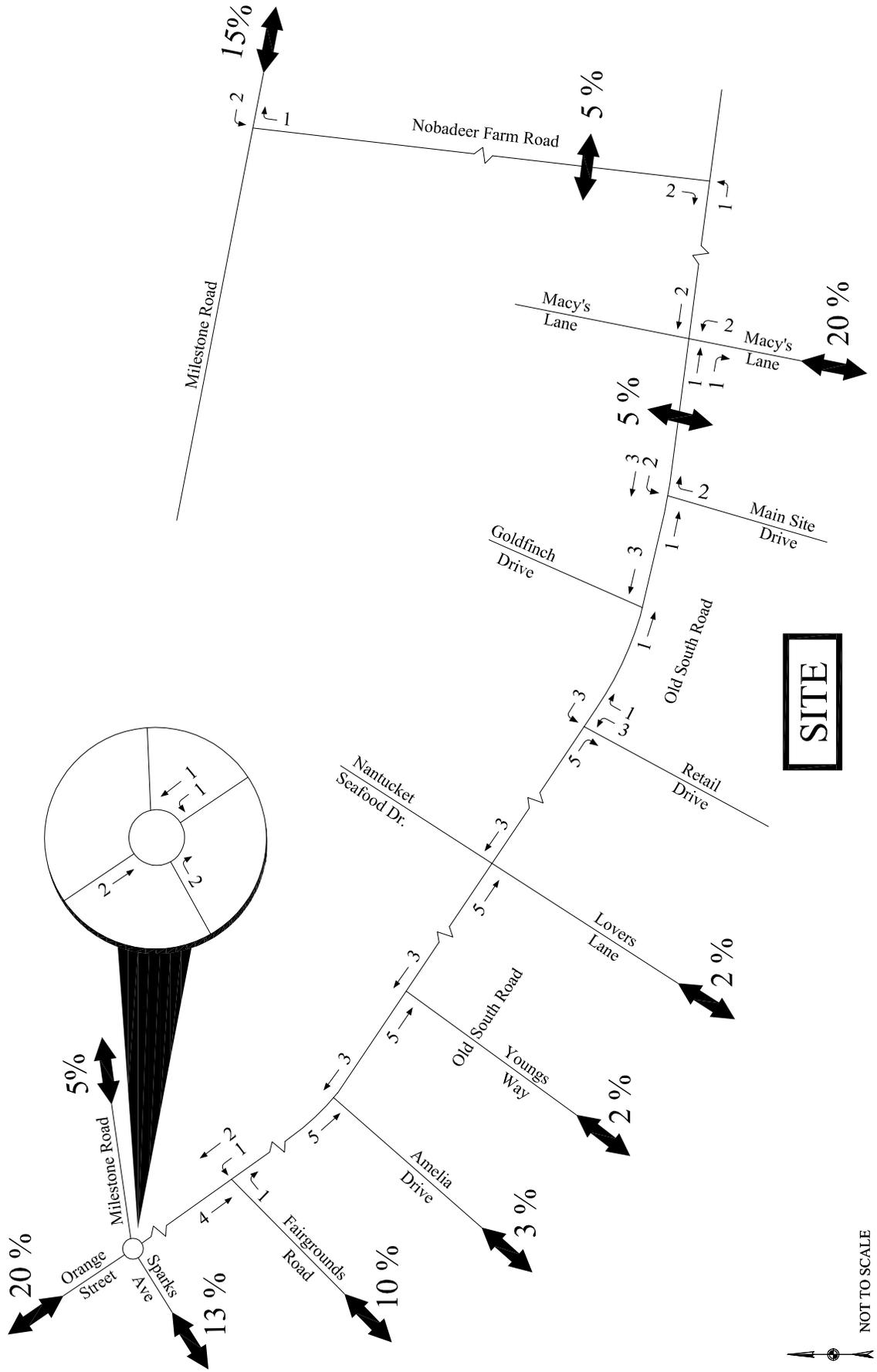


Figure 9
 Residential Trip Distribution
 PM Peak Hour Traffic Volumes



NOT TO SCALE

Figure 11
 Retail Trip Distribution
 AM Peak Hour Traffic Volumes



NOT TO SCALE

Figure 12
 Retail Trip Distribution
 PM Peak Hour Traffic Volumes

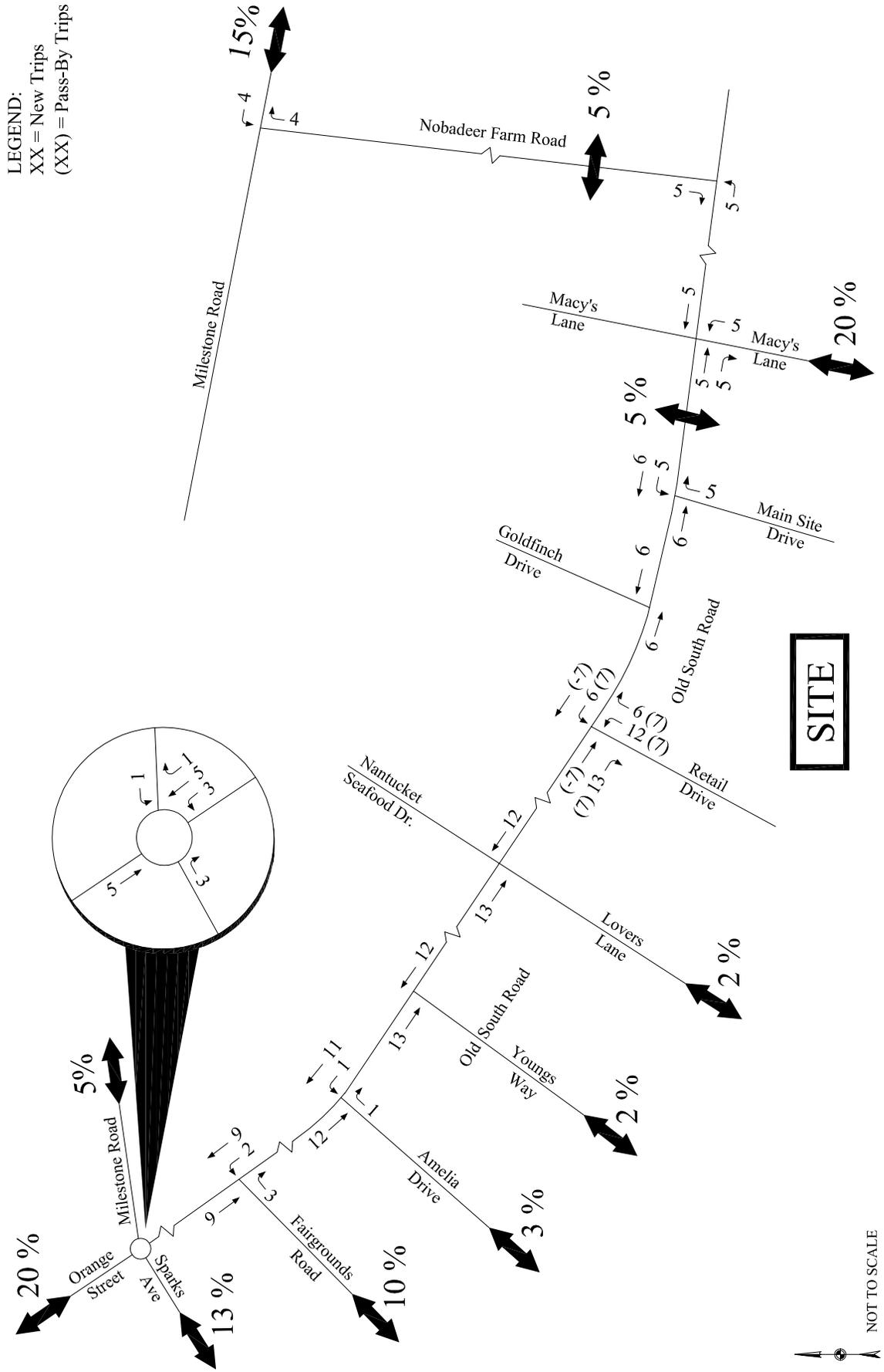


Figure 13
 Retail Trip Distribution
 Sat. Peak Hour Traffic Volumes

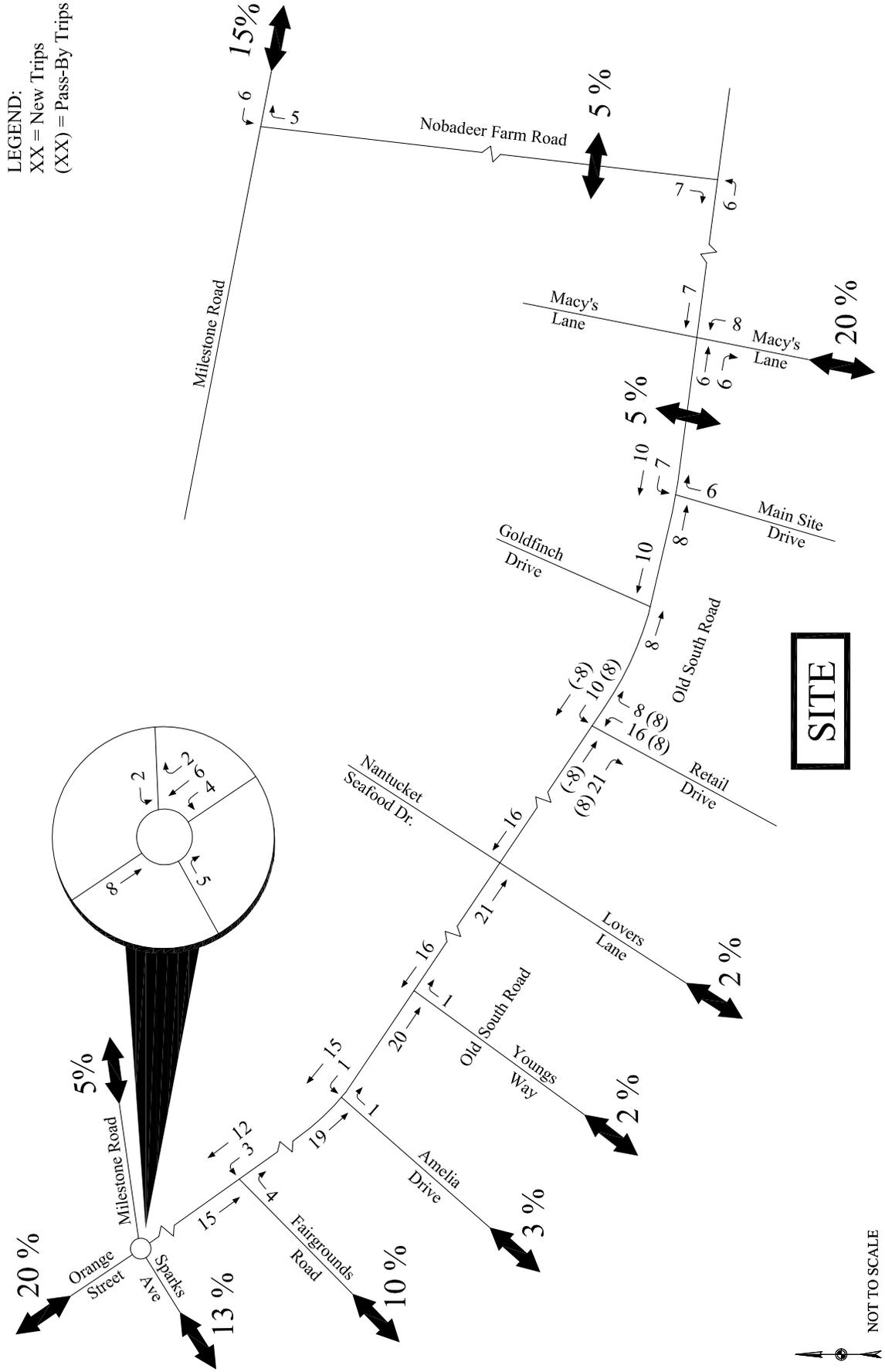


Figure 14
 2023 Build Weekday AM
 Peak Hour Traffic Volumes

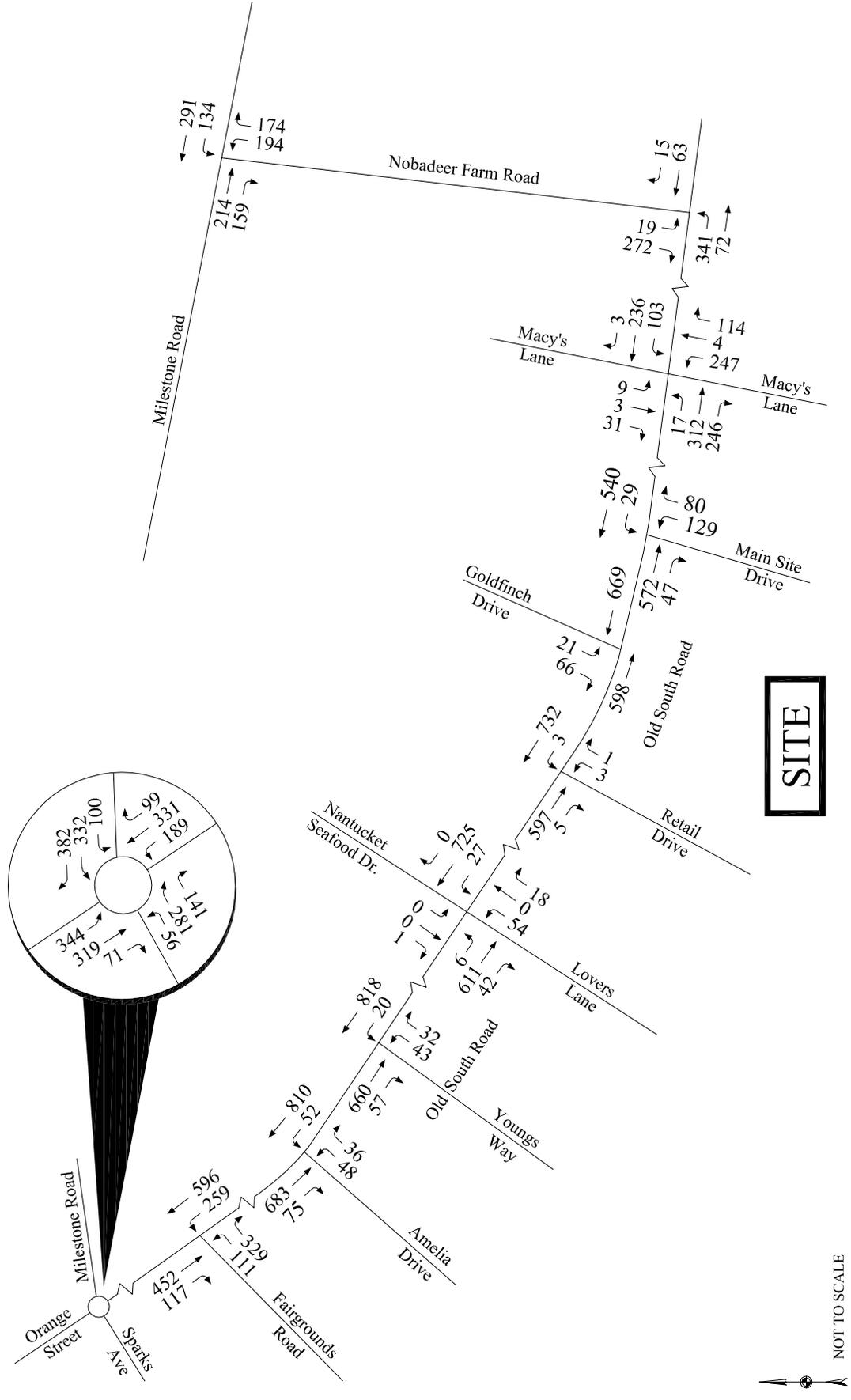


Figure 15
 2023 Build Weekday PM
 Peak Hour Traffic Volumes

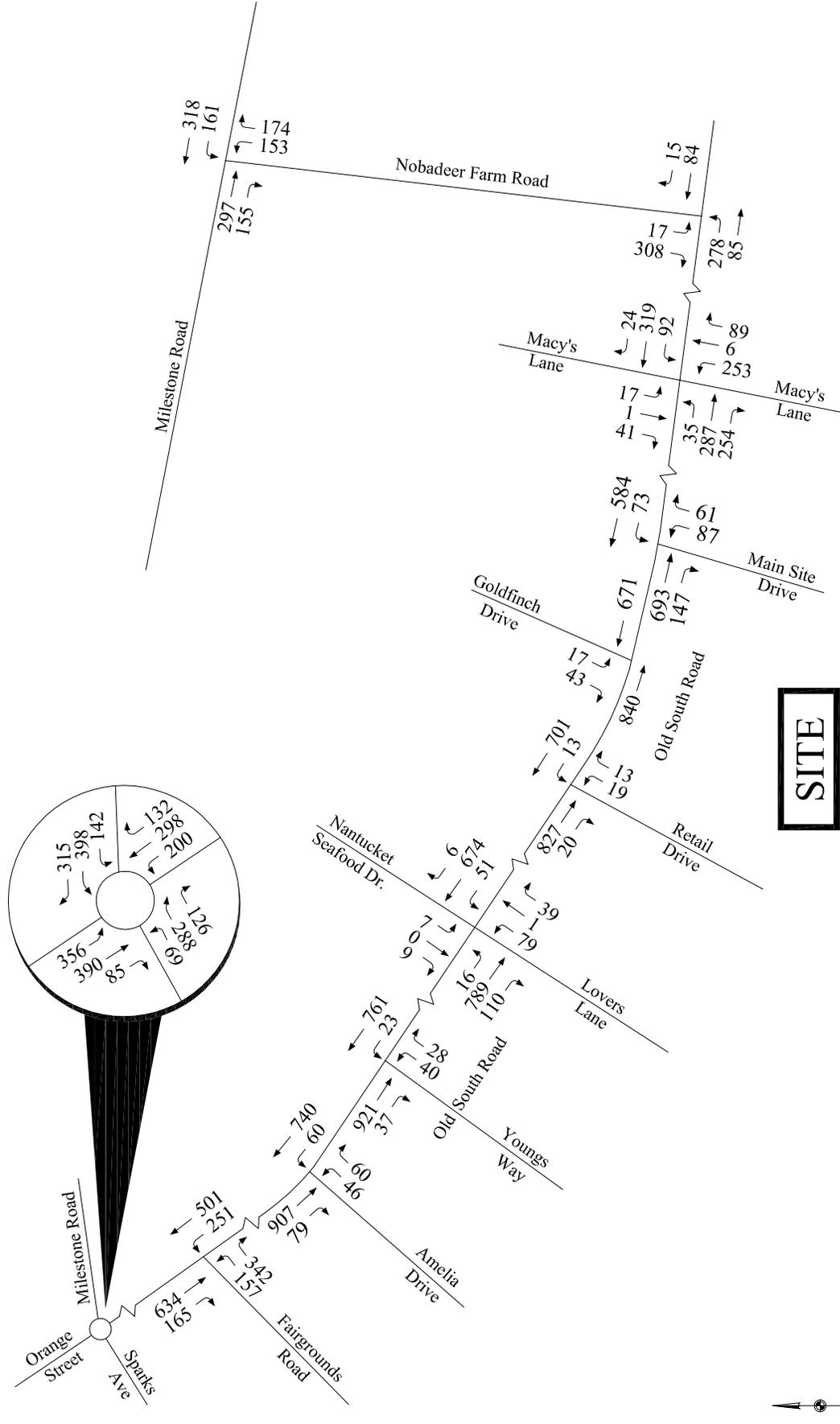
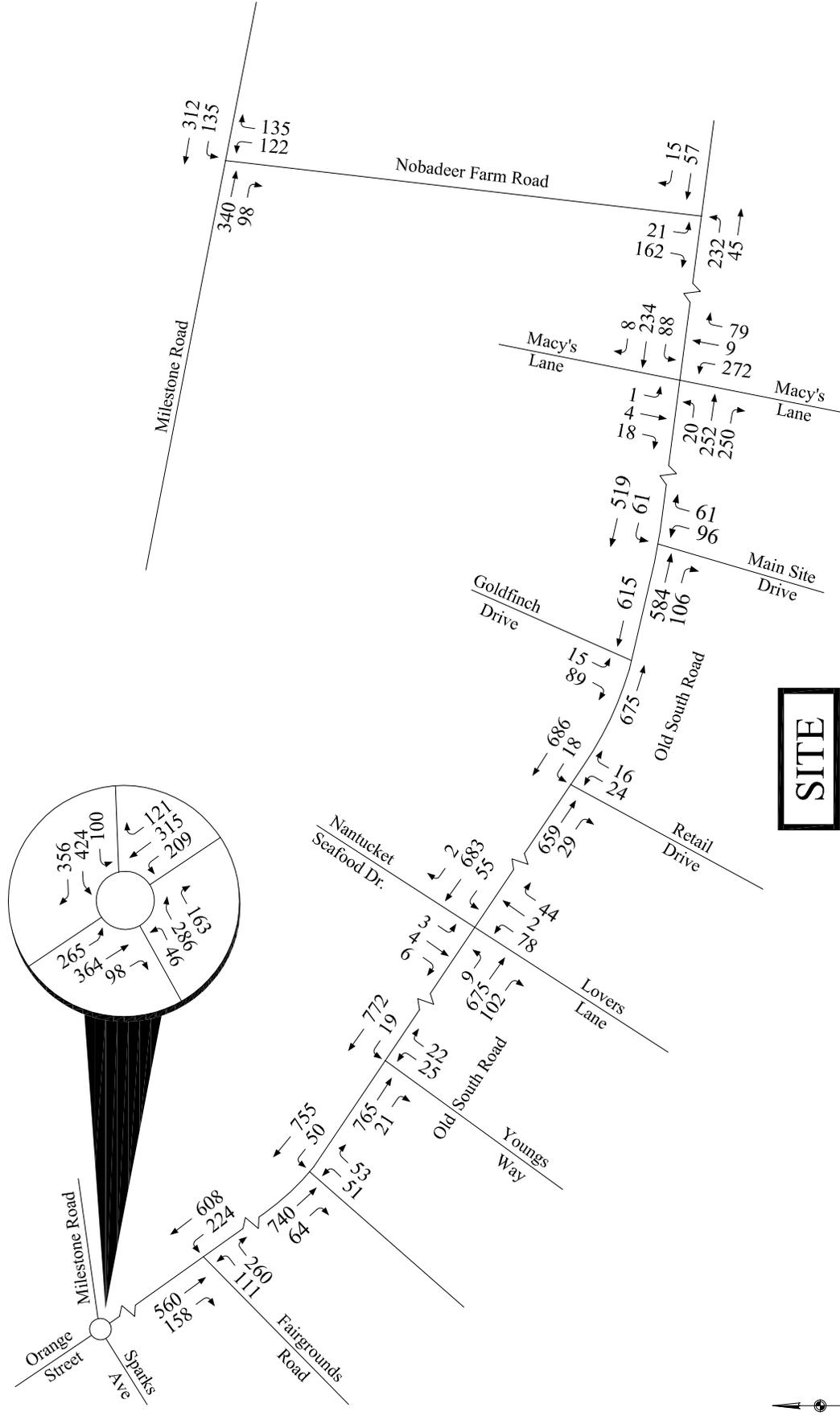


Figure 16
 2023 Build Saturday
 Peak Hour Traffic Volumes



NOT TO SCALE

Table 9
Traffic Increases Outside of the Study Area

Route/Peak Hour	2023 No-Build Volumes	2023 Build Volumes	Volume Increase	Percent Increase
