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MEMORANDUM

DATE: February 16, 2018
(Updated July 12, 2018)

TO: Surfside Crossing, LLC
c/o Donald F. Bracken, Jr., P.E.
Bracken Engineering
19 Old South Road
Nantucket, MA 02554

FROM: Robert J. Michaud, P.E. – Managing Principal
Daniel A. Dumais, P.E. – Senior Project Manager

RE: **Proposed Surfside Crossing Residential Development**
3-9 South Shore Road – Nantucket, MA

MDM Transportation Consultants, Inc. (MDM) has prepared this traffic impact assessment (TIA) for the proposed residential development to be located at 3-9 South Shore Road in Nantucket, Massachusetts. The location of the site relative to adjacent roadways is shown in **Figure 1**. This memorandum describes existing traffic volumes and travel speeds for South Shore Road, evaluates sight lines to/from the site driveway, estimates trip generation characteristics of the proposed development, quantifies incremental traffic impacts of the Site development on the adjacent roadways, and evaluates safety-related conditions at key study locations that provide access to the Site.

Key findings of the traffic assessment are as follows:

- *Safety Characteristics*. A review of the crash data indicated that no immediate safety countermeasures are warranted based on the crash history at the study intersection of Surfside Road at Fairgrounds Road/South Shore Road.

- *Measured Travel Speeds*. The observed 85th percentile travel speed of 38 mph is highly consistent with the posted regulatory speed limit of 35 mph along South Shore Road in the Site vicinity. The regulatory and observed travel speeds provide an appropriate basis for determining driveway sight lines to conform with sight line criteria published by AASHTO.

- *Sight Line Safety Characteristics.* Proposed clearing and regrading associated with construction of the proposed Site driveway will provide sight lines that exceed AASHTO's recommended criteria both stopping sight distance (SSD) and intersection sight distance (ISD) based on the regulatory speed limit and observed travel speeds along South Shore Road. This will provide ample visibility for vehicles approaching and leaving the Site driveways to properly exit/enter the South ShoreRoad traffic stream in a safe manner.

- *Modest Trip Generation*. The proposed development is estimated to generate approximately 88 vehicle trips (21 entering and 67 exiting) during the weekday morning peak hour and 113 vehicle trips (71 entering and 42 exiting) during the weekday evening peak hour. On a daily basis the project is estimated to generate approximately 1,272 trips with half entering and half exiting over a 24 hour period. While the Site is likely to benefit by its close proximity to public transportation and opportunities for pedestrian/bicycle use, the analysis utilizes ITE-based trip generation without downward adjustment to present a conservative analysis.

- *Adequate Roadway Capacity*. Under future Build conditions, capacity analyses indicate that the unsignalized Site Driveway approaches to South Shore Road will operate at level of service (LOS) B or better during the weekday morning and weekday evening peak hours. Under future Build conditions, capacity analyses indicate that the Surfside Road intersection with Fairgrounds Road and South Shore Road will operate with moderate delays at level of service (LOS) D or better during the peak season. The incremental traffic associated with the proposed development is not expected to materially impact operations and queue lengths at the intersection compared to No-Build conditions.

- *Site Access/Circulation.* AutoTURN analysis has been completed for the preliminary site plan using the Town's Ladder truck and single unit (SU) delivery truck. Site access, circulation aisles and parking layout provide adequate maneuvering area for the largest potential responding vehicle (ladder truck).

In summary, trip generation for the development is projected to be modest. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. The study intersections exhibit below-average crash rates based on historic crash data; safety countermeasures are therefore not warranted. Likewise, the available sight lines at the Site Driveway intersections with South Shore Road exceed the recommended sight line requirements from AASHTO. Implementation of access/egress improvements, proposed pedestrian, and bicycle improvements along with a Transportation Demand Management (TDM) program will establish a framework of minimizing Site traffic impacts by encouraging non-motorized travel modes and pedestrian/bicycle accommodation that is compatible with other projects in the area.

PROJECT DESCRIPTION

The existing Site consists of approximately 13.6± acres of undeveloped land located along South Shore Road in Nantucket, MA. Under the proposed site programming, 60 single family homes and 96 condominium units will be constructed. The proposed access/egress will be via three full-access/egress driveways along South Shore Road. The northern driveway will service the multi-family condominium units. The central and southern driveways will service 60 residential lots. A preliminary site plan prepared by Bracken Engineering, Inc. is presented in **Figure 2**.

