DAVENPORT

June 25, 2020

TECHNICAL MEMORANDUM

Demarest Pointe

New Hanover County, NC

Prepared for Middlesound, LLC

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Project #: 200221

Technical Memorandum

Demarest Pointe
New Hanover County, NC

Prepared for Middlesound, LLC
June 25, 2020

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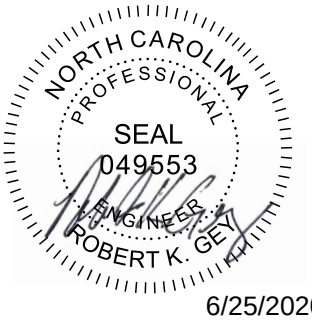
SEAL



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Intersection Capacity Analysis for Demarest Pointe
Technical Memorandum
DAVENPORT Project Number 200221
Prepared for Middlesound, LLC
June 25, 2020

Introduction

DAVENPORT was retained to determine the potential traffic impacts of the Demarest Pointe project at the roundabout of Middle Sound Loop Road and Darden Road and to identify transportation improvements that may be required to accommodate the impacts of both background traffic and new development traffic.

The proposed project is to be located north-east of the existing Ogden Elementary School in New Hanover County, NC. The project proposes 24 dwelling units of townhomes. Two (2) new restricted site access points are proposed. A right-in only site access is proposed to be located approximately 540 feet east of the existing roundabout at Middle Sound Loop Road and Darden Road. A right-out only site access is proposed to be located approximately 418 feet south of the roundabout.

Executive Summary and Conclusion

DAVENPORT was retained to determine the potential traffic impacts of this project and to identify transportation improvements that may be required to accommodate the impacts of both background traffic and new development traffic.

Based on the trip generation rates and equations published in Trip Generation (Institute of Transportation Engineers, 10th Edition), this development has a trip generation potential of 141 daily trips, 12 trips (3 entering 9 exiting) in the AM peak hour and 17 trips (11 entering 6 exiting) in the PM peak hour.

Demarest Pointe									
Average Weekday Driveway Volumes					24 Hour Two-Way	AM Peak Hour		PM Peak Hour	
Land Use	ITE Land Code	Size		Method/Type	Volume	Enter	Exit	Enter	Exit
Townhomes	220	24	Dwelling Units	Adjacent/ Equation	141	3	9	11	6
Total Trips					**141**	**3**	**9**	**11**	**6**

Roundabout Capacity Analysis

Overall, the study intersection currently operates at level of service (LOS) D in the AM peak hour and B during the PM peak hour, as shown in Table 2. In 2022 future no build conditions (without the project site trips) LOS E is expected in the AM peak hour and LOS B in the PM peak hour. In 2022 future build conditions (which includes the proposed

project site trips) the LOS is expected to remain unchanged. Overall, a slight increase (1.9 seconds per vehicle AM and 0.3 seconds per vehicle PM) in delay is expected at the roundabout. DAVENPORT is in agreement with NCDOT study, dated February 1, 2018 and conclusions regarding the Demarest Pointe development.

Table 2 - Middle Sound Loop Road at Darden Road (ROUNDABOUT)

Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
AM Peak Hour													
2020 Base	D (31.6)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.3)	A (9.3)	A (9.3)	F (66.2)	F (66.2)	F (66.2)	C (22.8)	C (22.8)	C (22.8)	D (28.7)	D (28.7)	D (28.7)
		A (9.3)			F (66.2)			C (22.8)			D (28.7)		
2022 Future No Build	E (40.5)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (91.0)	F (91.0)	F (91.0)	D (27.9)	D (27.9)	D (27.9)	D (31.6)	D (31.6)	D (31.6)
		A (9.9)			F (91.0)			D (27.9)			D (31.6)		
2022 Future Build	E (42.4)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (96.0)	F (96.0)	F (96.0)	D (29.9)	D (29.9)	D (29.9)	D (32.2)	D (32.2)	D (32.2)
		A (9.9)			F (96.0)			D (29.9)			D (32.2)		
PM Peak Hour													
2020 Base	B (11.1)	L	T	R	L	T	R	L	T	R	L	T	R
		B (14.0)	B (14.0)	B (14.0)	A (7.7)	A (7.7)	A (7.7)	A (9.2)	A (9.2)	A (9.2)	A (7.4)	A (7.4)	A (7.4)
		B (14.0)			A (7.7)			A (9.2)			A (7.4)		
2022 Future No Build	B (12.2)	L	T	R	L	T	R	L	T	R	L	T	R
		C (15.5)	C (15.5)	C (15.5)	A (8.2)	A (8.2)	A (8.2)	A (9.9)	A (9.9)	A (9.9)	A (7.8)	A (7.8)	A (7.8)
		C (15.5)			A (8.2)			A (9.9)			A (7.8)		
2022 Future Build	B (12.5)	L	T	R	L	T	R	L	T	R	L	T	R
		C (16.0)	C (16.0)	C (16.0)	A (8.2)	A (8.2)	A (8.2)	B (10.2)	B (10.2)	B (10.2)	A (7.9)	A (7.9)	B (11.8)
		C (16.0)			A (8.2)			B (10.2)			A (7.9)		

Safety

The right-in and right-out driveways paired with the roundabout, provides excellent access management which significantly improves safety when compared to traditional full movement access. Studies have shown that left turns account for 72% of driveway crashes for driveways located near intersections. Left turn movements are typically associated with angle crashes which can often result in injuries. Right turns are more often associated with rear end or sideswipe crashes typically resulting in property damage only.

Conclusion

In conclusion, this study has reviewed the impacts of both background traffic and proposed development traffic. There is negligible impact from traffic generated by this development and no traffic mitigation measures are recommended.

Methodology

Figure 1 in the Supporting Documents illustrates the site plan. The vicinity map and the existing lane geometry are illustrated in Figure 2 and Figure 3 respectively. Traffic counts collected on December 12, 2017 were used to determine the 2020 base volumes at this study intersection. A 2% annual growth rate, given from a NCDOT previous study, dated February 1, 2018, was applied to the 2017 traffic to obtain the 2020 base volumes. The 2017 count and method were used to reflect the traffic conditions prior to COVID-19 pandemic.

The 2020 base volumes were projected out to a future analysis year of 2022 by applying a 2% annual traffic growth rate. 2020 base volumes and 2022 future no build volumes are shown for AM and PM peaks in Figures 4 and 5, respectively.

The trip generation potential for this site was projected based on the 10th edition of ITE Trip Generation Manual. Table 1 presents the results. Site trips for this project were distributed based on the existing traffic patterns and engineering judgment. The trip distribution model is shown in Figure 6. The 2022 build-out traffic volumes were obtained by summing the 2022 future no build volumes and site trips generated by the proposed project. Site trips are shown in Figure 7. The 2022 future build volumes are shown for AM and PM peaks in Figure 8.

Table 1 - ITE Trip Generation

Demarest Pointe									
Average Weekday Driveway Volumes					24 Hour Two-Way	AM Peak Hour		PM Peak Hour	
Land Use	ITE Land Code	Size		Method/Type	Volume	Enter	Exit	Enter	Exit
Townhomes	220	24	Dwelling Units	Adjacent/ Equation	141	3	9	11	6
Total Trips					**141**	**3**	**9**	**11**	**6**

SIDRA 8.0 was used to determine the level of service of the study intersection. Queue lengths were also reviewed based on SIDRA 8.0 results. Based on NCDOT standards, roundabout environmental factor would be adjusted to 1.2 to reflect U.S. drivers' inexperience with roundabout driving. In this specific location, this roundabout has been in place for 10 years. Therefore, based on engineering judgement, the environmental factor was adjusted to 1.0 to reflect the familiarity of the roundabout. In general, the analysis for this project was conducted utilizing commonly accepted NCDOT standards.

The following intersection was included in the study:

1. Middle Sound Loop Road at Darden Road (ROUNDABOUT)

The intersections were analyzed during the AM (7-9 am) and PM (4-6 pm) peaks for the following conditions:

- 2020 Base Conditions
- 2022 Future No-Build Conditions
- 2022 Build Conditions

Capacity Analysis

Overall, the study intersection currently operates at level of service (LOS) D and B during the AM and PM peak hours respectively, as shown in Table 2 on the next page. In 2022 future no build conditions (without the project site trips) LOS E is expected in the AM peak and LOS B in the PM peak. In 2022 future build conditions (which includes the proposed project site trips) the LOS is expected to remain unchanged. Overall, a slight increase (2 seconds per vehicle AM and 0.3 seconds per vehicle PM) in delay is expected at the intersection.

Table 2 - Middle Sound Loop Road at Darden Road (ROUNDABOUT)

Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
AM Peak Hour													
2020 Base	D (31.6)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.3)	A (9.3)	A (9.3)	F (66.2)	F (66.2)	F (66.2)	C (22.8)	C (22.8)	C (22.8)	D (28.7)	D (28.7)	D (28.7)
		A (9.3)			F (66.2)			C (22.8)			D (28.7)		
2022 Future No Build	E (40.5)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (91.0)	F (91.0)	F (91.0)	D (27.9)	D (27.9)	D (27.9)	D (31.6)	D (31.6)	D (31.6)
		A (9.9)			F (91.0)			D (27.9)			D (31.6)		
2022 Future Build	E (42.4)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (96.0)	F (96.0)	F (96.0)	D (29.9)	D (29.9)	D (29.9)	D (32.2)	D (32.2)	D (32.2)
		A (9.9)			F (96.0)			D (29.9)			D (32.2)		
PM Peak Hour													
2020 Base	B (11.1)	L	T	R	L	T	R	L	T	R	L	T	R
		B (14.0)	B (14.0)	B (14.0)	A (7.7)	A (7.7)	A (7.7)	A (9.2)	A (9.2)	A (9.2)	A (7.4)	A (7.4)	A (7.4)
		B (14.0)			A (7.7)			A (9.2)			A (7.4)		
2022 Future No Build	B (12.2)	L	T	R	L	T	R	L	T	R	L	T	R
		C (15.5)	C (15.5)	C (15.5)	A (8.2)	A (8.2)	A (8.2)	A (9.9)	A (9.9)	A (9.9)	A (7.8)	A (7.8)	A (7.8)
		C (15.5)			A (8.2)			A (9.9)			A (7.8)		
2022 Future Build	B (12.5)	L	T	R	L	T	R	L	T	R	L	T	R
		C (16.0)	C (16.0)	C (16.0)	A (8.2)	A (8.2)	A (8.2)	B (10.2)	B (10.2)	B (10.2)	A (7.9)	A (7.9)	B (11.8)
		C (16.0)			A (8.2)			B (10.2)			A (7.9)		

Queue Length Analysis

A summary of the queue length analysis is shown in Table 3 and graphically in Figure 9. Based on the analysis, the northbound queue at the roundabout will extend past the proposed right-out only access. This queue length is expected to be short-lived as majority of the traffic during the morning peak is school traffic. Based on the NCDOT turn lane warrant charts, no turn lanes are warranted. Therefore, it is recommended to design the site access according to NCDOT standards. Figure 10 shows the recommended improvements.

Table 3 - Queue Results AM Peak Hour Queues				
Scenario	**Middle Sound Loop Road at Darden Road (ROUNDABOUT)**			
2020 Base	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	108.5	637.5	307.2	114.1
Storage Bay (ft)	FULL	FULL	FULL	FULL
2022 Future No Build	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	118.3	881.8	380.1	127.6
Storage Bay (ft)	FULL	FULL	FULL	FULL
2022 Future Build	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	119.4	921.4	412.8	129.0
Storage Bay (ft)	FULL	FULL	FULL	FULL
PM Peak Hour Queues				
Scenario	**Middle Sound Loop Road at Darden Road (ROUNDABOUT)**			
2020 Base	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	194.7	45.3	45.2	29.4
Storage Bay (ft)	FULL	FULL	FULL	FULL
2022 Future No Build	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	219.0	48.9	52.1	31.8
Storage Bay (ft)	FULL	FULL	FULL	FULL
2022 Future Build	**EBLTR**	**WBLTR**	**NBLTR**	**SBLTR**
95th Percentile Queue (ft)	254.1	49.2	55.7	32.0
Storage Bay (ft)	FULL	FULL	FULL	FULL

Alternative Analysis

An alternative trip generation was reviewed for the Demarest Pointe project. A 27 dwelling unit townhome trip generation was analyzed and compared to the original 24 units of townhomes. Table 4 presents the trip generation results.