Orange Street				
Weekday AM Peak Hour	1,442	1,503	61	4.2%
Weekday PM Peak Hour	1,430	1,513	83	5.8%
Saturday Peak Hour	1,369	1,444	75	5.5%
Sparks Avenue				
Weekday AM Peak Hour	1,028	1,070	42	4.1%
Weekday PM Peak Hour	1,110	1,166	56	5.0%
Saturday Peak Hour	1,175	1,226	51	4.3%
Fairgrounds Road				
Weekday AM Peak Hour	785	816	31	3.9%
Weekday PM Peak Hour	873	915	42	4.8%
Saturday Peak Hour	715	753	38	5.3%
Macy's Lane (Airport Road)				
Weekday AM Peak Hour	684	717	33	4.8%
Weekday PM Peak Hour	648	695	47	7.3%
Saturday Peak Hour	656	702	46	7.0%
Milestone Road (East of Nobadeer Farm Rd.)				
Weekday AM Peak Hour	782	813	31	4.0%
Weekday PM Peak Hour	906	950	44	4.9%
Saturday Peak Hour	880	922	42	4.8%

As shown in Table 9, once distributed onto the available roadways, relatively small incremental increases in traffic volumes will be added further “downstream” from the study area. In general, along these “downstream” local roadways segments, such as Orange Street (northwest of the Milestone rotary), Sparks Avenue (west of the Milestone rotary), Fairgrounds Road (near the Nantucket Police Station), Macy’s Lane (toward Nantucket Municipal Airport), and Milestone Road (east of Nobadeer Farm Road), these traffic volume increases will range from an average of +/- 40 additional vehicles during the weekday AM peak hour, +/- 55 additional vehicles during the weekday PM peak hour, and +/- 50 additional vehicles during the Saturday midday peak hour. When compared with the year 2023 design horizon No-Build conditions, these volumes represent increases in traffic between four and five percent (+/- 4.0% to +/- 5.0%). Much smaller increases in traffic are expected during all other hours of the day.