EXISTING TRAFFIC & SAFETY CHARACTERISTICS

An overview of existing roadway conditions, traffic volumes, and safety characteristics is provided below.

South Shore Road

South Shore Road is generally a north-south local roadway under Town jurisdiction South Shore Road provides a connection between Surfside Road to the north and Hillside Avenue to the south. South Shore Road provides a single travel lane in each direction with a multi-use path (South Shore Bike Path) along its eastern side. The posted (regulatory) speed limit on South Shore Road is 35 miles per hour (mph). Land use along South Shore Street is primarily residential homes but also include the South Shore Wastewater Treatment Plant and a junk yard.

Peak Hour Traffic Volumes

Traffic volume data was collected within the study area along South Shore Road in June 2018 during the weekday morning (7:00 – 9:00 AM) and weekday evening (4:00 – 6:00 PM) peak periods. Review of Cape Cod Commission data for the Cape and Islands indicates that June is an above average traffic month (approximately 11 percent above average month conditions) but it is approximately 17 percent below peak traffic conditions which occur in July and August. Thus, the traffic counts were adjusted by 17% (increase) to represent peak season conditions. The resulting Baseline weekday morning and weekday evening peak-hour traffic volumes for the study intersection are depicted in **Figure 3**. Turning movement counts and permanent count station data are provided in the **Attachments**.

Measured Travel Speeds

Vehicle speeds were obtained for South Shore Road adjacent to the Site using a radar recorder. These measured travel speeds provide a basis for determining sight line requirements at the proposed site driveway. **Table 1** presents a summary of the travel speed data collected for South Shore Road in the site vicinity. Collected speed data are provided in the **Attachments**.

TABLE 1
SPEED STUDY RESULTS – SOUTH SHORE ROAD

Travel Direction	Regulatory Speed Limit[1]	Travel Speed	
		Mean[2]	85th Percentile[3]
Northbound	35	33	38
Southbound	35	33	38

[1] Regulatory Speed limit in miles per hour (mph).
[2] Arithmetic mean
[3] The speed at or below which 85 percent of the vehicles are traveling

As summarized in **Table 1**, the mean (average) travel speed on South Shore Road was observed to be 33 mph and the 85th percentile travel speeds were observed to be 38 mph in both the northbound and southbound directions. The observed travel speeds are highly consistent with the 35 mph regulatory speed limit.

Intersection Crash History

In order to identify crash trends and safety characteristics for study area intersections, crash data were obtained from MassDOT for the Town of Nantucket for the three-year period 2013 through 2015 (the most recent data currently available from MassDOT). Crash data for the study intersections is summarized in **Table 2** with detailed data provided in the **Attachments.**

Crash rates were calculated for the study area intersection as reported in **Table 2**. This rate quantifies the number of crashes per million entering vehicles. MassDOT has determined the official District 5 (which includes the Town of Nantucket) crash rate to be 0.58 for unsignalized intersections. This rate represents MassDOT's "average" crash experience for District 5 communities and serves as a basis for comparing reported crash rates for the study intersections. Where calculated crash rates notably exceed the district average, some form of safety countermeasures may be warranted.

TABLE 2
INTERSECTION CRASH SUMMARY
2013 THROUGH 2015[1]

Data Category	Surfside Road at Fairgrounds Road/South Shore Road
Traffic Control	Unsignalized
Crash Rate[2]	**0.17**
District 5 Avg[3]	0.58
Year:	
2013	1
2014	1
2015	0
Total	**2**
Type:	
Angle	0
Rear-End	1
Head-On	0
Sideswipe	1
Single Vehicle	0
Other/Unknown	0
Severity:	
P. Damage Only	1
Personal Injury	0
Other/Unknown	1
Conditions:	
Dry	0
Wet	1
Snow	1
Other/Unknown	0
Time:	
7:00 to 9:00 AM	0
4:00 to 6:00 PM	1
Rest of Day	1

[1] Source: MassDOT Crash Database
[2] Crashes per million entering vehicles
[3] District 5 averages = 0.58 (unsignalized)

As summarized in **Table 2**:

- *Surfside Road at Fairgrounds Road/South Shore Road.* There are a total of two (2) crashes reported at the intersection during the three-year study period resulting crash rate of 0.17. The crashes involved one rear-end type collisions and one sideswipe collision. One of the two resulted in property damage type collisions. Both of the collisions occurred under wet or snow roadway conditions. One of the collisions occurred during the weekday evening peak travel times. No pedestrian related crashes or fatalities were reported.