Overall, compared to the original 24 units of townhome, the alternatives level of service has a slight increase delay. Table 5 presents the future build LOS comparison for both alternatives.

Table 4 - ITE Trip Generation

Demarest Pointe (27 Townhomes)

Average Weekday Driveway Volumes					24 Hour Two-Way	AM Peak Hour		PM Peak Hour	
Land Use	ITE Land Code	Size		Method/Type	Volume	Enter	Exit	Enter	Exit
Townhomes	220	27	Dwelling Units	Adjacent/ Equation	163	3	11	11	7
Total Trips					**163**	**3**	**11**	**11**	**7**

Table 5 - Middle Sound Loop Road at Darden Road (ROUNDABOUT)

Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)											
		Eastbound			Westbound			Northbound			Southbound		
AM Peak Hour													
24 Townhomes	E (42.4)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (96.0)	F (96.0)	F (96.0)	D (29.9)	D (29.9)	D (29.9)	D (32.2)	D (32.2)	D (32.2)
		A (9.9)			F (96.0)			D (29.9)			D (32.2)		
27 Townhomes	E (42.8)	L	T	R	L	T	R	L	T	R	L	T	R
		A (9.9)	A (9.9)	A (9.9)	F (97.1)	F (97.1)	F (97.1)	D (30.3)	D (30.3)	D (30.3)	D (32.3)	D (32.3)	D (32.3)
		A (9.9)			F (97.1)			D (30.3)			D (32.3)		
PM Peak Hour													
24 Townhomes	B (12.5)	L	T	R	L	T	R	L	T	R	L	T	R
		C (16.0)	C (16.0)	C (16.0)	A (8.2)	A (8.2)	A (8.2)	B (10.2)	B (10.2)	B (10.2)	A (7.9)	A (7.9)	B (11.8)
		C (16.0)			A (8.2)			B (10.2)			A (7.9)		
27 Townhomes	B (12.5)	L	T	R	L	T	R	L	T	R	L	T	R
		C (16.0)	C (16.0)	C (16.0)	A (8.3)	A (8.3)	A (8.3)	B (10.3)	B (10.3)	B (10.3)	A (7.9)	A (7.9)	B (11.8)
		C (16.0)			A (8.3)			B (10.3)			A (7.9)		

Summary and Conclusion

DAVENPORT was retained to determine the potential traffic impacts of this project and to identify transportation improvements that may be required to accommodate the impacts of both background traffic and new development traffic.

Based on the trip generation rates and equations published in Trip Generation (Institute of Transportation Engineers, 10th Edition), this development has a trip generation potential of 141 daily trips, 12 trips (3 entering 9 exiting) in the AM peak hour and 17 trips (11 entering 6 exiting) in the PM peak hour.

Roundabout Capacity Analysis

Overall, the study intersection currently operates at level of service (LOS) D in the AM peak hour and B during the PM peak hour, as shown in Table 2. In the 2022 future no build conditions (without the project site trips) LOS E is expected in the AM peak hour and LOS B in the PM peak hour. In the 2022 future build conditions (which includes the proposed project site trips) the LOS is expected to remain unchanged. Overall, a slight increase (1.9 seconds per vehicle AM and 0.3 seconds per vehicle PM) in delay is expected at the intersection. DAVENPORT is in agreement with NCDOT study, dated February 1, 2018 and conclusions regarding Demarest Pointe development.

The roundabout capacity analysis was also performed for a 27 townhome alternative. Considering the minimal additional traffic volumes generated by the 27 townhome alternative compared to the 24 townhome alternative, the AM peak hour delay would increase by 0.4 seconds per vehicle compared to the 24 townhome alternative. There would be no change in delay per vehicle for the PM peak hour.

Safety

The right-in and right-out driveways paired with the roundabout, provides excellent access management which significantly improves safety when compared to traditional full movement access. Studies have shown that left turns account for 72% of driveway crashes for driveways located near intersections. Left turn movements are typically associated with angle crashes which can often result in injuries. Right turns are more often associated with rear end or sideswipe crashes typically resulting in property damage only.

Conclusion

In conclusion, this study has reviewed the impacts of both background traffic and proposed development traffic. There is negligible impact from traffic generated by this development and no traffic mitigation measures are recommended.

Attached Supporting Documents:

1. Figure 1: Site Plan 2. Figure 2: Vicinity Map 3. Figure 3: Existing Lane Geometry 4. Figure 4: 2020 Base Volumes 5. Figure 5: 2022 Future No Build Vol. 6. Figure 6: Trip Distribution	7. Site Trips 8. Figure 8: 2022 Future Build Volumes 9. Figure 9: Roundabout Queue 10. Figure 10: Recommended Imp. 11. Appendix

Supporting Documents

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FIGURE 1
SITE PLAN

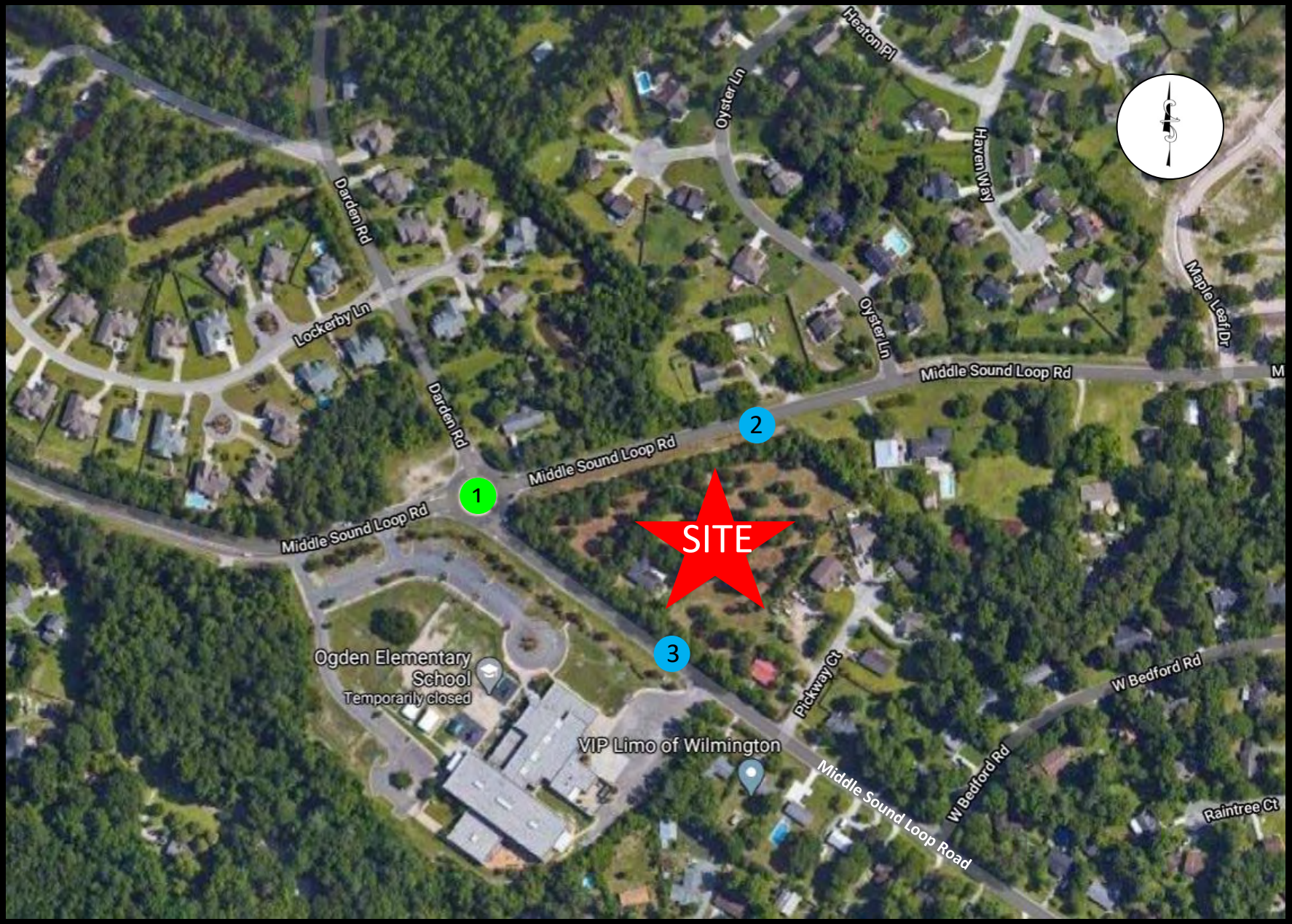

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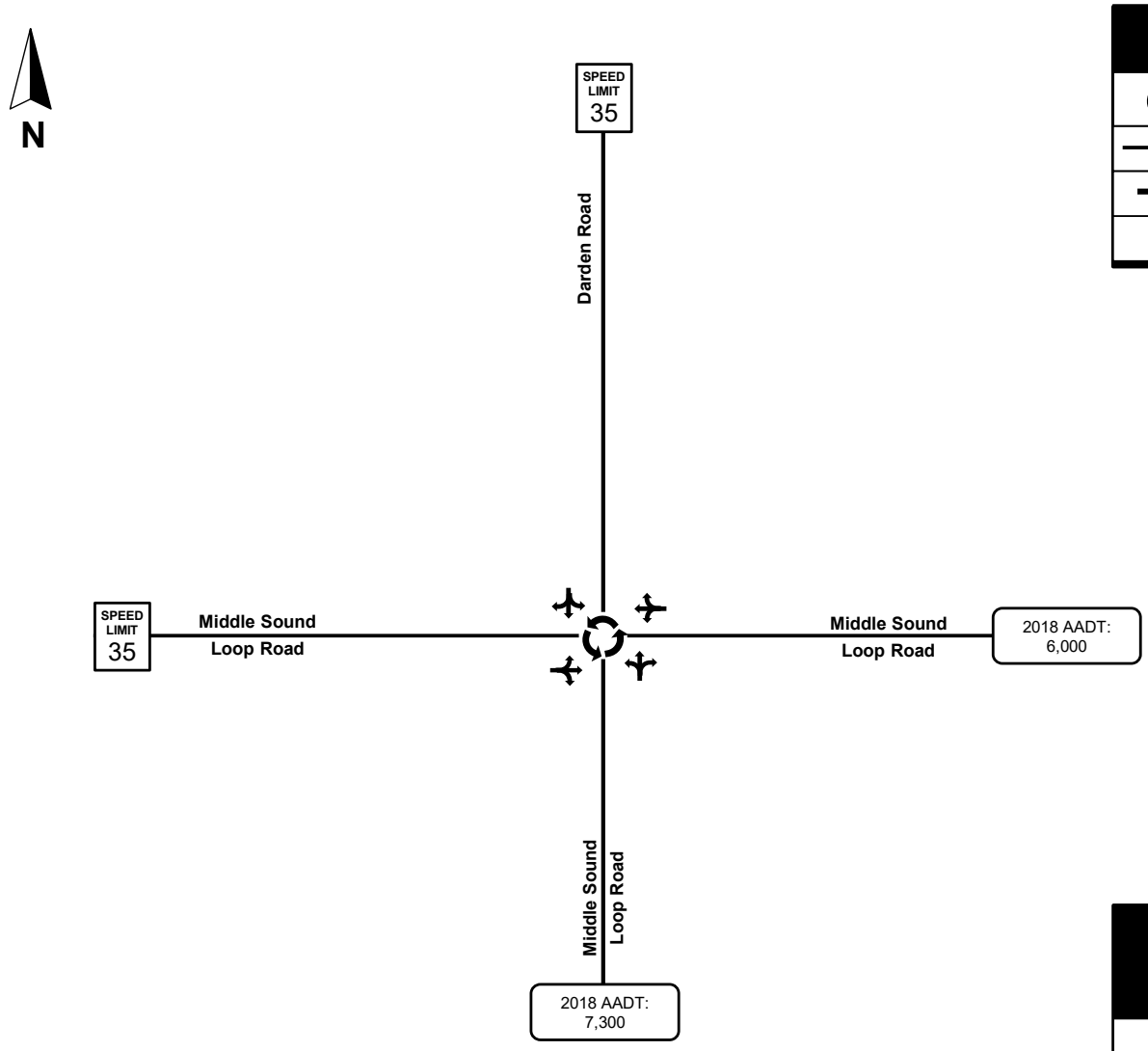
FIGURE 2
VICINITY MAP