Note that little to no additional traffic is anticipated to be generated by the Project on Lover’s Lane (south of its existing intersection with Nancy Ann Lane) and on Young’s Way and Amelia Drive, due to the fact that the percentage of retail traffic to/from these streets is too low to

produce a statistically meaningful value and the fact that none of the residential traffic is expected to use these streets.

Site Access (To and From the Project)

Access to the Project site is proposed via a combination of: (1) a (new) primary access road connecting to Old South Road, to be located east of Goldfinch Drive (West) (the existing exit road serving the Naushop residential community), (2) a (new) driveway connecting to Old South Road, which is primarily intended to serve the retail space, located further west of Goldfinch Drive (West), and (3) a (new) driveway connecting to Lover's Lane, which is also primarily intended to serve the retail space.

All site driveways will be interconnected within the Property, to allow for convenient travel between the various components of the Project, without vehicles having to exit and re-enter to and from Old South Road, although it is expected that all of the residential development will be accessed exclusively via the (new) primary access road.

As previously referenced, the existing "extension" of Greglen Avenue (which was not plotted or approved as a road, but was constructed by the prior owner of the surrounding properties and has been utilized as a means of providing vehicular access to Old South Road for several decades) will also be terminated / eliminated, between Old South Road and Nancy Ann Lane, once the (new) primary access road is constructed.

From a design and engineering standpoint, it is recommended that the (new) primary access road be constructed to provide two 10-foot wide exiting lanes with a 2-foot wide paved shoulder to allow separate left and right turns out of the Property. A STOP sign and stop line should be installed at the access road exit. Entering traffic should be separated from the exiting travel lanes by a raised median and should be 15 feet in width, providing a 10-foot wide travel lane and a 5-foot wide paved shoulder to allow motorists to by-pass any vehicles that may break down in the section of the access road where the raised median is located. The access road should provide 30-foot corner radii, to accommodate turning movements of larger single-unit trucks such as moving trucks, other delivery trucks (particularly those which will serve the proposed retail and restaurant uses) as well as to ensure that it can accommodate larger emergency vehicles. Five-foot wide sidewalks should be constructed along both sides of the access road, with crosswalks and handicap-accessible wheelchair ramps constructed across the access road and across Old South Road, in order to connect with the existing bike path that is located on the north side of Old South Road. This crosswalk connection should be located on the east side of the new intersection as traffic volumes are lower at this location.

The (new) retail driveway should be constructed as a 24-foot wide driveway, providing one entering and one exiting lane, separated by a double yellow centerline. A STOP sign and stop line should be installed at the driveway exit. The driveway should provide minimum 25-foot

corner radii to accommodate the turning movements of delivery trucks to the retail and restaurant establishments, without having to cross into oncoming traffic on Old South Road.

The (new) driveway connecting to Lover's Lane should be constructed as a 24-foot wide driveway, providing one entering and one exiting lane, separated by a double yellow centerline. A STOP sign and stop line should be installed at the driveway exit. As this driveway is not expected to be used by delivery vehicles, the corner radii should be a minimum of 10 feet.

Potential For Inter-Neighborhood Roadway Connections

During preliminary meetings and public hearings that have been held in conjunction with the applications filed with the Town of Nantucket for the Project, the Project Proponent has received some indication that Town officials, including the Planning Board, which has the primary jurisdiction over local subdivision plans, and the Board of Selectmen, which has the primary jurisdiction over local roadway layouts and improvements in its capacity as the Nantucket County Commissioners, may wish to require inter-neighborhood roadway connections at one or more locations to and from from the Project.

Given the substantial scale of the overall portfolio owned by the Project Proponent (totaling +/- sixty 60 acres) the mixed-use nature of the Project, its location abutting Old South Road and its adjacency to several prominent existing residential neighborhoods (including Cedar Crest, Naushop, and Surfside) as well as to several major existing or potential roadways such as Macy's Lane (Airport Road), Lovers Lane, Ticcoma Way, Rugged Road, and the Boulevarde, Town officials and the community at large may collectively want to consider the relative benefits and impacts of providing such inter-neighborhood roadway connections.

Because such a wide variety of alternative interconnections could be proposed and considered and are not known at this time and would need to be further refined and described by the Town Boards with jurisdiction over these issues, no specific analysis of the traffic volumes / impacts of these prospective interconnections could be analyzed within the scope of this study.

Accordingly, in the event that the concept for such inter-neighborhood roadway connections is proposed by either of the Town Boards with jurisdiction over these issues, the Town would need to establish the scope of, and then commission additional traffic impact analyses, in order to specifically assess the benefits and impacts of such connections in conjunction with these decisions.

CAPACITY ANALYSIS

Level-of-service (LOS) analyses were conducted at the nine (9) different study area intersections under existing and projected traffic volume conditions to determine the effect that the traffic generated by the Project will have on traffic operations. The capacity analysis methodology is based on the concepts and procedures set forth in the *Highway Capacity Manual*⁷ (HCM) and is described in the Appendix. For unsignalized intersections, the 95th percentile queue represents the length of queue of the critical minor-street movement that is not expected to be exceeded 95 percent of the time during the analysis period (typically one hour). In this case, the queue length is a function of the capacity of the movement and the movement's degree of saturation.

The Synchro analysis program was used for capacity analyses of the unsignalized intersections. For the Milestone Rotary, the SIDRA Intersection 6.0, "Standard SIDRA" capacity model was used applying the HCM 2010 LOS criteria. The level-of-service and queue results are presented in Table 10 and are discussed below. All analysis worksheets are provided in the Appendix.

⁷*Highway Capacity Manual 2010*; Transportation Research Board; Washington, DC; 2010.

Table 10
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Milestone Rotary												
<i>Weekday AM Peak</i>												
Old South Rd.	1.21	124.2	F	1086	1.35	183.2	F	1556	1.55	269.2	F	2268
Milestone Rd.	0.57	8.4	A	127	0.62	9.0	A	151	0.63	9.2	A	155
Orange St.	0.54	11.0	B	109	0.63	12.9	B	144	0.66	13.4	B	159
Sparks Ave.	1.13	87.4	F	715	1.35	178.7	F	1302	1.41	204.7	F	1454
<i>Weekday PM Peak</i>												
Old South Rd.	1.20	121.0	F	1048	1.37	190.9	F	1619	1.46	229.9	F	1994
Milestone Rd.	0.64	8.9	A	162	0.71	9.9	A	205	0.65	9.1	A	166
Orange St.	0.64	13.5	B	149	0.78	18.6	C	236	0.82	18.7	C	278
Sparks Ave.	1.09	74.3	F	575	1.38	194.2	F	1294	1.54	264.3	F	1686
<i>Sat Midday Peak</i>												
Old South Rd.	1.03	53.9	F	623	1.27	145.4	F	1407	1.37	186.4	F	1835
Milestone Rd.	0.67	9.8	A	180	0.73	10.7	B	222	0.76	11.5	B	240
Orange St.	0.67	14.0	B	164	0.81	19.5	C	261	0.91	26.4	D	383
Sparks Ave.	1.30	157.5	F	1323	1.30	160.2	F	1233	1.45	225.8	F	1622
Old South Road at Fairgrounds Road												
<i>Weekday AM Peak</i>												
NB Left	0.92	133.9	F	150	1.32	NA	F	225	1.88	NA	F	275
NB Right	0.50	16.6	C	75	0.58	19.6	C	100	0.61	21.4	C	125
WB Left	0.21	9.4	A	25	0.24	9.8	A	25	0.27	10.1	B	50
<i>Weekday PM Peak</i>												
NB Left	1.38	NA	F	275	2.22	NA	F	400	3.30	NA	F	450
NB Right	0.60	20.2	C	100	0.69	28.4	D	150	0.80	40.5	E	175
WB Left	0.23	10.0	A	25	0.28	10.7	B	50	0.32	11.6	B	50
<i>Sat Midday Peak</i>												
NB Left	1.12	203.5	F	200	1.80	NA	F	275	2.74	NA	F	325
NB Right	0.43	16.6	C	75	0.54	20.7	C	100	0.65	27.1	D	125
WB Left	0.21	9.7	A	25	0.25	10.3	B	25	0.29	11.1	B	50