In summary, the study intersection experienced a crash rate below the District 5 average and no immediate safety countermeasures are warranted based on the crash history at the study intersection.

Public Transportation Facilities

The Nantucket Regional Transit Authority operates two (2) bus Routes with service within ¼ mile of the Site as follows:

- The Surfside Beach Route provides service between Washington Street and Surfside Beach with a stop at the intersection of Surfside Road and Fairgrounds Road. Service is provided everyday between late June and early September between 10:00 am and 6:00 pm and generally runs every 40 minutes.

- The Miacomet Loop provides service between Washington Street and Surfside Beach with a stop at the intersection of Surfside Road and Fairgrounds Road. Service is provided everyday between late April and early October between 7:00 am and 9:00 pm – 12:00 am depending on the season and generally runs every 15 to 30 minutes.

To remain conservative no credit (trip reduction) was taken for the use of nearby public transportation. Specific route and schedule information is provided in the **Attachments**.

Bike Path

The South Shore Bike Path is located along South Shore Road along its eastern side between South Shore Wastewater Treatment Plant to the south and Surfside Road to the north. The Bike Path connects to the Fairgrounds Bike Path and Surfside Bike Path at the intersection of Surfside Road and Fairgrounds Road/South Shore Road. To remain conservative no credit (trip reduction) was taken for the use of the adjunct bike path.

Sight Line Evaluation

An evaluation of sight lines was conducted to ensure that minimum recommended sight lines are available at the site driveway intersections with South Shore Road. The evaluation documents sight lines under proposed conditions for vehicles as they relate to these roadways with comparison to recommended guidelines.

The American Association of State Highway and Transportation Officials' (AASHTO) standards[1] reference two types of sight distance which are relevant at the site driveway intersection: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements at the site driveway intersections along South Shore Road were compared to minimum SSD and ISD recommendations for the regulatory and observed travel speeds in the area.

Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near the design speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle exiting onto South Shore Road. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet level pavement. Adjustment factors are applied to account for roadway grades when applicable.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the South Shore Road approaches to the site driveways. **Table 3** presents a summary of the available SSD as they relate to South Shore Road and AASHTO's recommended SSD based on regulatory and observed speeds along South Shore Road.

[1] *A policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO), 2011.

TABLE 3
STOPPING SIGHT DISTANCE SUMMARY
SOUTH SHORE ROAD APPROACHES TO SITE DRIVEWAYS

Approach/ Travel Direction	Available SSD	AASHTO Recommended[1]		
		Regulatory Speed Limit[2]	Average Travel Speed[3]	85th Percentile Travel Speed[4]
Northern Site Driveway				
Northbound	>500 Feet	250 Feet	230 Feet	280 Feet
Southbound	280± Feet	80 Feet[5]	--	--
Central Site Driveway				
Northbound	>500 Feet	250 Feet	230 Feet	280 Feet
Southbound	450± Feet	250 Feet	230 Feet	280 Feet
Southern Site Driveway				
Northbound	>500 Feet	250 Feet	230 Feet	280 Feet
Southbound	>500 Feet	250 Feet	230 Feet	280 Feet

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet.
[2] Regulatory speed limit: 35 mph
[3]Average Speed: 33 mph NB & SB.
[4]85th Percentile travel speed: 38 mph NB & SB.
[5]Based on 15 mile per hour travel speed for vehicles turning from 4-way STOP at Surfside Road/Fairgrounds Road.

As summarized in **Table 3,** analysis results indicate that the existing available sight lines exceed AASHTO's recommended SSD criteria along South Shore Road for the posted and observed travel speeds. Stopping sight distance calculations are provided in the **Attachments**.

Intersection Sight Distance

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO's Intersection Sight Distance (ISD) considerations, "*…If the available sight distance for an entering …vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions…To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road*." AASHTO's ISD criteria are defined into several "cases". In this case, the site driveway approach is under "STOP" control. The ISD in question relates to the ability to turn either right or left onto South Shore Road.

Available ISD was estimated in the field using AASHTO standards for driver's eye (3.5 feet), object height (3.5 feet) and decision point (8 to 14.5 feet from the edge of the travel lane) for the northbound and southbound travel directions on South Shore Road. **Table 4** presents a summary of the available ISD for the departures from the site driveway and AASHTO's recommended ISD assuming continued maintenance of vegetation within the sight line triangles.