INTERSECTIONS
STUDIED
PROPOSED



LEGEND

- ROUNDABOUT
- ROADWAY
- TRAFFIC MOVEMENT
- BLACK = EXISTING

*** NOT TO SCALE ***

FIGURE 3
EXISTING LANE GEOMETRY

DEMAREST POINTE
NEW HANOVER COUNTY, NC

PROJECT NUMBER 200221

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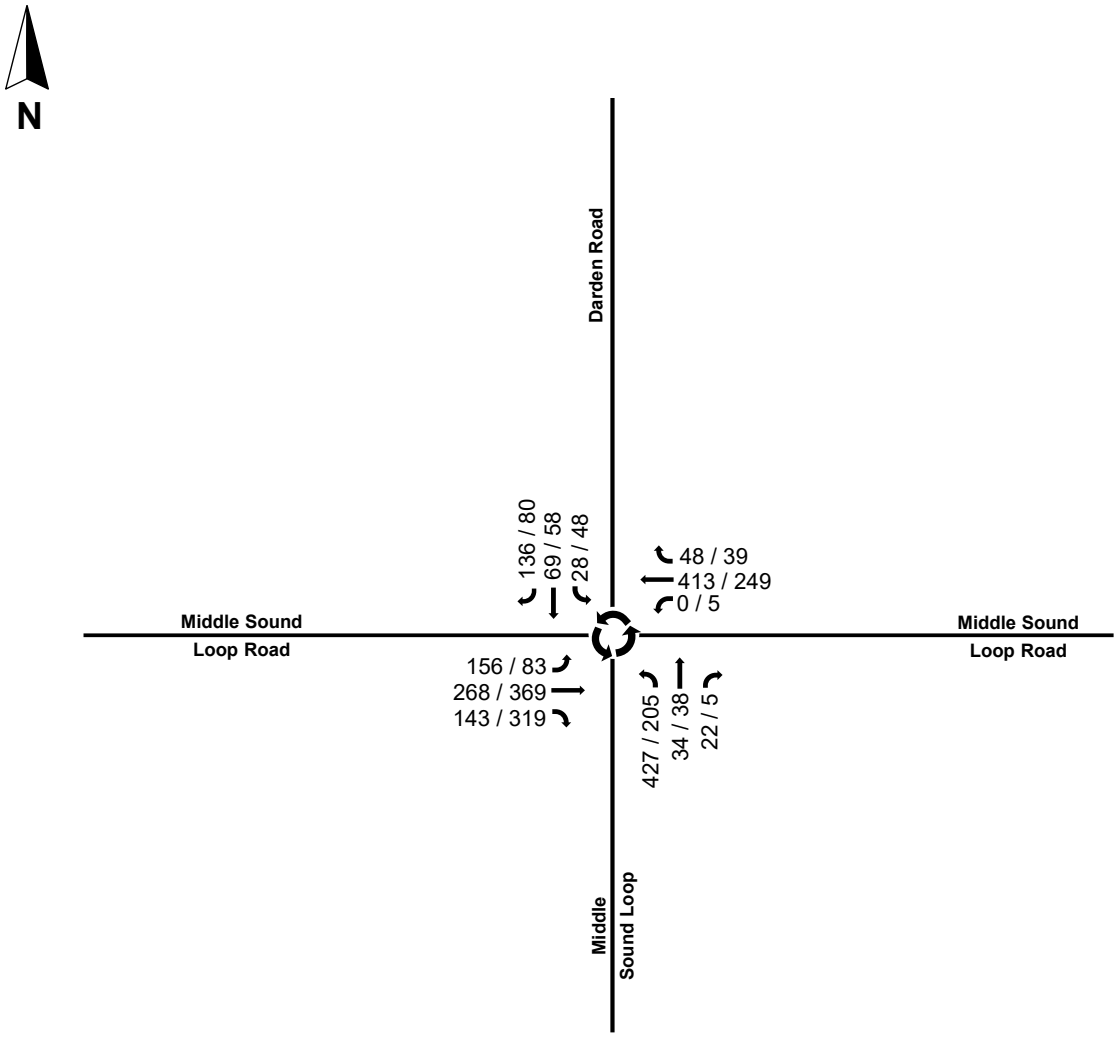

LEGEND

- ROUNDABOUT
- ROADWAY
- TRAFFIC MOVEMENT
- BLACK = EXISTING
- AM / PM PEAKS

FIGURE 4
2020 BASE TRAFFIC VOLUMES

DEMAREST POINTE
NEW HANOVER COUNTY, NC

PROJECT NUMBER 200221

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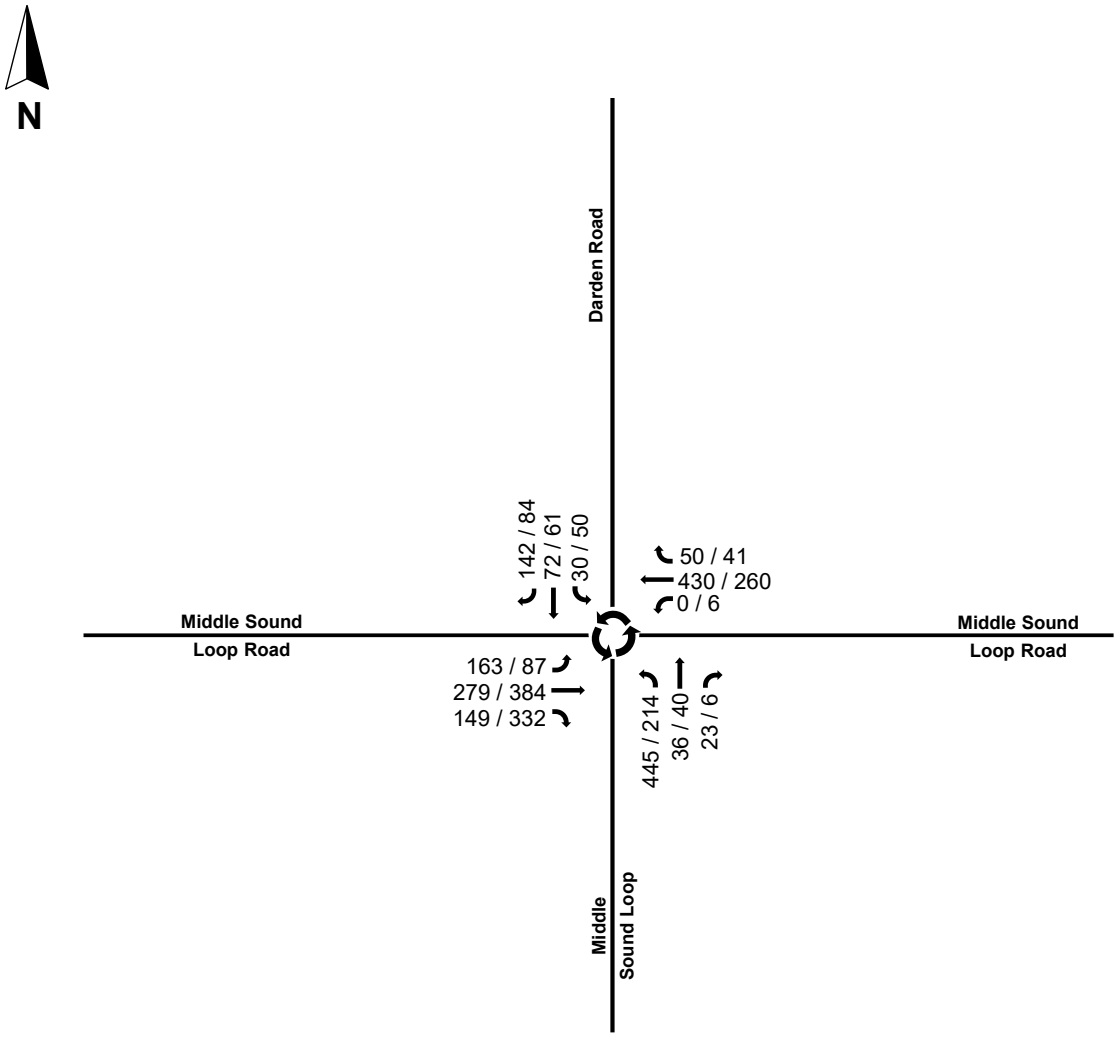
*** NOT TO SCALE ***