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 10 (continued)
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Amelia Drive												
<i>Weekday AM Peak</i>												
NB All	0.41	35.3	E	50	0.54	50.7	F	75	0.67	75.4	F	100
WB Left	0.06	9.3	A	25	0.07	9.6	A	25	0.08	9.8	A	25
<i>Weekday PM Peak</i>												
NB All	0.48	37.1	E	75	0.70	68.5	F	125	0.94	138.1	F	150
WB Left	0.07	9.6	A	25	0.08	10.2	B	25	0.09	10.9	B	25
<i>Sat Midday Peak</i>												
NB All	0.50	38.1	E	75	0.66	59.0	F	100	0.86	109.4	F	150
WB Left	0.06	9.2	A	25	0.06	9.6	A	25	0.07	10.0	B	25
Old South Road at Young's Way												
<i>Weekday AM Peak</i>												
NB All	0.32	27.8	D	50	0.41	36.1	E	50	0.49	47.9	E	75
WB Left	0.02	9.0	A	25	0.02	9.3	A	25	0.03	9.4	A	25
<i>Weekday PM Peak</i>												
NB All	0.33	32.7	D	50	0.48	50.2	F	75	0.64	81.8	F	100
WB Left	0.03	9.4	A	25	0.03	9.8	A	25	0.04	10.4	B	25
<i>Sat Midday Peak</i>												
NB All	0.22	26.6	D	25	0.28	31.5	D	50	0.36	43.5	E	50
WB Left	0.02	9.1	A	25	0.02	9.3	A	25	0.03	9.7	A	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 10 (continued)
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Lover's Lane												
<i>Weekday AM Peak</i>												
NB All	0.16	30.8	D	25	0.36	42.6	E	50	0.73	100.1	F	100
EB Left	0.01	8.9	A	0	0.01	9.1	A	0	0.01	9.4	A	0
WB Left	0.02	8.8	A	0	0.03	9.1	A	25	0.03	9.3	A	25
SB All	0.00	12.4	B	0	0.00	13.0	B	0	0.00	14.0	B	0
<i>Weekday PM Peak</i>												
NB All	0.42	44.9	E	50	0.95	146.5	F	150	1.80	NA	F	300
EB Left	0.02	8.9	A	25	0.02	9.2	A	25	0.02	9.3	A	25
WB Left	0.04	9.4	A	25	0.07	9.9	A	25	0.08	10.5	B	25
SB All	0.10	28.4	D	25	0.15	41.1	E	25	0.20	56.4	F	25
<i>Sat Midday Peak</i>												
NB All	0.28	32.7	D	50	0.88	117.0	F	150	1.66	NA	F	300
EB Left	0.01	8.8	A	0	0.01	9.1	A	0	0.01	9.3	A	0
WB Left	0.03	9.0	A	25	0.07	9.5	A	25	0.08	10.0	B	25
SB All	0.08	25.6	D	25	0.11	36.1	E	25	0.15	49.0	E	25
Old South Road at Goldfinch Drive												
<i>Weekday AM Peak</i>												
NB All	0.41	35.8	E	50	0.75	98.5	F	125	---	---	---	---
WB Left	0.01	8.7	A	0	0.02	9.1	A	25	---	---	---	---
SB All	0.28	19.9	C	50	0.43	33.2	D	25	0.32	22.5	C	50
<i>Weekday PM Peak</i>												
NB All	0.46	41.8	E	75	0.65	72.1	F	100	---	---	---	---
WB Left	0.02	9.1	A	25	0.03	9.5	A	25	---	---	---	---
SB All	0.22	21.0	C	25	0.28	26.7	D	50	0.26	24.5	C	25
<i>Sat Midday Peak</i>												
NB All	0.42	38.2	E	50	0.60	63.7	F	100	---	---	---	---
WB Left	0.02	8.8	A	25	0.03	9.1	A	25	---	---	---	---
SB All	0.29	17.4	C	50	0.35	21.4	C	50	0.34	20.7	C	50

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 10 (continued)
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Macy's Lane												
<i>Weekday AM Peak</i>												
NB All	0.61	19.2	C	125	0.72	25.1	D	150	0.73	26.6	D	175
EB All	0.81	28.5	D	225	0.95	49.5	E	325	1.04	62.1	F	375
WB All	0.57	17.5	C	100	0.67	22.4	C	125	0.69	23.4	C	150
SB All	0.09	10.8	B	25	0.10	11.8	B	25	0.10	11.9	B	25
<i>Weekday PM Peak</i>												
NB All	0.56	17.8	C	100	0.69	24.6	C	150	0.77	31.1	D	175
EB All	0.83	31.6	D	225	1.04	63.0	F	375	1.16	64.7	F	375
WB All	0.68	21.2	C	150	0.83	34.8	D	225	0.91	47.7	E	275
SB All	0.09	11.0	B	25	0.15	12.5	B	25	0.15	13.0	B	25
<i>Sat Midday Peak</i>												
NB All	0.51	14.8	B	75	0.63	19.1	C	125	0.70	24.0	C	150
EB All	0.61	16.1	C	125	0.79	25.6	D	200	0.89	40.0	E	275
WB All	0.46	13.5	B	75	0.56	16.8	C	100	0.63	220.1	C	125
SB All	0.04	9.6	A	25	0.05	10.5	B	25	0.05	11.1	B	25
Old South Road at Nobadeer Farm Road												
<i>Weekday AM Peak</i>												
EB Left	0.21	8.1	A	25	0.23	8.2	A	25	0.25	8.2	A	25
SB All	0.34	11.5	B	50	0.38	12.1	B	50	0.40	12.4	B	50
<i>Weekday PM Peak</i>												
EB Left	0.17	8.0	A	25	0.20	8.1	A	25	0.21	8.1	A	25
SB All	0.33	11.3	B	50	0.39	12.0	B	50	0.43	12.5	B	75
<i>Sat Midday Peak</i>												
EB Left	0.13	7.8	A	25	0.16	7.9	A	25	0.17	7.9	A	25
SB All	0.18	10.2	B	25	0.21	10.5	B	25	0.24	10.7	B	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 10 (continued)
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Milestone Road at Nobadeer Farm Road												
<i>Weekday AM Peak</i>												
NB Left	0.64	35.7	E	100	0.77	53.4	F	150	0.80	57.9	F	175
NB Right	0.19	11.1	B	25	0.22	11.5	B	25	0.36	11.8	B	25
WB Left	0.10	8.5	A	25	0.12	8.6	A	25	0.13	8.6	A	25
<i>Weekday PM Peak</i>												
NB Left	0.56	34.5	D	100	0.71	52.4	F	150	0.80	69.7	F	150
NB Right	0.21	11.7	B	25	0.25	12.3	B	25	0.28	12.6	B	50
WB Left	0.10	8.6	A	25	0.13	8.8	A	25	0.15	8.9	A	25
<i>Sat Midday Peak</i>												
NB Left	0.43	26.9	D	50	0.53	35.8	E	75	0.59	42.4	E	100
NB Right	0.15	11.4	B	25	0.19	11.9	B	25	0.22	12.2	B	25
WB Left	0.09	8.5	A	25	0.11	8.7	A	25	0.13	8.8	A	25
Old South Road at Primary Access Road												
<i>Weekday AM Peak</i>												
NB Left	---	---	---	---	---	---	---	---	0.82	82.5	F	150
NB Right	---	---	---	---	---	---	---	---	0.18	14.3	B	25
WB Left	---	---	---	---	---	---	---	---	0.03	9.0	A	25
<i>Weekday PM Peak</i>												
NB Left	---	---	---	---	---	---	---	---	0.99	168.1	F	150
NB Right	---	---	---	---	---	---	---	---	0.18	16.8	C	25
WB Left	---	---	---	---	---	---	---	---	0.11	10.3	B	25
<i>Sat Midday Peak</i>												
NB Left	---	---	---	---	---	---	---	---	0.74	81.2	F	125
NB Right	---	---	---	---	---	---	---	---	0.15	14.5	B	25
WB Left	---	---	---	---	---	---	---	---	0.08	9.5	A	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 10 (continued)
Level-of-Service Analysis Summary

Location/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c ^a	Del. ^b	LOS ^c	Queue	v/c ^a	Del. ^b	LOS ^c	Queue
Old South Road at Retail Site Driveway												
<i>Weekday AM Peak</i>												
NB All	---	---	---	---	---	---	---	---	0.03	26.2	D	25
WB Left	---	---	---	---	---	---	---	---	0.00	8.8	A	0
<i>Weekday PM Peak</i>												
NB All	---	---	---	---	---	---	---	---	0.25	39.3	E	25
WB Left	---	---	---	---	---	---	---	---	0.02	9.9	A	25
<i>Sat Midday Peak</i>												
NB All	---	---	---	---	---	---	---	---	0.24	31.6	D	25
WB Left	---	---	---	---	---	---	---	---	0.02	9.2	A	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Capacity Analysis Results

As shown in Table 10, the Milestone Rotary currently experiences significant capacity constraints, particularly on the Old South Road and Sparks Avenue approaches, where very long delays and queues are experienced, at level of service (LOS) F. It should be noted that the analysis model does not take into consideration the access and parking conflicts in the southwest corner of the intersection that can lead to additional delays and queues not reflected in the analysis results. These conditions will be exacerbated under the future volume conditions, with or without the additional traffic from the Project. As described previously, the Town of Nantucket is planning major upgrades and will be reconstructing this intersection into a modern roundabout, providing adequate deflection to reduce entry speeds, two lanes of traffic on every approach, safe pedestrian/bicycle crossings across all four approaches, and eliminating the access conflicts by controlling site access to the property in the southwest corner. As documented in the study commissioned by the Town, upon the construction of these improvements, a significant improvement in traffic operations would be realized on all approaches. These improvements should be advanced by the town at the earliest possible time, given the current level of operation.