TABLE 4
INTERSECTION SIGHT DISTANCE SUMMARY
SITE DRIVEWAY DEPARTURES TO SOUTH SHORE ROAD

Approach/ Travel Direction	Available ISD	AASHTO Minimum[1] 85th Percentile Travel Speed[4]	AASHTO Ideal[1] Regulatory Speed Limit[2]
Northern Site Driveway			
Looking North	280± Feet	--	145 Feet[5]
Looking South	>500 Feet	280 Feet	230 Feet
Central Site Driveway			
Looking North	450± Feet	280 Feet	335 Feet
Looking South	>500 Feet	280 Feet	390 Feet
Southern Site Driveway			
Looking North	>500 Feet	280 Feet	335 Feet
Looking South	>500 Feet	280 Feet	390 Feet

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet. Minimum value as noted represents SSD per AASHTO guidance.
[2] Regulatory speed limit: 35 mph
[3]Average Speed: 33 mph NB & SB.
[4]85th Percentile travel speed: 38 mph NB & SB.
[5]Based on 15 mile per hour travel speed for vehicles turning from 4-way STOP at Surfside Road/Fairgrounds Road.

The results of the ISD analysis presented in **Table 4** indicate that with clearing and grading associated with the construction of the proposed site driveways, the available sight lines looking north and south from the site driveways onto South Shore Road exceed the sight line requirements from AASHTO for the regulatory and 85th percentile travel speeds. MDM recommends that any new plantings (shrubs, bushes) or physical landscape features to be located within the sight lines should also be maintained at a height of 2 feet or less above the adjacent roadway grade to ensure unobstructed lines of sight.

PROJECTED FUTURE TRAFFIC CONDITIONS

Evaluation of the proposed development impacts requires the establishment of a future baseline analysis condition. This section estimates future roadway and traffic conditions with and without the proposed development. For planning purposes, a five-year planning horizon (year 2023) was selected consistent with standard industry practice.

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to a future year condition. Traffic volumes on the roadway network at that time, in the absence of the development (that is, the No-Build condition), includes existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others that are currently under review at the local and/or state level. Consideration of these factors resulted in the development of No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic-flow networks to develop future Build conditions.

The following sections provide an overview of the future No-Build and Build traffic volumes.

Background Growth

Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

Consistent with recent traffic studies on the island, a 1.0-percent compounded annual growth rate was used (5.1 percent increase over a 5-year horizon). This growth rate is higher than historic rates and is also expected to account for any small fluctuation in hourly traffic as may occur from time to time in the study area and traffic associated with other potential small developments or vacancies in the area. MassDOT permanent count station data and background growth calculations are provided in the **Attachments**.

Development of future No-Build traffic volumes also considers traffic generated through the study area from other specific area developments. Review of Massachusetts Environmental Policy Act (MEPA) files indicates that there are no Site-specific development projects in the area that may increase baseline traffic at the study intersections.

2023 No-Build Traffic Volume Networks

In summary, to account for future traffic growth in the study area future No-Build traffic volumes are developed by increasing the baseline (2018) volumes by approximately 5.1 percent (1.0 percent compounded annually over 5 years). The resulting 2023 No-Build traffic volumes are displayed in **Figure 4**.

Trip Generation

The trip generation estimates for the proposed development of the Site are provided for the weekday morning and weekday evening periods, which correspond to the critical analysis periods for the proposed use and adjacent street traffic flow. New traffic generated by the project was estimated using trip rates published in ITE's *Trip Generation*[2] for the Land Use Code (LUC) 210 – Single-Family Detached Housing and LUC 220 – Multifamily Housing (Low-Rise).

Table 5 presents the trip-generation estimates for the proposed development based on ITE methodology for the 60 single family units and 96 condominium units.

TABLE 5
TRIP-GENERATION SUMMARY

Period/Direction	Single Family[1]	Condominiums[2]	Total
Weekday Morning Peak Hour:			
Entering	11	10	21
Exiting	33	34	67
Total	44	44	88
Weekday Evening Peak Hour:			
Entering	37	34	71
Exiting	22	20	42
Total	59	54	113
Weekday Daily	570	702	1,272

[1]Based on ITE LUC 210 Single-Family Detached Housing trip rates applied to 60 units.
[2]Based on ITE LUC 220 Multifamily Housing (Low-Rise) trip rates applied to 96 units.