LEGEND

- ROUNDABOUT
- ROADWAY
- TRAFFIC MOVEMENT
- BLACK = EXISTING
- AM / PM PEAKS

FIGURE 5
2022 FUTURE NO BUILD VOLUMES

DEMAREST POINTE
NEW HANOVER COUNTY, NC

PROJECT NUMBER 200221

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*** NOT TO SCALE ***

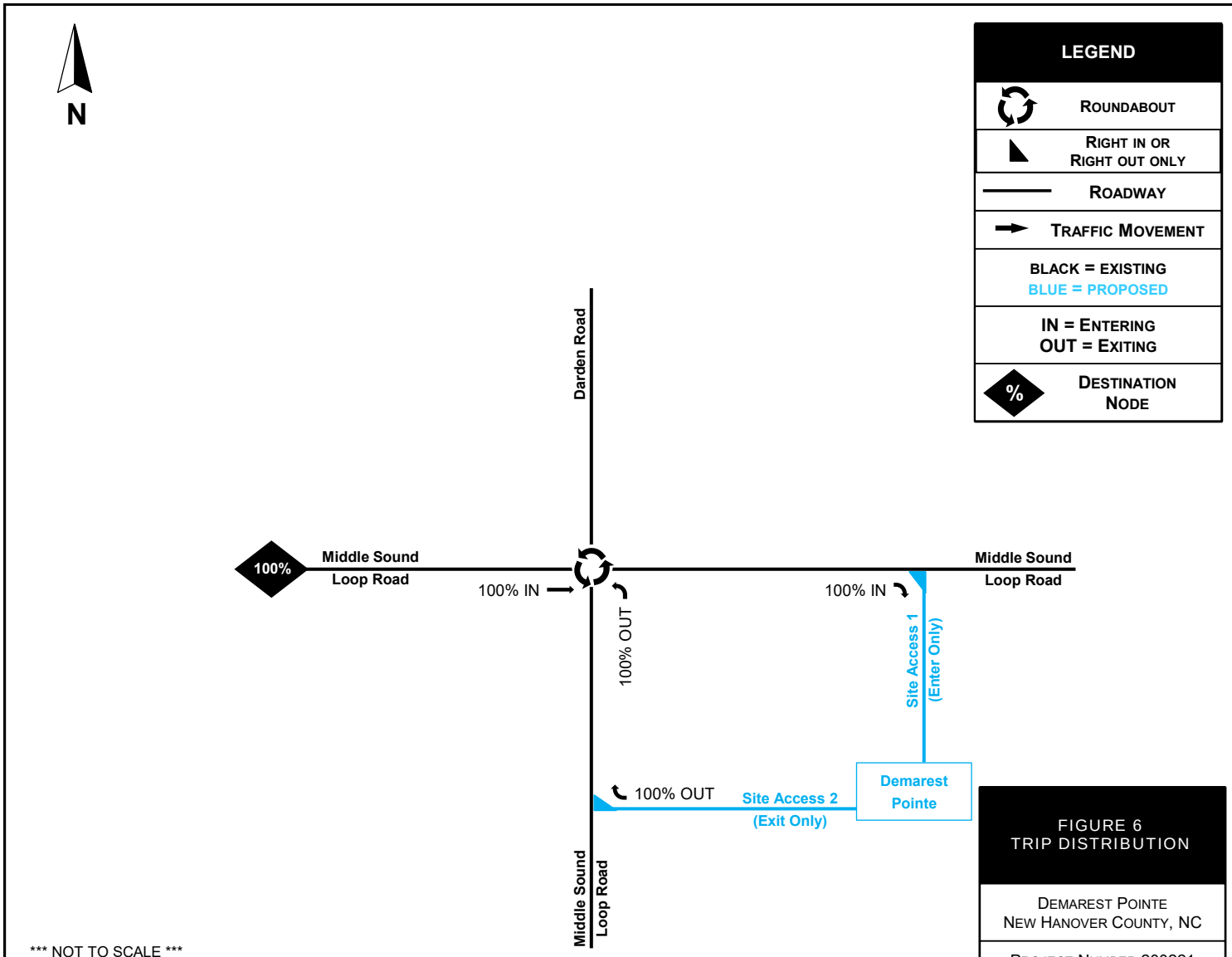

FIGURE 6
TRIP DISTRIBUTION

DEMAREST POINTE
NEW HANOVER COUNTY, NC

PROJECT NUMBER 200221

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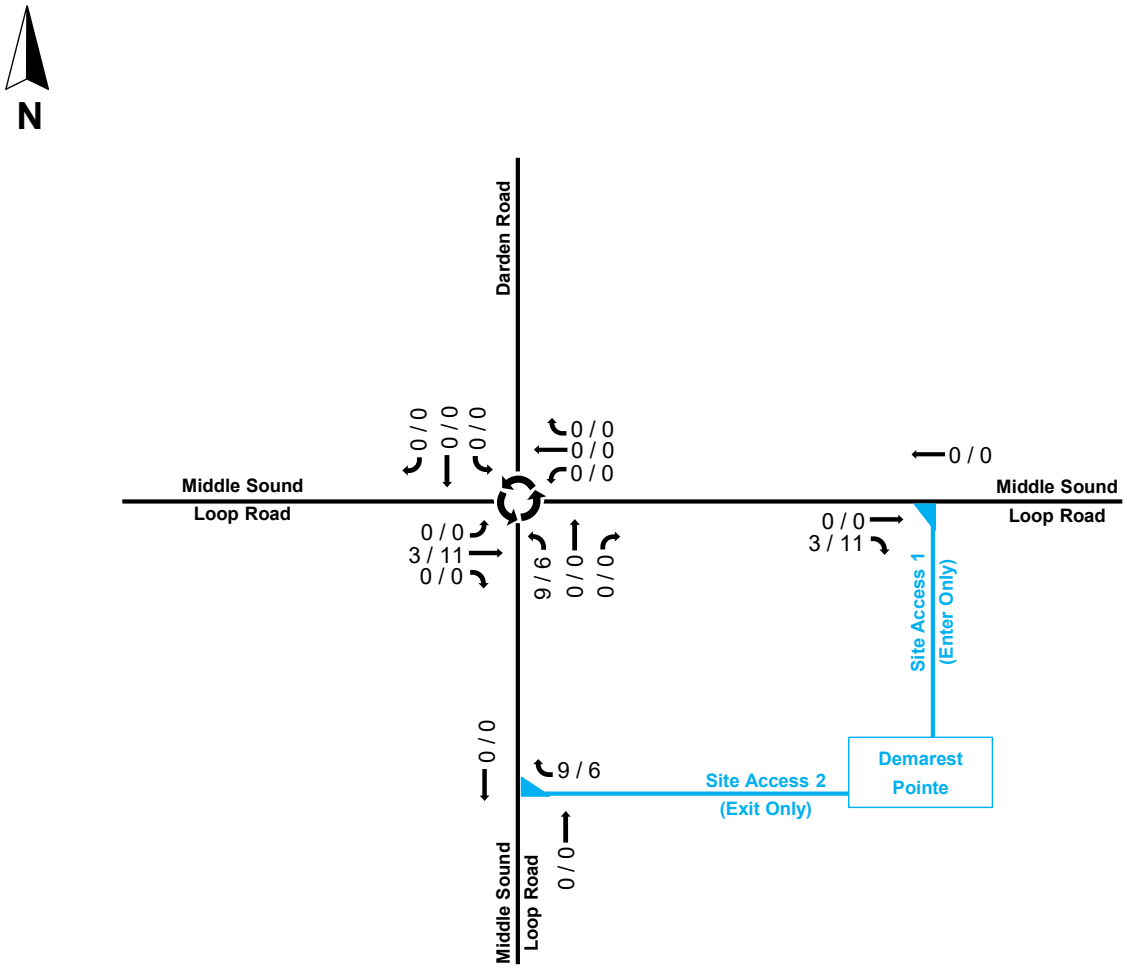

LEGEND

- ROUNDABOUT
- RIGHT IN OR RIGHT OUT ONLY
- ROADWAY
- TRAFFIC MOVEMENT
- BLACK = EXISTING
  BLUE = PROPOSED
- AM / PM PEAKS

FIGURE 7
SITE TRIPS

DEMAREST POINTE
NEW HANOVER COUNTY, NC

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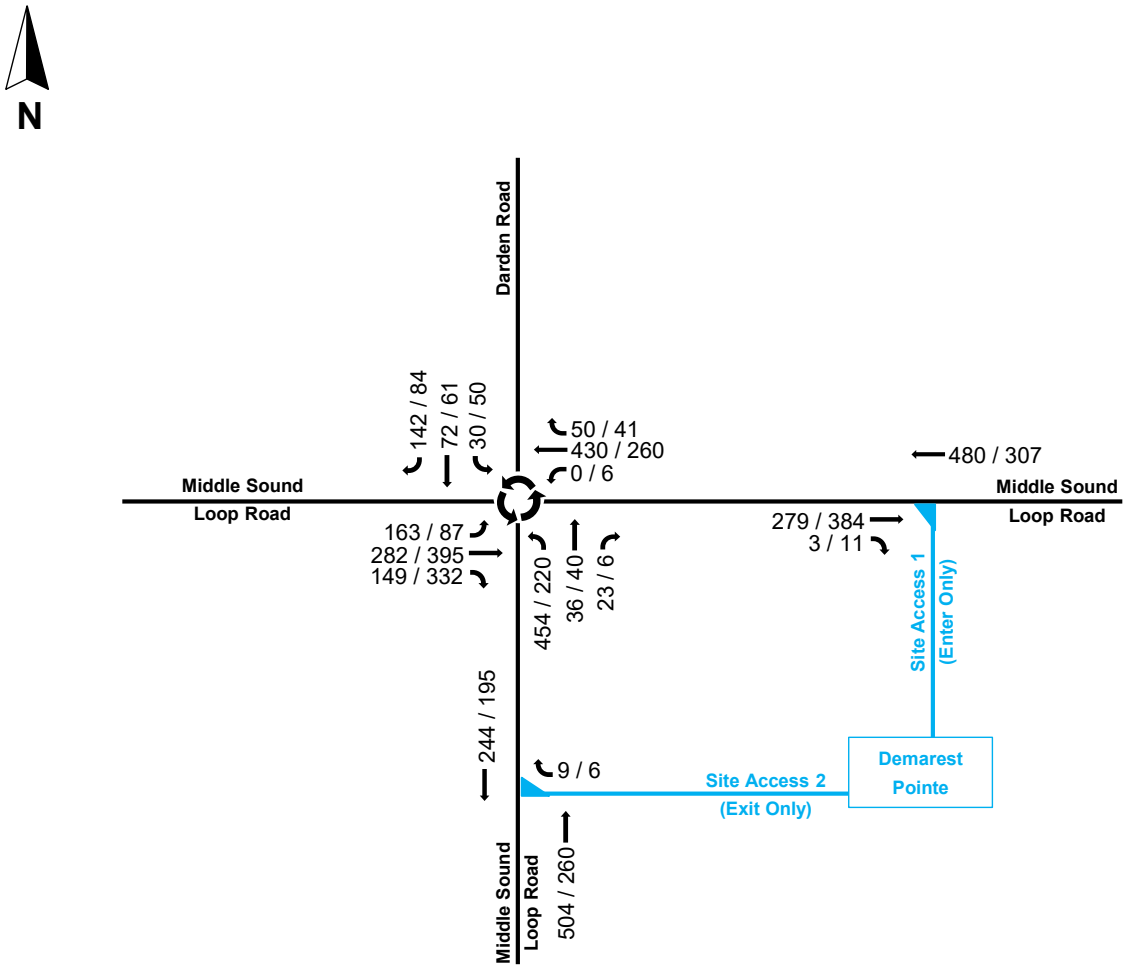

LEGEND

- ROUNDABOUT
- RIGHT IN OR RIGHT OUT ONLY
- ROADWAY
- TRAFFIC MOVEMENT
- BLACK = EXISTING
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- AM / PM PEAKS

FIGURE 8
2022 FUTURE BUILD VOLUMES

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Figure 9: Roundabout Queue
Demarest Pointe

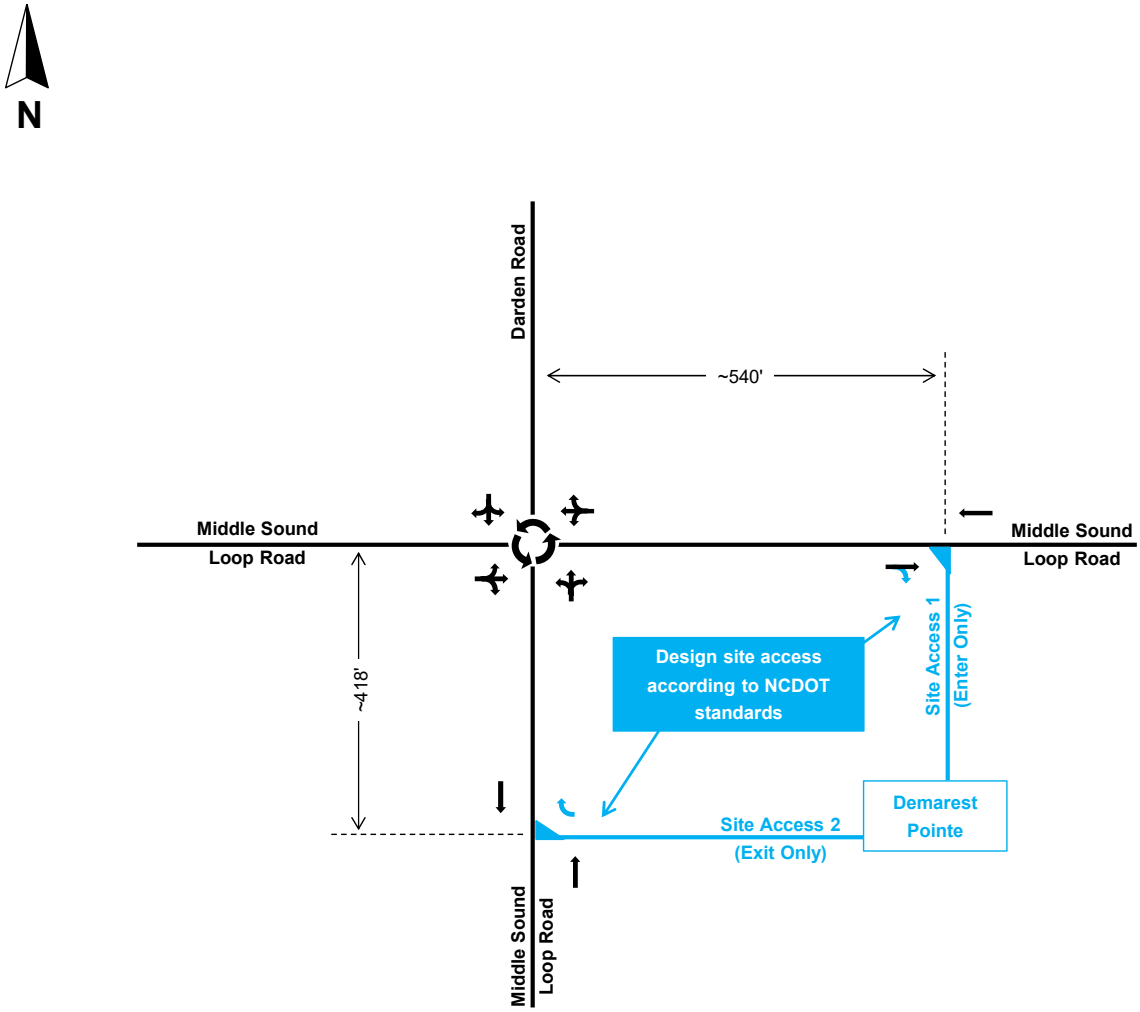

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FIGURE 10
RECOMMENDED IMPROVEMENTS