Similarly, the Old South Road and Fairgrounds Road intersection currently operates at LOS F during all peak hours with very long delays and queues on the Fairgrounds Road approach (particularly for vehicles attempting to make a left turn, to the west, traveling toward the Milestone rotary and the Downtown area). The volume-to-capacity (v/c) ratio for existing traffic exiting Fairgrounds Road is calculated at well over 1.0 during the weekday PM and Saturday peak hours, indicating that there is insufficient capacity to accommodate the volume of traffic. As these volumes were counted going through the intersection, the volume-to-capacity (v/c) ratio cannot be greater than 1.0. This indicates that motorists are accepting gaps in traffic that are far shorter than those assumed in the analysis model. As shown in Table 10, these conditions will be exacerbated under the future volume conditions, with or without the additional traffic from the Project. The Town of Nantucket has plans to reconstruct this intersection into a modern roundabout, with single-lane approaches on all legs of the intersection. Based on the study commissioned by the Town, upon the construction of these improvements, the intersection would operate at LOS C or better during all peak hours. These improvements should be advanced by the Town at the earliest possible time, given the current level of operation.

Traffic exiting Amelia Drive during peak hours currently operates at LOS E, indicating long delays. By the 2023 design year, these movements will operate at LOS F with or without the additional traffic from the Project. However, v/c ratios will remain below 1.0, indicating that capacity remains to accommodate the traffic. At the Old South Road and Young's Way intersection, traffic exiting Young's Way currently operates at acceptable levels (LOS D) during all peak hours. By 2023, these movements will operate at levels ranging from E to F with or without additional traffic from the Project, with long delays for traffic exiting Young's Way. However, v/c ratios will remain well below 1.0, indicating that ample capacity remains to accommodate the traffic.

Traffic exiting Lover's Lane onto Old South Road currently operates at LOS D to E during peak hours. With the increase in through traffic along Old South Road under the 2023 No-Build condition, these traffic movements will operate at LOS E to F. As a result of the redistribution of traffic that will occur from the elimination of the existing "extension" of Greglen Avenue, as a result of the Project, as well as the increase in traffic on Old South Road as a result of the Project, Lover's Lane traffic will experience a significant increase in delay with v/c ratios well above 1.0. As a result, improvements are recommended to be made at this intersection, as further described in the *Mitigation* section of this study.

At the Old South Road and Greglen Avenue / Goldfinch Drive intersection, traffic exiting the existing "extension" of Greglen Avenue currently operates at LOS E and is projected to operate at LOS F under the 2023 No-Build conditions. These movements will be eliminated as a result of the development of the Project. As a result, traffic exiting the Goldfinch Drive (West) exit from the Naushop residential community actually improves in level of service, fairly substantially, from LOS D to C. Additional improvements in traffic operations for Goldfinch Drive traffic will also be experienced as a result of the improvements proposed and described in the *Mitigation* section of this study.

The Old South Road and Macy's Lane (Airport Road) intersection currently operates at acceptable levels during all peak hours, but vehicle queues of about nine (9) vehicles are noted on the Old South Road eastbound approach during the weekday AM and PM peak hours. Under the 2023 No-Build conditions, this approach is expected to operate at LOS F with long delays and queues of about fifteen (15) vehicles during the PM peak hour and a v/c ratio in excess of 1.0, indicating that the volume of traffic exceeds the capacity of this movement. The addition of traffic from the Project will cause additional delays and queues on this approach with LOS F traffic operations also occurring during the weekday AM peak hour. As a result of this impact, improvements are recommended at this intersection as described in the *Mitigation* section of this study.

The Old South Road and Nobadeer Farm Road intersection operates at desirable levels (LOS A to B) during all peak hours under all volume conditions. The Milestone Road and Nobadeer Farm Road intersection currently operates at LOS E during the weekday AM peak hour and at LOS D during all other peak hours. Under the 2023 No-Build conditions, the Nobadeer Farm Road approach is expected to operate at LOS F during both weekday peak hours with long delays and queues of about six (6) vehicles. The addition of site traffic from the Project under the 2023 Build conditions will create some additional delays, but no changes in level of service and all v/c ratios will remain below 1.0, indicating that capacity remains at the intersection to accommodate the projected volumes of traffic.

Absent any improvements, the (new) site driveway and (new) primary access roadway connecting to and from Old South Road are projected to operate at LOS E to F with long delays and v/c ratios nearing 1.0. As a result, improvements are recommended at these locations that will significantly improve traffic operations, as further described in the *Mitigation* section of this study. No capacity analyses were performed for the proposed site driveway on Lover's Lane as none of the site traffic was assigned to this driveway.

MITIGATION RECOMMENDATIONS

The final component of the traffic analysis process is to identify any measures that may be necessary to improve existing or projected traffic operations and to mitigate the effects of the Project on the area transportation system.

As described in the *Capacity Analysis* section of this study, both the Milestone Rotary and the Old South Road and Fairgrounds Road intersection currently operate at LOS F with insufficient capacity to accommodate the existing volume of peak hour traffic. The Town of Nantucket is proposing significant improvements to these locations that will not only resolve existing operational constraints, but will provide additional capacity to accommodate future traffic levels. These improvements should be advanced by the town at the earliest possible time.

There are several other study area intersections that are projected to operate at LOS F with or without the generation of any future traffic from the Project, but have sufficient remaining capacity (volume-to-capacity ratios of less than 1.0) to accommodate the future traffic levels. Improvements are therefore not required at these locations as part of the Project.

The Project will have a significant impact at several study area roadway segment and intersection locations, as described below, and specific traffic improvements are recommended to be implemented by the Project Proponent in order to mitigate these impacts.

Old South Road Corridor Improvements (Center-Left-Turn Lane)

Each of the proposed (new) primary access road, the (new) site driveway location, and the Lover's Lane intersection with Old South Road are projected to operate with long delays at LOS F and with v/c ratios over 1.0 as a result of traffic generated by the Project. To improve traffic operations for these intersections as well as all driveways along this section of Old South Road, it is recommended that Old South Road be widened (+/- 1,500 feet in length) to construct a two-way center-left-turn lane, extending from west of Lover's Lane to a point east of the proposed (new) primary access road. Such a center turn lane has the effect of allowing side-street traffic to make left turns in two stages, crossing first one direction of traffic on Old South Road, then waiting in the center turn lane to merge with the other direction of traffic. In addition, the center turn lane allows left turns from Old South Road a safe place to wait for a gap in traffic without affecting through traffic (which will no longer have to wait and cause a backup or delay until the turning vehicle has exited the main travel lane). Construction of a center turn lane will require widening Old South Road on both sides of the street and will also require acquisition of land from the Project site. A conceptual plan of such a center turn lane is provided in the Appendix. As shown on this plan, it is recommended that Old South Road be widened to provide 12-foot wide through lanes, a 14-foot wide center turn lane, and 2-foot wide shoulders. Appropriate signs should be installed identifying the beginning and end of the center turn lane.

The levels of service that will be experienced along Old South Road in this area as a result of the construction of these improvements are shown in Table 11 and all analysis worksheets are provided in the Appendix. As shown, delays for traffic exiting the proposed (new) primary access road, the (new) site driveway, and Goldfinch Drive (West) will be significantly improved to LOS C to D during all peak hours. Traffic exiting Lover's Lane will also experience a significant reduction in delay, although LOS F conditions would still exist during the weekday PM and Saturday peak hours. However, v/c ratios are projected at 0.68 or less, indicating that ample capacity remains to accommodate the traffic. Similar results would be expected at all of the other driveways within this section of Old South Road, including the driveways to Nantucket Seafood, the Nantucket Emporium, the cluster of existing retail uses owned by the Project Proponent near the intersection of Old South Road and Lovers Lane, and all of the driveways serving the Valero & Sons Garden Center. It is also important to point out that these operating conditions will exist only during the peak summer months, which has a short duration of 3-4 months. During the remainder of the year, volumes will be significantly lower and traffic operations accordingly better.