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

As summarized in **Table 5**, the proposed development is estimated to generate approximately 88 vehicle trips (21 entering and 67 exiting) during the weekday morning peak hour and 113 vehicle trips (71 entering and 42 exiting) during the weekday evening peak hour. On a daily basis the project is estimated to generate approximately 1,272 trips with half entering and half exiting over a 24 hour period. Trip generation calculations are provided in the **Attachments**. While the Site is likely to benefit by its close proximity to public transportation and opportunities for pedestrian/bicycle use, the analysis utilizes ITE-based trip generation without downward adjustment to present a conservative analysis.

Trip Distribution

Trip distribution patterns for the proposed residential development are based on existing travel patterns observed at the study intersection of Surfside Road at Fairgrounds Road/South Shore Road. For planning purposes it was assumed that all of the trips used the study intersection to present a conservative analysis. The trip distribution percentages and new development-related trips at the Surfside Road intersection with Fairgrounds Road/South Shore Road for the weekday morning and weekday evening peak hours are quantified in **Figure 5**. Trip distribution calculations are provided in the **Attachments.**

Development-related trips for the residential development were assigned to the roadway network using the trip-generation estimates shown in **Table 5** and the distribution patterns presented in **Figure 5**. New development-related trips at each intersection approach for the weekday morning and weekday evening peak hours are quantified in **Figure 6** and **Figure 7**, respectively. Trip distribution calculations are provided in the **Attachments.**

2023 Build Traffic Conditions

2023 Build condition traffic volumes are derived by adding the incremental traffic increases for the Site to the 2023 No-Build conditions. **Figure 8** and **Figure 9** present the 2023 Build condition traffic-volume networks for the weekday morning and weekday evening peak hours.

OPERATIONS ANALYSIS

This section provides an overview of operational analysis methodology, an assessment of driveway operations under Existing (Baseline) and projected future No-Build and Build conditions.

Analysis Methodology

Intersection capacity analyses are presented in this section for the Baseline, No-Build, and Build traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section.

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the 2010 Highway Capacity Manual (HCM). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements). The specific control delays and associated LOS designations are presented in the **Attachments**.

Analysis Results

Level-of-Service (LOS) analyses were conducted for the Baseline, No-Build, and Build conditions for the study intersections. The results of the intersection capacity are summarized below in **Table 6** and **Table 7**. Detailed analysis results are presented in the **Attachments**.

TABLE 6
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY MORNING PEAK HOUR (PEAK SEASON)

		2018 Baseline			2023 No-Build			2023 Build		
Period	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Surfside Road at	Eastbound	0.64	18	C	0.71	23	C	0.78	29	D
Fairgrounds Road/South	Westbound	0.32	13	B	0.35	14	B	0.38	15	C
Shore Road	Northbound	0.27	12	B	0.30	13	B	0.45	16	C
	Southbound	0.54	15	C	0.59	17	C	0.65	21	C
South Shore Road at North	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.05	11	B
Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
South Shore Road at	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.04	10	B
Middle Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
South Shore Road at South	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.01	10	A
Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service
[4]n/a = not applicable

TABLE 7
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY EVENING PEAK HOUR (PEAK SEASON)

		2018 Baseline			2023 No-Build			2023 Build		
Period	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Surfside Road at	Eastbound	0.55	15	C	0.59	17	C	0.69	22	C
Fairgrounds Road/South	Westbound	0.27	11	B	0.29	12	B	0.32	13	B
Shore Road	Northbound	0.19	11	B	0.20	11	B	0.31	13	B
	Southbound	0.57	15	C	0.61	17	C	0.72	23	C
South Shore Road at North	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.03	11	B
Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
South Shore Road at	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.03	10	B
Middle Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
South Shore Road at South	Eastbound	n/a	n/a	n/a	n/a	n/a	n/a	0.01	10	B
Site Driveway	Northbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A
	Southbound	n/a	n/a	n/a	n/a	n/a	n/a	0.00	<5	A

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service
[4]n/a = not applicable

As summarized in **Table 6 and Table 7**:

- *Surfside Road at Fairgrounds Road/South Shore Road.* Under future Build conditions, capacity analyses indicate that the Surfside Road intersection with Fairgrounds Road and South Shore Road will operate with moderate delays at level of service (LOS) D or better during the peak season. The incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the intersection compared to No-Build conditions.

- *South Shore Road at Site Driveways.* Under future Build conditions, capacity analyses indicate that the unsignalized Site Driveway approaches to South Shore Road will operate at LOS B or better during the weekday morning and weekday evening peak hours.

Queue Results

The results of the approach queue lengths from the capacity analysis are summarized below in **Table 8**. Detailed analysis results are presented in the **Attachments**.