DEMAREST POINTE
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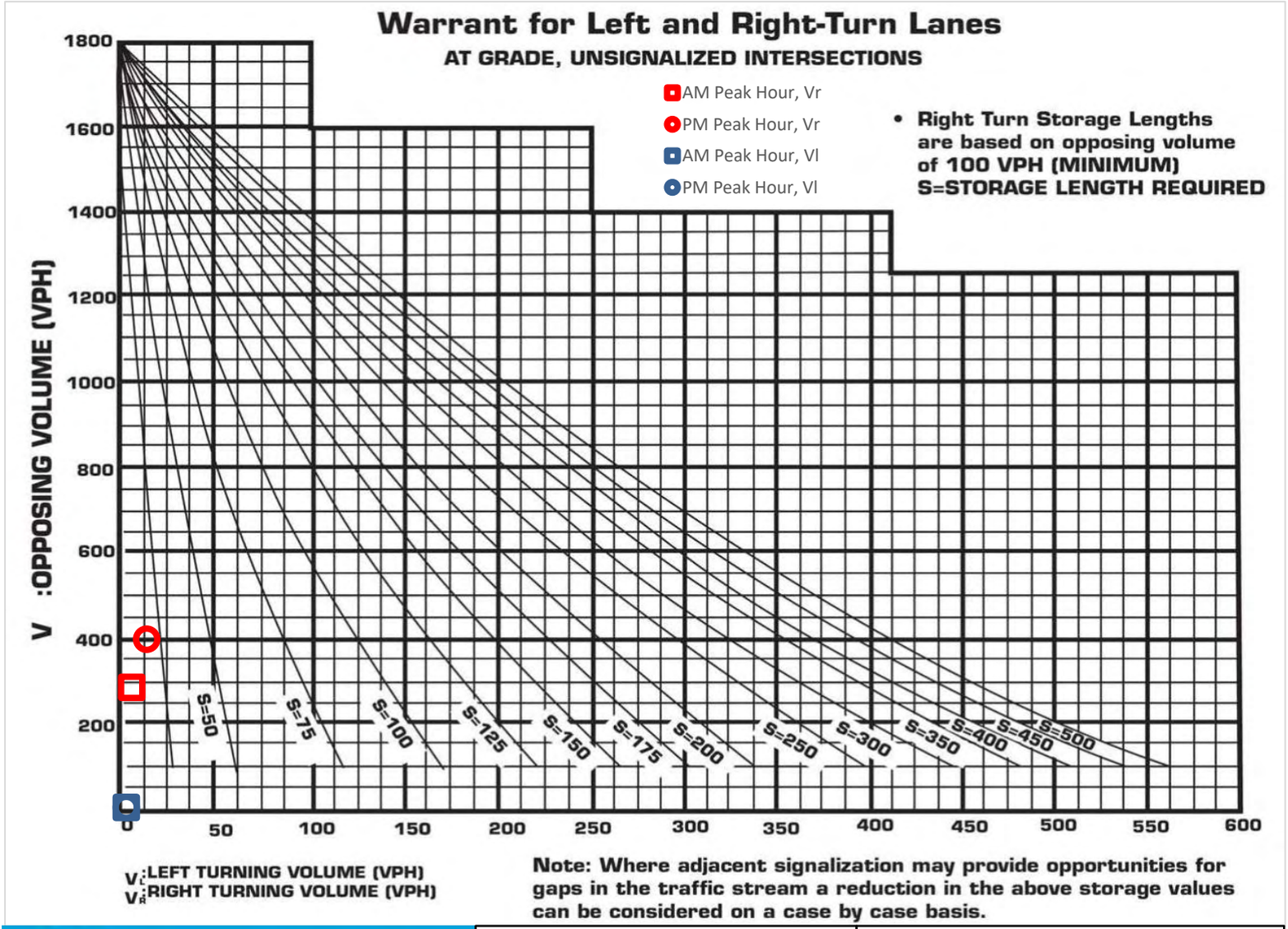
Peak Hour	Volumes		Peak Hour	Volumes	
	Opposing	Lefts		Opposing	Rights
AM	0	0	AM	282	3
PM	0	0	PM	395	11



DAVENPORT	TURN LANE WARRANT SUMMARY	SITE ACCESS 1

Cumbo, Daniel R <drcumbo@ncdot.gov>

To: Scott Stewart

Cc: Roan, Jon

Mon, Mar 23 at 7:17 AM

Scott,

Thank you again for coordinating with NCDOT on the review of your proposed development. Please see below NCDOT responses to the items below related to the Demarest Pointe proposed development:

1. Requirement for a Traffic Impact Analysis (TIA);

   A TIA will not be required by NCDOT and is below the WMPO and County thresholds for requirement of a TIA.

2. Location and proposed alignment for Demarest Pointe entrance, point of Ingress:
   NCDOT is in agreement with the entrance access as proposed in your conceptual plan. A turn lane will not be required based on our review of the roadway and site traffic volumes.

3. Location and proposed alignment for Demarest Pointe exit, point of Egress;
   NCDOT is in agreement with the exit access as proposed in your conceptual plan.

4. Commentary regarding preference specific to Egress onto Middle Sound Loop Road, as shown on the attached Master Development Plan or is there a preference for the possible alternate Egress location utilizing the access/utility/drainage easement provided through 3618 Middle Sound Loop Road onto Pickway Court to Middle Sound Loop Road.
   NCDOT does not have a preference with regard to exit access alternatives described above.

5. General internal vehicular circulation alignment and vehicular flow pattern of the Demarest Pointe neighborhood design relationship (one way vehicular pattern, right in, right out) to the existing vehicular patterns of Middle Sound Loop Road, the Middle Sound Loop Road Round - A - Bout and Ogden Elementary School points of Ingress, Egress and vehicular flow patterns.

The Demarest Pointe access design provides excellent access management with limited movement right-in and right-out driveways instead of traditional full movement intersections. The roundabout provides a nearby intersection for vehicular site traffic to make u-turn type movements to accommodate left-in and left-out movements related to the development site. NCDOT does not have any concerns related to the development exit access relative to the school driveways. In general, the development design is well thought out in regard to circulation and flow of traffic.

Please let us know if you have any questions or if additional information is needed.

Sincerely,

-Dan

Daniel R. Cumbo, PE

Deputy District Engineer

Division 3 | District 3

(910) 398-9100

Trip Generation Summary

Alternative: Alternative 1
Phase:
Project: Demarest Pointe

Open Date: 5/20/2020
Analysis Date: 5/20/2020

ITE	Land Use		Weekday Average Daily Trips			Weekday AM Peak Hour of Adjacent Street Traffic			Weekday PM Peak Hour of Adjacent Street Traffic		
		*	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
220	LOW-RISE 1		71	70	141	3	9	12	11	6	17
	24 Dwelling Units										
Unadjusted Volume			71	70	141	3	9	12	11	6	17
Internal Capture Trips			0	0	0	0	0	0	0	0	0
Pass-By Trips			0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets			71	70	141	3	9	12	11	6	17

Total Weekday Average Daily Trips Internal Capture = 0 Percent
Total Weekday AM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent
Total Weekday PM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent

* - Custom rate used for selected time period.

Source: Institute of Transportation Engineers, Trip Generation Manual 10th Edition

MOVEMENT SUMMARY

Site: 100 [AM 2020 Base]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	569	2.0	0.787	22.8	LOS C	12.1	307.2	0.93	1.52	2.03	20.0
8	T1	38	2.0	0.787	22.8	LOS C	12.1	307.2	0.93	1.52	2.03	19.7
18	R2	24	2.0	0.787	22.8	LOS C	12.1	307.2	0.93	1.52	2.03	19.4
Approach		632	2.0	0.787	22.8	LOS C	12.1	307.2	0.93	1.52	2.03	19.9
East: Middle Sound Loop Road												
1	L2	4	2.0	1.013	66.2	LOS F	25.1	637.5	1.00	2.65	4.56	14.8
6	T1	551	2.0	1.013	66.2	LOS F	25.1	637.5	1.00	2.65	4.56	14.7
16	R2	53	2.0	1.013	66.2	LOS F	25.1	637.5	1.00	2.65	4.56	14.5
Approach		608	2.0	1.013	66.2	LOS F	25.1	637.5	1.00	2.65	4.56	14.6
North: Darden Road												
7	L2	31	2.0	0.686	28.7	LOS D	4.5	114.1	0.87	1.22	1.72	19.4
4	T1	77	2.0	0.686	28.7	LOS D	4.5	114.1	0.87	1.22	1.72	19.2
14	R2	181	2.0	0.686	28.7	LOS D	4.5	114.1	0.87	1.22	1.72	18.9
Approach		289	2.0	0.686	28.7	LOS D	4.5	114.1	0.87	1.22	1.72	19.0
West: Middle Sound Loop Road												
5	L2	173	2.0	0.550	9.3	LOS A	4.3	108.5	0.45	0.27	0.45	23.3
2	T1	298	2.0	0.550	9.3	LOS A	4.3	108.5	0.45	0.27	0.45	22.9
12	R2	191	2.0	0.550	9.3	LOS A	4.3	108.5	0.45	0.27	0.45	22.4
Approach		662	2.0	0.550	9.3	LOS A	4.3	108.5	0.45	0.27	0.45	22.9
All Vehicles		2191	2.0	1.013	31.6	LOS D	25.1	637.5	0.80	1.42	2.21	18.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [AM 2022 FNB]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	593	2.0	0.840	27.9	LOS D	15.0	380.1	0.98	1.74	2.41	19.1
8	T1	40	2.0	0.840	27.9	LOS D	15.0	380.1	0.98	1.74	2.41	18.9
18	R2	26	2.0	0.840	27.9	LOS D	15.0	380.1	0.98	1.74	2.41	18.6
Approach		659	2.0	0.840	27.9	LOS D	15.0	380.1	0.98	1.74	2.41	19.1
East: Middle Sound Loop Road												
1	L2	4	2.0	1.092	91.0	LOS F	34.7	881.8	1.00	3.29	6.01	12.7
6	T1	573	2.0	1.092	91.0	LOS F	34.7	881.8	1.00	3.29	6.01	12.6
16	R2	56	2.0	1.092	91.0	LOS F	34.7	881.8	1.00	3.29	6.01	12.5
Approach		633	2.0	1.092	91.0	LOS F	34.7	881.8	1.00	3.29	6.01	12.6
North: Darden Road												
7	L2	33	2.0	0.724	31.6	LOS D	5.0	127.6	0.88	1.28	1.85	19.0
4	T1	80	2.0	0.724	31.6	LOS D	5.0	127.6	0.88	1.28	1.85	18.7
14	R2	189	2.0	0.724	31.6	LOS D	5.0	127.6	0.88	1.28	1.85	18.4
Approach		303	2.0	0.724	31.6	LOS D	5.0	127.6	0.88	1.28	1.85	18.5
West: Middle Sound Loop Road												
5	L2	181	2.0	0.576	9.9	LOS A	4.7	118.3	0.48	0.29	0.48	23.1
2	T1	310	2.0	0.576	9.9	LOS A	4.7	118.3	0.48	0.29	0.48	22.8
12	R2	199	2.0	0.576	9.9	LOS A	4.7	118.3	0.48	0.29	0.48	22.3
Approach		690	2.0	0.576	9.9	LOS A	4.7	118.3	0.48	0.29	0.48	22.8
All Vehicles		2285	2.0	1.092	40.5	LOS E	34.7	881.8	0.82	1.67	2.75	17.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [AM 2022 FB]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	605	2.0	0.859	29.9	LOS D	16.3	412.8	1.00	1.83	2.56	18.8
8	T1	40	2.0	0.859	29.9	LOS D	16.3	412.8	1.00	1.83	2.56	18.6
18	R2	26	2.0	0.859	29.9	LOS D	16.3	412.8	1.00	1.83	2.56	18.3
Approach		671	2.0	0.859	29.9	LOS D	16.3	412.8	1.00	1.83	2.56	18.8
East: Middle Sound Loop Road												
1	L2	4	2.0	1.106	96.0	LOS F	36.3	921.4	1.00	3.40	6.27	12.4
6	T1	573	2.0	1.106	96.0	LOS F	36.3	921.4	1.00	3.40	6.27	12.3
16	R2	56	2.0	1.106	96.0	LOS F	36.3	921.4	1.00	3.40	6.27	12.2
Approach		633	2.0	1.106	96.0	LOS F	36.3	921.4	1.00	3.40	6.27	12.3
North: Darden Road												
7	L2	33	2.0	0.728	32.2	LOS D	5.1	129.0	0.88	1.29	1.87	18.9
4	T1	80	2.0	0.728	32.2	LOS D	5.1	129.0	0.88	1.29	1.87	18.6
14	R2	189	2.0	0.728	32.2	LOS D	5.1	129.0	0.88	1.29	1.87	18.3
Approach		303	2.0	0.728	32.2	LOS D	5.1	129.0	0.88	1.29	1.87	18.5
West: Middle Sound Loop Road												
5	L2	181	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	23.1
2	T1	313	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.8
12	R2	199	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.3
Approach		693	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.7
All Vehicles		2300	2.0	1.106	42.4	LOS E	36.3	921.4	0.83	1.73	2.87	17.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [PM 2020 Base]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	228	2.0	0.363	9.2	LOS A	1.8	45.2	0.66	0.68	0.70	22.7
8	T1	42	2.0	0.363	9.2	LOS A	1.8	45.2	0.66	0.68	0.70	22.4
18	R2	6	2.0	0.363	9.2	LOS A	1.8	45.2	0.66	0.68	0.70	22.0
Approach		276	2.0	0.363	9.2	LOS A	1.8	45.2	0.66	0.68	0.70	22.7
East: Middle Sound Loop Road												
1	L2	6	2.0	0.351	7.7	LOS A	1.8	45.3	0.57	0.50	0.57	24.0
6	T1	277	2.0	0.351	7.7	LOS A	1.8	45.3	0.57	0.50	0.57	23.6
16	R2	43	2.0	0.351	7.7	LOS A	1.8	45.3	0.57	0.50	0.57	23.1
Approach		326	2.0	0.351	7.7	LOS A	1.8	45.3	0.57	0.50	0.57	23.6
North: Darden Road												
7	L2	53	2.0	0.260	7.4	LOS A	1.2	29.4	0.60	0.57	0.60	23.7
4	T1	64	2.0	0.260	7.4	LOS A	1.2	29.4	0.60	0.57	0.60	23.4
14	R2	89	2.0	0.260	7.4	LOS A	1.2	29.4	0.60	0.57	0.60	22.9
Approach		207	2.0	0.260	7.4	LOS A	1.2	29.4	0.60	0.57	0.60	23.2
West: Middle Sound Loop Road												
5	L2	92	2.0	0.720	14.0	LOS B	7.7	194.7	0.66	0.41	0.66	22.4
2	T1	410	2.0	0.720	14.0	LOS B	7.7	194.7	0.66	0.41	0.66	22.0
12	R2	354	2.0	0.720	14.0	LOS B	7.7	194.7	0.66	0.41	0.66	21.6
Approach		857	2.0	0.720	14.0	LOS B	7.7	194.7	0.66	0.41	0.66	21.9
All Vehicles		1664	2.0	0.720	11.1	LOS B	7.7	194.7	0.63	0.49	0.64	22.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [PM 2022 FNB]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	238	2.0	0.390	9.9	LOS A	2.1	52.1	0.68	0.73	0.78	22.6
8	T1	44	2.0	0.390	9.9	LOS A	2.1	52.1	0.68	0.73	0.78	22.3
18	R2	7	2.0	0.390	9.9	LOS A	2.1	52.1	0.68	0.73	0.78	21.8
Approach		289	2.0	0.390	9.9	LOS A	2.1	52.1	0.68	0.73	0.78	22.5
East: Middle Sound Loop Road												
1	L2	7	2.0	0.374	8.2	LOS A	1.9	48.9	0.59	0.53	0.59	23.9
6	T1	289	2.0	0.374	8.2	LOS A	1.9	48.9	0.59	0.53	0.59	23.5
16	R2	46	2.0	0.374	8.2	LOS A	1.9	48.9	0.59	0.53	0.59	23.0
Approach		341	2.0	0.374	8.2	LOS A	1.9	48.9	0.59	0.53	0.59	23.5
North: Darden Road												
7	L2	56	2.0	0.279	7.8	LOS A	1.3	31.8	0.61	0.60	0.61	23.6
4	T1	68	2.0	0.279	7.8	LOS A	1.3	31.8	0.61	0.60	0.61	23.3
14	R2	93	2.0	0.279	7.8	LOS A	1.3	31.8	0.61	0.60	0.61	22.8
Approach		217	2.0	0.279	7.8	LOS A	1.3	31.8	0.61	0.60	0.61	23.1
West: Middle Sound Loop Road												
5	L2	97	2.0	0.755	15.5	LOS C	8.6	219.0	0.73	0.47	0.73	22.0
2	T1	427	2.0	0.755	15.5	LOS C	8.6	219.0	0.73	0.47	0.73	21.7
12	R2	369	2.0	0.755	15.5	LOS C	8.6	219.0	0.73	0.47	0.73	21.3
Approach		892	2.0	0.755	15.5	LOS C	8.6	219.0	0.73	0.47	0.73	21.5
All Vehicles		1739	2.0	0.755	12.2	LOS B	8.6	219.0	0.68	0.54	0.70	22.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [PM 2022 FB]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	244	2.0	0.404	10.2	LOS B	2.2	55.7	0.69	0.76	0.83	22.5
8	T1	44	2.0	0.404	10.2	LOS B	2.2	55.7	0.69	0.76	0.83	22.2
18	R2	7	2.0	0.404	10.2	LOS B	2.2	55.7	0.69	0.76	0.83	21.7
Approach		296	2.0	0.404	10.2	LOS B	2.2	55.7	0.69	0.76	0.83	22.4
East: Middle Sound Loop Road												
1	L2	7	2.0	0.377	8.2	LOS A	1.9	49.2	0.60	0.53	0.60	23.9
6	T1	289	2.0	0.377	8.2	LOS A	1.9	49.2	0.60	0.53	0.60	23.5
16	R2	46	2.0	0.377	8.2	LOS A	1.9	49.2	0.60	0.53	0.60	23.0
Approach		341	2.0	0.377	8.2	LOS A	1.9	49.2	0.60	0.53	0.60	23.4
North: Darden Road												
7	L2	56	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.6
4	T1	68	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.2
14	R2	93	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	22.7
Approach		217	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.1
West: Middle Sound Loop Road												
5	L2	97	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.9
2	T1	439	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.6
12	R2	369	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.2
Approach		904	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.4
All Vehicles		1758	2.0	0.765	12.5	LOS B	10.0	254.1	0.69	0.57	0.73	22.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DAVENPORT