As previously described, construction of the (new) primary access road will eliminate the "extension" of Greglen Avenue located between Old South Road and Nancy Ann Lane. Greglen Avenue currently intersects Old South Road opposite Goldfinch Drive (West), but is offset slightly to the west. This often causes conflicts between vehicles turning right from Goldfinch Drive (West) traveling to the west (toward the Downtown area) and those turning left from Greglen Avenue, also traveling to the west (toward the Downtown area), which is by far the dominant turning movement and direction for traffic exiting these intersections. Eliminating this poorly located and designed existing "extension" of Greglen Avenue will accordingly have a significant traffic safety benefit.

While the additional traffic generated by the Project along this section of Old South Road represents an increase in traffic of only about 14 percent and the recommended improvements will have significant benefits to access and traffic safety for all other properties along the corridor, it is anticipated that the Project Proponent will solely fund and provide for the construction of these recommended improvements before any substantial component of the Project is actually built and occupied.

Table 11
Level-of-Service Analysis Summary - With Mitigation

Location/Peak Hour/Movement	2023 No-Build				2023 Build				2023 Build Mitigated			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Lover's Lane												
<i>Weekday AM Peak</i>												
NB All	0.36	42.6	E	50	0.73	100.1	F	100	0.33	28.0	D	50
EB Left	0.01	9.1	A	0	0.01	9.4	A	0	0.01	9.4	A	0
WB Left	0.03	9.1	A	25	0.03	9.3	A	25	0.03	9.3	A	25
SB All	0.00	13.0	B	0	0.00	14.0	B	0	0.00	14.0	B	0
<i>Weekday PM Peak</i>												
NB All	0.95	146.5	F	150	1.80	NA	F	300	0.68	57.5	F	125
EB Left	0.02	9.2	A	25	0.02	9.3	A	25	0.02	9.3	A	25
WB Left	0.07	9.9	A	25	0.08	10.5	B	25	0.08	10.5	B	25
SB All	0.15	41.1	E	25	0.20	56.4	F	25	0.08	23.6	C	25
<i>Sat Midday Peak</i>												
NB All	0.88	117.0	F	150	1.66	NA	F	300	0.66	50.9	F	100
EB Left	0.01	9.1	A	0	0.01	9.3	A	0	0.01	9.3	A	0
WB Left	0.07	9.5	A	25	0.08	10.0	B	25	0.08	10.0	B	25
SB All	0.11	36.1	E	25	0.15	49.0	E	25	0.07	22.8	C	25
Old South Road at Goldfinch Drive												
<i>Weekday AM Peak</i>												
NB All	0.75	98.5	F	125	---	---	---	---	---	---	---	---
WB Left	0.02	9.1	A	25	---	---	---	---	---	---	---	---
SB All	0.43	33.2	D	25	0.32	22.5	C	50	0.25	17.5	C	25
<i>Weekday PM Peak</i>												
NB All	0.65	72.1	F	100	---	---	---	---	---	---	---	---
WB Left	0.03	9.5	A	25	---	---	---	---	---	---	---	---
SB All	0.28	26.7	D	50	0.26	24.5	C	25	0.18	17.1	C	25
<i>Sat Midday Peak</i>												
NB All	0.60	63.7	F	100	---	---	---	---	---	---	---	---
WB Left	0.03	9.1	A	25	---	---	---	---	---	---	---	---
SB All	0.35	21.4	C	50	0.34	20.7	C	50	0.28	17.1	C	50

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 11 (continued)
Level-of-Service Analysis Summary - With Mitigation

Location/Peak Hour/Movement	2023 No-Build				2023 Build				2023 Build Mitigated			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Retail Site Driveway												
<i>Weekday AM Peak</i>												
NB All	---	---	---	---	0.03	26.2	D	25	0.01	16.6	C	0
WB Left	---	---	---	---	0.00	8.8	A	0	0.00	8.8	A	0
<i>Weekday PM Peak</i>												
NB All	---	---	---	---	0.25	39.3	E	25	0.13	20.4	C	25
WB Left	---	---	---	---	0.02	9.9	A	25	0.02	9.9	A	25
<i>Sat Midday Peak</i>												
NB All	---	---	---	---	0.24	31.6	D	25	0.14	18.3	C	25
WB Left	---	---	---	---	0.02	9.2	A	25	0.02	9.2	A	25
Old South Road at Primary Access Road												
<i>Weekday AM Peak</i>												
NB Left	---	---	---	---	0.82	82.5	F	150	0.45	25.4	D	75
NB Right	---	---	---	---	0.18	14.3	B	25	0.18	14.3	B	25
WB Left	---	---	---	---	0.03	9.0	A	25	0.03	9.0	A	25
<i>Weekday PM Peak</i>												
NB Left	---	---	---	---	0.99	168.1	F	150	0.40	30.1	D	50
NB Right	---	---	---	---	0.18	16.8	C	25	0.18	16.8	C	25
WB Left	---	---	---	---	0.11	10.3	B	25	0.11	10.3	B	25
<i>Sat Midday Peak</i>												
NB Left	---	---	---	---	0.74	81.2	F	125	0.37	24.6	C	50
NB Right	---	---	---	---	0.15	14.5	B	25	0.15	14.5	B	25
WB Left	---	---	---	---	0.08	9.5	A	25	0.08	9.5	A	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Table 11 (continued)
Level-of-Service Analysis Summary - With Mitigation

Location/Peak Hour/Movement	2023 No-Build				2023 Build				2023 Build Mitigated			
	v/c ^a	Del. ^b	LOS ^c	Queue ^d	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Old South Road at Macy's Lane												
<i>Weekday AM Peak</i>												
NB All	0.72	25.1	D	150	0.73	26.6	D	175	0.71	24.5	C	150
EB All	0.95	49.5	E	325	1.04	62.1	F	375	0.67	22.8	C	125
EB Right	---	---	---	---	---	---	---	---	0.45	13.9	B	75
WB All	0.67	22.4	C	125	0.69	23.4	C	150	0.68	23.0	C	150
SB All	0.10	11.8	B	25	0.10	11.9	B	25	0.10	11.4	B	25
<i>Weekday PM Peak</i>												
NB All	0.69	24.6	C	150	0.77	31.1	D	175	0.76	29.7	D	175
EB All	1.04	63.0	F	375	1.16	64.7	F	375	0.73	27.7	D	150
EB Right	---	---	---	---	---	---	---	---	0.52	16.3	C	75
WB All	0.83	34.8	D	225	0.91	47.7	E	275	0.91	47.1	E	275
SB All	0.15	12.5	B	25	0.15	13.0	B	25	0.15	12.8	B	25
<i>Sat Midday Peak</i>												
NB All	0.63	19.1	C	125	0.70	24.0	C	150	0.67	21.1	C	125
EB All	0.79	25.6	D	200	0.89	40.0	E	275	0.53	16.5	C	75
EB Right	---	---	---	---	---	---	---	---	0.43	12.9	B	75
WB All	0.56	16.8	C	100	0.63	220.1	C	125	0.61	18.8	C	125
SB All	0.05	10.5	B	25	0.05	11.1	B	25	0.05	10.6	B	25

^a Volume-to-capacity ratio.

^b Average control delay (sec./vehicle).

^c Level of service.

^d 95th percentile queue in feet, assuming 25 feet/vehicle.

NA = not calculable.

Old South Road at Macy's Lane Intersection Improvements (Exclusive Right-Turn Lane)

This intersection currently operates with long delays and queues on the Old South Road eastbound approach to the intersection (for vehicles traveling east, toward Nantucket Memorial Airport), particularly during the weekday PM peak hour. Traffic growth by 2023 will exacerbate these conditions and the Project has a measurable impact on these conditions by causing the v/c ratio on the eastbound approach to exceed 1.0, resulting in the approach being well over capacity to accommodate this level of traffic.

It is accordingly recommended that Old South Road eastbound approach be widened along the south side to create a shared left/through lane and an exclusive right-turn lane. The turn lane should be 150 feet in length with a 100-foot taper to meet the existing pavement edge. The left/through lane should be 11 feet in width and the exclusive right-turn lane should be 10 feet in

width with a 2-foot paved shoulder. The intersection should continue to operate under ALL-WAY STOP control. A sketch of the recommended improvements is shown on Figure 17. With these improvements, the eastbound approach improves substantially, from LOS F to D or better during all peak hours, as shown in Table 11. All analysis worksheets are provided in the Appendix.