TABLE 8
VEHICLE QUEUE ANALYSIS SUMMARY
SURFSIDE ROAD AT FAIRGROUNDS ROAD/SOUTH SHORE ROAD

Approach	Available Queue Storage Length (feet)	2018 Baseline Maximum Queue Length[1]	2023 No-Build Maximum Queue Length[1]	2023 Build Maximum Queue Length[1]	Difference (Δ) No-Build to Build
Weekday Morning Peak Hour					
Eastbound L/T/R	>1000	4	6	7	+1
Westbound L/T/R	>1000	1	2	2	+0
Northbound L/T/R	>1000	1	1	3	+2
Southbound L/T/R	>1000	3	4	6	+2
Weekday Evening Peak Hour					
Eastbound L/T/R	>1000	3	4	5	+1
Westbound L/T/R	>1000	1	1	1	+0
Northbound L/T/R	>1000	1	1	1	+0
Southbound L/T/R	>1000	4	4	6	+2

[1]Average and 95th percentile queue lengths are reported vehicles per lane.

As presented in **Table 8,** the 95th percentile vehicle queues at the study intersections will generally be contained within available storage lanes during peak hours. During peak hours under peak summer conditions the eastbound Surfside Road approach and southbound Fairgrounds Road approach will have No-Build queues that are manageable which extend between one and two hundred feet from the intersection. The project will not significantly change queue lengths compared to No-Build conditions and will generally result in an increase of 2 vehicles or less on all approaches.

SITE ACCESS/CIRCULATION

AutoTURN analysis has been completed for the preliminary site plan using the Town's Ladder truck and a single unit (SU) delivery truck. Site access, circulation aisles and parking layout provide adequate maneuvering area for the largest potential responding vehicle (ladder truck). Supporting AutoTurn® truck turn analysis and exhibits are provided to confirm this finding (refer to the **Attachments**).

RECOMMENDATIONS AND CONCLUSIONS

Trip generation for the development is projected to be moderate with approximately 88 vehicle trips during the weekday morning peak hour and 113 vehicle trips during the weekday evening peak hour. The project will result in 1 to 2 additional trips per minute during the peak commute hours. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. The study intersections exhibit below-average crash rates based on historic crash data; safety countermeasures are therefore not warranted. Likewise, the available sight lines at the Site Driveway intersection with South Shore Road exceed the recommended sight line requirements from AASHTO.

MDM recommends the following access/egress elements to enhance safety and capacity:

- *Signage and Markings.* A STOP sign (R1-1) and STOP line pavement markings are recommended on the site driveway approaches to South Shore Road. The sign and pavement markings shall be compliant with the Manual on Uniform Traffic Control Devices (MUTCD).

- *Pedestrian Accommodation.* The Proponent proposes a sidewalk along the site driveways as part of the development which will provide a connection between the various units and South Shore Road. Additionally, sidewalk extends along the frontage of South Shore Road between the driveways and marked crosswalks provide access to the existing multi-use path.

- *Bicycle Accommodations.* The development should incorporate bicycle storage racks near the multi-family buildings with specific locations to be identified in the final approved Site Plans. Provide bicycle parking, including weather protected racks for residents within or proximate to the multi-family building entrances.

- *Driveway Design.* The final curb radii between the site driveways and South Shore Road should be designed to accommodate the Towns largest fire apparatus (ladder truck) and singe unit delivery vehicles.

- *Sight Line Maintenance.* The sight lines should be cleared and graded with the construction of the proposed primary site driveway approaches to South Shore Road. Any new plantings (shrubs, bushes) or physical landscape features to be located within the project driveway sight lines should also be maintained at a height of 2 feet or less above the adjacent roadway grade to ensure unobstructed lines of sight.

- *Transportation Demand Management (TDM).* TDM actions should be considered that may be appropriate to encourage alternative travel modes for residents and visitors. These include on-site amenities, bicycle storage racks, pedestrian connections, and other methods of reducing automobile use.

In summary, trip generation for the development is projected to be modest. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. The study intersections exhibit below-average crash rates based on historic crash data; safety countermeasures are therefore not warranted. Likewise, the available sight lines at the Site Driveway intersections with South Shore Road exceed the recommended sight line requirements from AASHTO. Implementation of access/egress improvements, proposed pedestrian, and bicycle improvements along with a Transportation Demand Management (TDM) program will establish a framework of minimizing Site traffic impacts by encouraging non-motorized travel modes and pedestrian/bicycle accommodation that is compatible with other projects in the area.