Home Office:
305 West Fourth Street, Suite 2A
Winston-Salem, NC 27101
Main: 336.744.1636 Fax: 336.458.9377

Count Number: 17-02640
Division: 3
County: New Hanover
City: Wilmington

Intersection: SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
13-Hour Traffic Volume: 13,421 Vehicles

	Day 1
Count Date:	12/12/2017
Count Time:	6:00am-7:00pm
Weather Conditions:	65-Hi/34-Lo/Prec: 0"
Milepost:	N/A

Comments:

1. Counted By: M. Martin
2. Data Processor: C. Bowers
3. Method Used: JAMAR Traffic Data Collector with video
4. Equipment Operating as Specified by the Manufacturer: Yes
5. School in Session: Yes
6. Break Times: None
7. Area Lighting Present: None present
8. Traffic Control: Roundabout - Single Lane
9. Signal Cabinet Number: N/A
10. Disabled Pedestrians: None observed
11. Construction Present: No
12. Traffic Flow Disruption: None observed
13. Railroad Crossings: None within 200 ft of each leg
14. Other Signal or Stop Controlled Intersections: None within 300 ft of each leg

Vicinity Map

Intersection Sketch

DAVENPORT

119 Brookstown Ave., Suite PH1,
Winston Salem NC, 27101
Ph:(336)744-1636

Counted By: M. Martin

File Name : 17-02640
Site Code : 1702640
Start Date : 12/12/2017
Page No : 1

Groups Printed- All Vehicles

	Darden Road Southbound					Middle Sound Loop Road Westbound					Middle Sound Loop Road Northbound					Middle Sound Loop Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
06:00 AM	3	1	0	0	4	0	16	0	0	16	0	1	17	0	18	6	11	4	0	21	0	59	59
06:15 AM	2	1	0	0	3	0	24	0	0	24	1	2	27	0	30	8	21	7	0	36	0	93	93
06:30 AM	4	3	0	0	7	2	39	1	0	42	0	4	37	0	41	18	23	6	0	47	0	137	137
06:45 AM	10	4	1	0	15	3	52	0	1	55	0	3	46	0	49	21	19	13	0	53	1	172	173
Total	19	9	1	0	29	5	131	1	1	137	1	10	127	0	138	53	74	30	0	157	1	461	462
07:00 AM	7	3	4	0	14	5	70	1	0	76	0	5	68	0	73	17	18	11	0	46	0	209	209
07:15 AM	26	7	0	0	33	6	95	0	1	101	1	6	65	0	72	24	27	16	0	67	1	273	274
07:30 AM	32	5	1	0	38	8	88	2	0	98	4	5	86	0	95	15	39	20	0	74	0	305	305
07:45 AM	20	10	4	0	34	7	73	0	0	80	3	5	82	0	90	21	44	23	0	88	0	292	292
Total	85	25	9	0	119	26	326	3	1	355	8	21	301	0	330	77	128	70	0	275	1	1079	1080
08:00 AM	27	14	5	0	46	10	99	0	0	109	4	7	96	0	107	29	60	32	0	121	0	383	383
08:15 AM	38	19	8	0	65	13	111	0	0	124	6	9	107	0	122	39	73	43	0	155	0	466	466
08:30 AM	39	20	8	0	67	14	93	0	0	107	6	10	102	0	118	41	67	45	0	153	0	445	445
08:45 AM	24	12	5	0	41	8	86	0	0	94	4	6	97	0	107	25	52	27	0	104	0	346	346
Total	128	65	26	0	219	45	389	0	0	434	20	32	402	0	454	134	252	147	0	533	0	1640	1640
09:00 AM	13	5	2	0	20	2	51	2	0	55	2	7	60	0	69	25	35	6	0	66	0	210	210
09:15 AM	17	8	4	0	29	2	69	0	0	71	0	5	58	0	63	38	27	5	0	70	0	233	233
09:30 AM	10	9	2	0	21	3	42	0	0	45	1	6	43	0	50	34	31	12	0	77	0	193	193
09:45 AM	8	3	3	0	14	8	44	1	0	53	1	6	51	0	58	32	33	12	0	77	0	202	202
Total	48	25	11	0	84	15	206	3	0	224	4	24	212	0	240	129	126	35	0	290	0	838	838
10:00 AM	10	10	3	0	23	7	47	1	0	55	1	9	50	1	60	41	28	17	0	86	1	224	225
10:15 AM	11	7	2	0	20	6	38	1	0	45	1	8	39	1	48	23	38	14	0	75	1	188	189
10:30 AM	14	10	5	0	29	4	50	0	1	54	2	5	52	0	59	36	28	15	0	79	1	221	222
10:45 AM	15	7	5	0	27	5	49	1	0	55	0	9	50	0	59	41	30	17	0	88	0	229	229
Total	50	34	15	0	99	22	184	3	1	209	4	31	191	2	226	141	124	63	0	328	3	862	865
11:00 AM	13	15	4	0	32	4	50	1	0	55	3	10	51	1	64	31	22	14	0	67	1	218	219
11:15 AM	12	5	3	0	20	5	43	1	0	49	0	11	45	0	56	37	46	13	0	96	0	221	221
11:30 AM	7	7	1	0	15	4	45	1	0	50	1	7	36	0	44	44	34	9	0	87	0	196	196
11:45 AM	6	15	7	0	28	5	52	1	0	58	1	6	63	0	70	42	35	8	0	85	0	241	241
Total	38	42	15	0	95	18	190	4	0	212	5	34	195	1	234	154	137	44	0	335	1	876	877
12:00 PM	21	17	1	0	39	9	44	2	0	55	2	4	57	0	63	47	36	11	0	94	0	251	251
12:15 PM	11	7	6	0	24	4	58	2	0	64	1	6	46	0	53	34	41	15	0	90	0	231	231
12:30 PM	10	11	6	0	27	5	46	0	0	51	0	6	42	0	48	52	34	17	0	103	0	229	229
12:45 PM	17	6	5	0	28	10	35	0	0	45	1	4	44	1	49	45	35	21	0	101	1	223	224
Total	59	41	18	0	118	28	183	4	0	215	4	20	189	1	213	178	146	64	0	388	1	934	935
01:00 PM	24	13	4	1	41	19	30	0	1	49	1	8	47	1	56	39	47	18	1	104	4	250	254
01:15 PM	12	1	3	0	16	4	41	1	1	46	0	5	54	0	59	38	52	20	0	110	1	231	232
01:30 PM	13	4	3	0	20	8	44	1	0	53	1	12	54	0	67	52	52	11	0	115	0	255	255
01:45 PM	21	8	8	0	37	6	47	1	0	54	4	8	34	0	46	60	46	15	0	121	0	258	258
Total	70	26	18	1	114	37	162	3	2	202	6	33	189	1	228	189	197	64	1	450	5	994	999
02:00 PM	13	9	8	0	30	5	56	0	1	61	1	15	60	0	76	51	37	14	0	102	1	269	270
02:15 PM	15	7	3	0	25	12	49	1	0	62	4	13	68	0	85	49	39	14	0	102	0	274	274
02:30 PM	14	8	10	0	32	7	46	0	0	53	1	11	33	0	45	40	51	17	0	108	0	238	238