In instances where a specific development project generates an increment of traffic that causes an existing intersection on a public roadway system with poor levels of service and unacceptable v/c ratios to worsen further, industry standard methodology is to require the project to contribute funding for the necessary mitigation at a rate that is proportionate or “pro –rata” to its impact on the intersection. In this case, the traffic added by the proposed Project to the Macy’s Lane (Airport Road) and Old South Road intersection represents an increase of 5.1 percent during the weekday AM peak hour, 7.0 percent during the weekday PM peak hour, and 7.9 percent during the Saturday peak hour over the total traffic that is expected to travel through the intersection at the (future) 2023 design horizon.

Accordingly, based on this methodology, the Project Proponent should be required to fund 7.9% of the total cost of the recommended mitigation for this intersection. The proportion of funding of the total cost of the recommended mitigation should be negotiated with the local permitting authority with jurisdiction over the review and approval of the Project and / or the traffic improvements (which, in this case, is the Town of Nantucket Planning Board and / or the Town of Nantucket Board of Selectmen, acting as the Nantucket County Commissioners).



**Figure 17 - Conceptual Improvement Plan
Old South Road at Macy's Lane**



SUMMARY OF CONCLUSIONS

Existing and future traffic conditions at the nine (9) different study area intersections have been described and analyzed with respect to traffic operations and the impact of the proposed Project. Conclusions of this study and recommendations are summarized below.

Project Description

- The proposed Project includes the prospective development of a combination of 100 single-family homes, 225 apartment units, and approximately 15,500 square feet of retail and restaurant space. Site access is proposed via a (new) primary access road connecting to Old South Road east of Goldfinch Drive (West), a (new) driveway on Old South Road, primarily intended to serve the retail space and located further west of Goldfinch Drive (West), and a (new) driveway connecting to Lover's Lane that is also primarily intended to serve the retail space.

Existing Traffic Counts / Volumes

- Existing traffic conditions within the study area were developed by collecting manual turning movement and vehicle classification counts during peak month (July and August) conditions. While the majority of the counts were collected in 2014, historical count data provided by the Town of Nantucket Planning and Land Use Services (PLUS) Department indicates that traffic has remained fairly consistent over the past 10 years. The collected data therefore accurately reflect existing traffic volume conditions.

Vehicle Accident History

- A review of vehicle accident records revealed that none of the study intersections experienced a significant number of crashes and the calculated crash rates are well below the statewide average. Nearly seventy percent (70%) of all accidents occurred during the summer months of June, July, and August, which is expected given the surge in traffic during these peak seasonal months and the fact that more drivers that are unfamiliar with the local roadway system are driving during these periods (visitors / tourists, as opposed to local residents).

Site Distance Analysis

- Sight distance analysis conducted for the proposed (new) primary access road and the (new) site driveways indicates that the available sight lines exceed both minimum requirements and desirable distances and safe operation can therefore be expected. It is recommended that any proposed landscaping or obstructions in the vicinity of the driveways be set back sufficiently so as not to impede sight distances for drivers exiting the site.

Future Traffic Conditions

- Future traffic volumes were projected out to the year 2023 by applying a one percent (1.00%) compounded annual traffic growth rate to all volumes and by adding the traffic from six (6) other recently constructed and / or planned development projects.
- Due to long-standing capacity constraints at the Milestone Rotary and the Old South Road and Fairgrounds Road intersection, the Town of Nantucket has plans to modify these intersections that will significantly improve traffic conditions at these locations in the future. Based on discussions with Town of Nantucket PLUS Department staff however, these improvements are not expected to be implemented by the 2023 design year and accordingly were not assumed to be completed within the design horizon of this study. In addition, the Town of Nantucket PLUS Department will soon be undertaking a study of the Old South Road corridor to evaluate multi-modal access and congestion improvements.

Project Generated Traffic Volumes and Increases on Local Intersections / Roadways

- The Project is expected to generate approximately 210, 293, and 277 new peak hour vehicle trips during the weekday AM peak hour, weekday PM peak hour, and Saturday midday peak hour (respectively) to the adjacent streets.
- Once distributed onto the local roadway network, traffic generated by the Project is expected to increase peak hour volumes on Old South Road in the immediate vicinity of the Project site by a maximum of 198 new trips (during the weekday PM peak hour) or by +/- 14 percent compared to the year 2023 design horizon No-Build volumes..
- As traffic generated by the Project distributes onto the available access routes to and from the west of the site (to and from the Downtown area), peak hour traffic volumes at the Milestone Rotary at the western end of the Old South Road corridor are expected to increase by a maximum of 154 new trips (during the weekday PM peak hour) or by +/- 6 percent compared to the year 2023 design horizon No-Build volumes.
- As traffic generated by the Project distributes to and from the east (to and from the airport area), peak hour traffic volumes at the Macy's Lane (Airport Road) intersection with Old South Road are expected to increase by a maximum 93 new trips (during the weekday PM peak hour) or by +/- 7 percent, compared to the year 2023 design horizon No-Build volumes.
- Smaller incremental increases in traffic will also be generated further "downstream" from the study area. Along these "downstream" local roadways segments, such as Orange Street (northwest of the Milestone rotary), Sparks Avenue (west of the Milestone rotary), Fairgrounds Road (near the Nantucket Police Station), Macy's Lane (toward Nantucket Municipal Airport), and Milestone Road (east of Nobadeer Farm Road), these traffic

volume increases will range from an average of +/- 40 additional vehicles during the weekday AM peak hour, +/- 55 additional vehicles during the weekday PM peak hour, and +/- 50 additional vehicles during the Saturday midday peak hour. When compared with the year 2023 design horizon No-Build conditions, these volumes represent increases in traffic between four and five percent (+/- 4.0% to +/- 5.0%). Much smaller increases in traffic are expected during all other hours of the day.

Impacts of Project Generated Traffic and Recommended Mitigation / Improvements

- Analysis of future traffic conditions reveals that many of the study area intersections will operate at level of service (LOS) F by 2023, with or without any traffic from the Project. Both the Milestone Rotary and the Fairgrounds Road and Old South Road intersection will operate far above the capacity of these intersections. The Town of Nantucket has plans to improve both of these locations. Several other study area intersections will operate at LOS F with or without any traffic from the Project, but with volume-to-capacity (v/c) ratios remaining below 1.0, indicating that additional capacity remains to accommodate the anticipated demand.
- Several of the study area intersections will operate at LOS F or at v/c ratios above 1.0 directly as a result of additional traffic that will be generated by the Project and specific traffic improvements are recommended to mitigate those impacts. These include:
 - (1) Improvements along the entire segment of Old South Road in the vicinity of the Project, primarily comprised of a center-left-turn lane running from the intersection of Old South Road and Lover's Lane, to the east, past the (new) retail driveway connecting to Old South Road, and past the (new) primary access road serving the Project (located east of the Goldfinch Drive (West) intersection, which serves as the exit to the Naushop residential community).
 - (2) Improvements to the Macy's Lane (Airport Road) and Old South Road intersection, primarily comprised of a widening of the south side of the road, to accommodate a dedicated right-turn lane to allow improved operations at this intersection, particularly for vehicles seeking to turn right from Old South Road traveling toward Nantucket Memorial Airport.
- Implementation of the series of traffic improvements that are recommended in the body of this study, as summarized above, will result in substantial improvement to and mitigation of traffic operations (in terms of levels of service, volume-to-capacity ratios, delays, and queues) at these locations, to the point where traffic conditions will, in almost all cases, actually be better than those which are experienced under current conditions.
- In conjunction with the development of the Project, the existing "extension" of Greglen Avenue (which was not plotted or approved as a road, but was constructed by the prior owner of the surrounding properties and has been utilized as a means of providing

vehicular access to Old South Road for several decades) will also be terminated / eliminated between Old South Road and Nancy Ann Lane once the (new) primary access road is constructed. This modification will have a significant traffic safety and vehicle capacity benefit along this important segment of Old South Road, by eliminating the existing conflict that is created by the offset intersection that is currently formed by this “extension” of Greglen Avenue and the Goldfinch Drive (West) (exit) road from the Naushop residential community as they intersect with Old South Road.

Site Roadway Design Recommendations

- It is recommended that the proposed (new) primary access road for the Project should be constructed by providing two exiting lanes and one entering lane separated by a raised median. The exiting lanes (for vehicles seeking to make either a left hand turn or a right hand turn from the Project on to Old South Road) should be under STOP-sign control. The two (new) driveways connecting to Old South Road and to Lover’s Lane, primarily intended to serve the proposed retail uses, should be constructed providing one exiting lane (under STOP-sign control) and one entering lane, separated by a double yellow centerline.