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File Name : 17-02640
Site Code : 1702640
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Groups Printed- All Vehicles

	Darden Road Southbound					Middle Sound Loop Road Westbound					Middle Sound Loop Road Northbound					Middle Sound Loop Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
02:45 PM	14	19	7	0	40	5	60	0	0	65	0	12	61	0	73	39	53	11	0	103	0	281	281
Total	56	43	28	0	127	29	211	1	1	241	6	51	222	0	279	179	180	56	0	415	1	1062	1063
03:00 PM	13	6	2	0	21	6	46	1	0	53	2	9	55	0	66	37	67	21	0	125	0	265	265
03:15 PM	15	7	16	0	38	5	35	0	0	40	4	13	60	0	77	39	55	11	0	105	0	260	260
03:30 PM	14	10	9	0	33	8	59	1	0	68	1	10	54	0	65	57	58	15	0	130	0	296	296
03:45 PM	13	10	5	0	28	5	38	2	0	45	3	6	38	0	47	46	66	16	0	128	0	248	248
Total	55	33	32	0	120	24	178	4	0	206	10	38	207	0	255	179	246	63	0	488	0	1069	1069
04:00 PM	11	10	4	0	25	4	41	0	0	45	1	11	49	0	61	44	61	14	0	119	0	250	250
04:15 PM	15	16	2	0	33	12	47	1	0	60	3	10	47	0	60	47	65	18	0	130	0	283	283
04:30 PM	13	10	15	0	38	7	46	1	0	54	4	11	58	0	73	55	79	21	0	155	0	320	320
04:45 PM	11	18	4	0	33	6	52	0	0	58	4	13	54	0	71	59	81	25	0	165	0	327	327
Total	50	54	25	0	129	29	186	2	0	217	12	45	208	0	265	205	286	78	0	569	0	1180	1180
05:00 PM	23	13	13	0	49	14	61	1	0	76	0	7	65	0	72	79	76	13	0	168	0	365	365
05:15 PM	17	12	9	0	38	9	52	0	0	61	1	9	39	0	49	98	103	20	0	221	0	369	369
05:30 PM	19	19	9	0	47	5	58	2	0	65	2	8	35	0	45	70	91	17	0	178	0	335	335
05:45 PM	16	10	14	0	40	8	63	1	0	72	1	11	54	0	66	53	77	28	0	158	0	336	336
Total	75	54	45	0	174	36	234	4	0	274	4	35	193	0	232	300	347	78	0	725	0	1405	1405
06:00 PM	14	11	0	0	25	11	50	0	0	61	3	9	65	0	77	44	66	21	0	131	0	294	294
06:15 PM	16	8	8	0	32	6	43	2	0	51	0	7	49	0	56	45	61	9	0	115	0	254	254
06:30 PM	16	10	6	0	32	3	28	1	0	32	1	13	61	0	75	49	56	11	0	116	0	255	255
06:45 PM	12	8	4	0	24	5	23	0	0	28	0	6	43	0	49	55	49	13	0	117	0	218	218
Total	58	37	18	0	113	25	144	3	0	172	4	35	218	0	257	193	232	54	0	479	0	1021	1021
Grand Total	791	488	261	1	1540	339	2724	35	6	3098	88	409	2854	5	3351	2111	2475	846	1	5432	13	13421	13434
Apprch %	51.4	31.7	16.9			10.9	87.9	1.1			2.6	12.2	85.2			38.9	45.6	15.6					
Total %	5.9	3.6	1.9		11.5	2.5	20.3	0.3		23.1	0.7	3	21.3		25	15.7	18.4	6.3		40.5	0.1	99.9	

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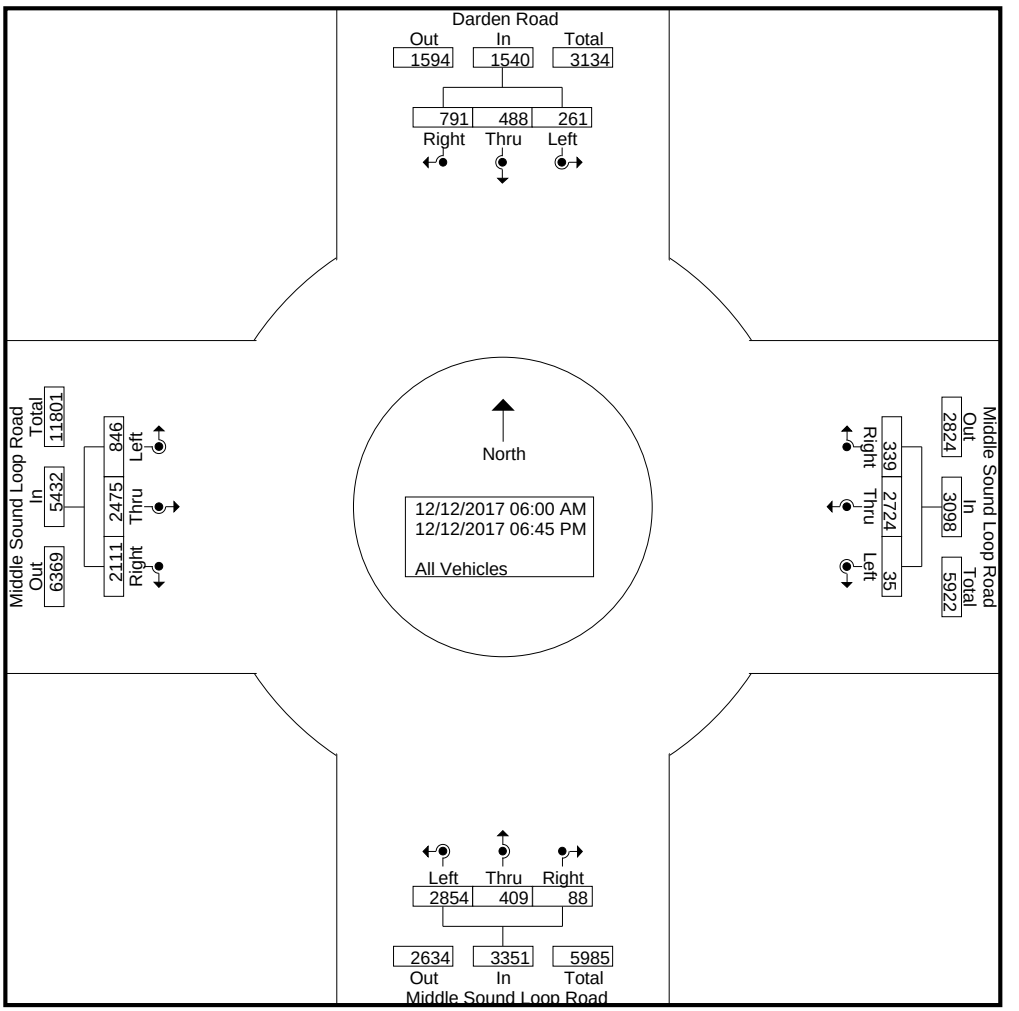

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File Name : 17-02640
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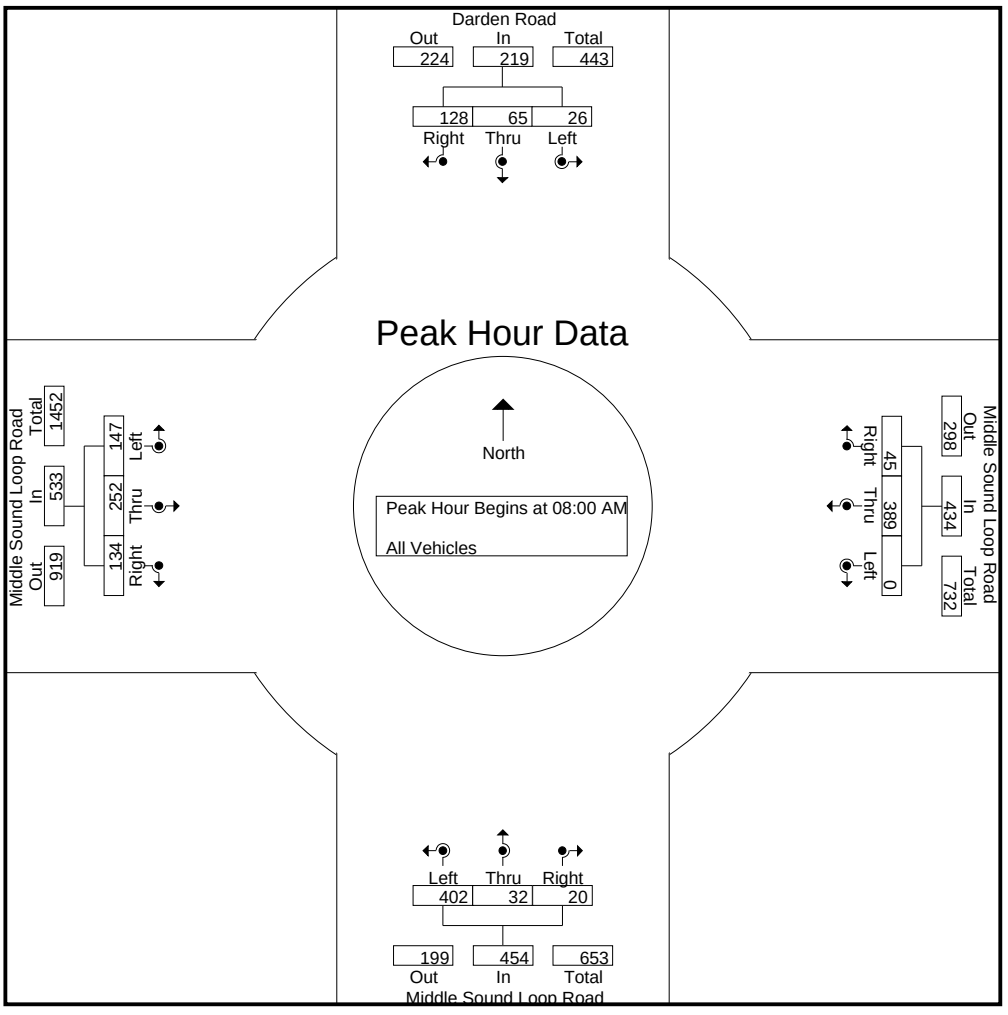
	Darden Road Southbound				Middle Sound Loop Road Westbound				Middle Sound Loop Road Northbound				Middle Sound Loop Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	27	14	5	46	10	99	0	109	4	7	96	107	29	60	32	121	383
08:15 AM	38	19	**8**	65	13	**111**	0	**124**	**6**	9	**107**	**122**	39	**73**	43	**155**	**466**
08:30 AM	**39**	**20**	8	**67**	**14**	93	0	107	6	**10**	102	118	**41**	67	**45**	153	445
08:45 AM	24	12	5	41	8	86	0	94	4	6	97	107	25	52	27	104	346
Total Volume	128	65	26	219	45	389	0	434	20	32	402	454	134	252	147	533	1640
% App. Total	58.4	29.7	11.9		10.4	89.6	0		4.4	7	88.5		25.1	47.3	27.6		
PHF	.821	.813	.813	.817	.804	.876	.000	.875	.833	.800	.939	.930	.817	.863	.817	.860	.880



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File Name : 17-02640
Site Code : 1702640
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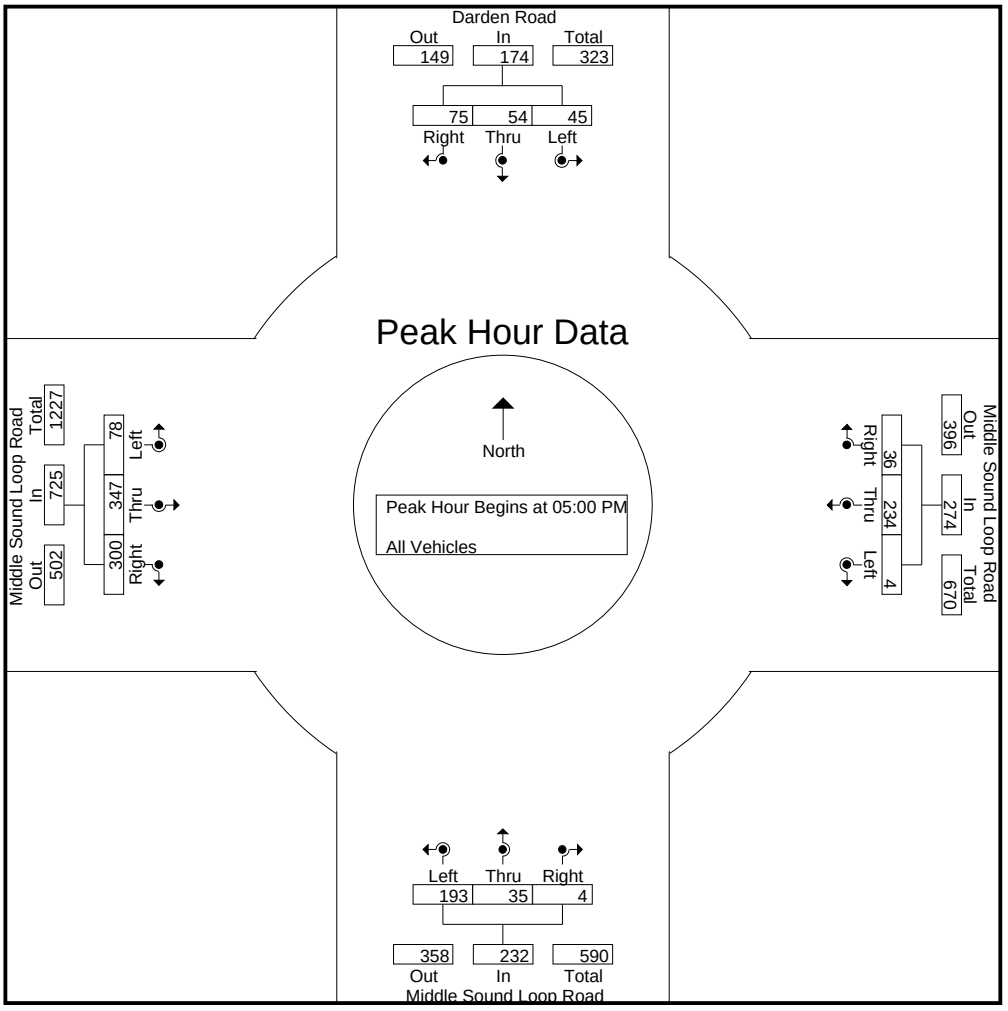
	Darden Road Southbound				Middle Sound Loop Road Westbound				Middle Sound Loop Road Northbound				Middle Sound Loop Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	**23**	13	13	**49**	**14**	61	1	**76**	0	7	**65**	**72**	79	76	13	168	365
05:15 PM	17	12	9	38	9	52	0	61	1	9	39	49	**98**	**103**	20	**221**	**369**
05:30 PM	19	**19**	9	47	5	58	**2**	65	**2**	8	35	45	70	91	17	178	335
05:45 PM	16	10	**14**	40	8	**63**	1	72	1	**11**	54	66	53	77	**28**	158	336
Total Volume	75	54	45	174	36	234	4	274	4	35	193	232	300	347	78	725	1405
% App. Total	43.1	31	25.9		13.1	85.4	1.5		1.7	15.1	83.2		41.4	47.9	10.8		
PHF	.815	.711	.804	.888	.643	.929	.500	.901	.500	.795	.742	.806	.765	.842	.696	.820	.952



DAVENPORT Project #17-02640 NCDOT Count #17-02640
SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road), New Hanover County, NC

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Northbound Facing North

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Northbound Facing South

DAVENPORT Project #17-02640 NCDOT Count #17-02640
SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road), New Hanover County, NC

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Southbound Facing South

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Southbound Facing North

DAVENPORT Project #17-02640 NCDOT Count #17-02640
SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road), New Hanover County, NC

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Westbound Facing West

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Westbound Facing East

DAVENPORT Project #17-02640 NCDOT Count #17-02640
SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road), New Hanover County, NC

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Eastbound Facing East

SR 1403 (Middle Sound Loop Road) and SR 1407 (Darden Road)
Eastbound Facing West

Trip Generation Summary

Alternative: Alternative 1
Phase:
Project: Demarest Pointe

Open Date: 5/27/2020
Analysis Date: 5/27/2020

ITE	Land Use		Weekday Average Daily Trips			Weekday AM Peak Hour of Adjacent Street Traffic			Weekday PM Peak Hour of Adjacent Street Traffic		
		*	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
220	LOW-RISE 1		82	81	163	3	11	14	11	7	18
	27 Dwelling Units										
Unadjusted Volume			82	81	163	3	11	14	11	7	18
Internal Capture Trips			0	0	0	0	0	0	0	0	0
Pass-By Trips			0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets			82	81	163	3	11	14	11	7	18

Total Weekday Average Daily Trips Internal Capture = 0 Percent
Total Weekday AM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent
Total Weekday PM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent

* - Custom rate used for selected time period.

Source: Institute of Transportation Engineers, Trip Generation Manual 10th Edition

MOVEMENT SUMMARY

Site: 100 [AM 2022 FB 27 Townhomes]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	608	2.0	0.862	30.3	LOS D	16.5	419.6	1.00	1.84	2.59	18.8
8	T1	40	2.0	0.862	30.3	LOS D	16.5	419.6	1.00	1.84	2.59	18.5
18	R2	26	2.0	0.862	30.3	LOS D	16.5	419.6	1.00	1.84	2.59	18.2
Approach		674	2.0	0.862	30.3	LOS D	16.5	419.6	1.00	1.84	2.59	18.7
East: Middle Sound Loop Road												
1	L2	4	2.0	1.109	97.1	LOS F	36.6	930.3	1.00	3.43	6.33	12.3
6	T1	573	2.0	1.109	97.1	LOS F	36.6	930.3	1.00	3.43	6.33	12.2
16	R2	56	2.0	1.109	97.1	LOS F	36.6	930.3	1.00	3.43	6.33	12.1
Approach		633	2.0	1.109	97.1	LOS F	36.6	930.3	1.00	3.43	6.33	12.2
North: Darden Road												
7	L2	33	2.0	0.729	32.3	LOS D	5.1	129.3	0.89	1.30	1.88	18.9
4	T1	80	2.0	0.729	32.3	LOS D	5.1	129.3	0.89	1.30	1.88	18.6
14	R2	189	2.0	0.729	32.3	LOS D	5.1	129.3	0.89	1.30	1.88	18.3
Approach		303	2.0	0.729	32.3	LOS D	5.1	129.3	0.89	1.30	1.88	18.4
West: Middle Sound Loop Road												
5	L2	181	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	23.1
2	T1	313	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.8
12	R2	199	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.3
Approach		693	2.0	0.579	9.9	LOS A	4.7	119.4	0.49	0.29	0.49	22.7
All Vehicles		2303	2.0	1.109	42.8	LOS E	36.6	930.3	0.83	1.74	2.89	17.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 100 [PM 2022 FB 27 Townhomes]

Roundabout - Middle Sound Loop Road @ Darden Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Middle Sound Loop Road												
3	L2	246	2.0	0.406	10.3	LOS B	2.2	56.1	0.69	0.76	0.83	22.5
8	T1	44	2.0	0.406	10.3	LOS B	2.2	56.1	0.69	0.76	0.83	22.2
18	R2	7	2.0	0.406	10.3	LOS B	2.2	56.1	0.69	0.76	0.83	21.7
Approach		297	2.0	0.406	10.3	LOS B	2.2	56.1	0.69	0.76	0.83	22.4
East: Middle Sound Loop Road												
1	L2	7	2.0	0.377	8.3	LOS A	1.9	49.3	0.60	0.54	0.60	23.9
6	T1	289	2.0	0.377	8.3	LOS A	1.9	49.3	0.60	0.54	0.60	23.5
16	R2	46	2.0	0.377	8.3	LOS A	1.9	49.3	0.60	0.54	0.60	23.0
Approach		341	2.0	0.377	8.3	LOS A	1.9	49.3	0.60	0.54	0.60	23.4
North: Darden Road												
7	L2	56	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.6
4	T1	68	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.2
14	R2	93	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	22.7
Approach		217	2.0	0.281	7.9	LOS A	1.3	32.0	0.62	0.60	0.62	23.1
West: Middle Sound Loop Road												
5	L2	97	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.9
2	T1	439	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.6
12	R2	369	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.2
Approach		904	2.0	0.765	16.0	LOS C	10.0	254.1	0.74	0.51	0.78	21.4
All Vehicles		1759	2.0	0.765	12.5	LOS B	10.0	254.1	0.69	0.57	0.73	22.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Technical Summary

Access Management in the Vicinity of Intersections

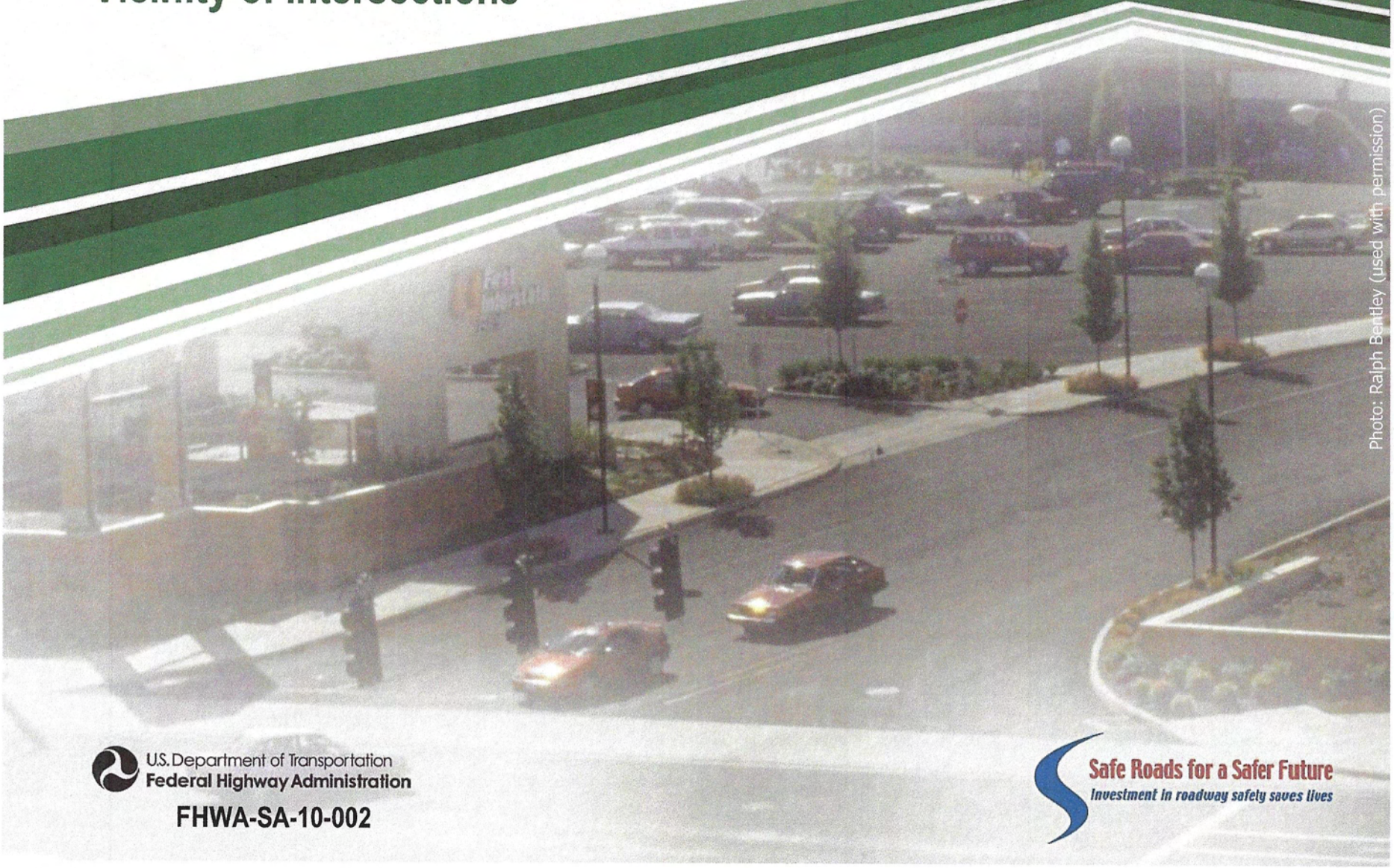


Photo: Ralph Bentley (used with permission)

U.S. Department of Transportation
Federal Highway Administration

FHWA-SA-10-002

Safe Roads for a Safer Future
Investment in roadway safety saves lives

Access Management is:

- The design, implementation and management of entry and exit points between roadways and adjacent properties.
- This presentation overviews the safety considerations of access management near intersections.

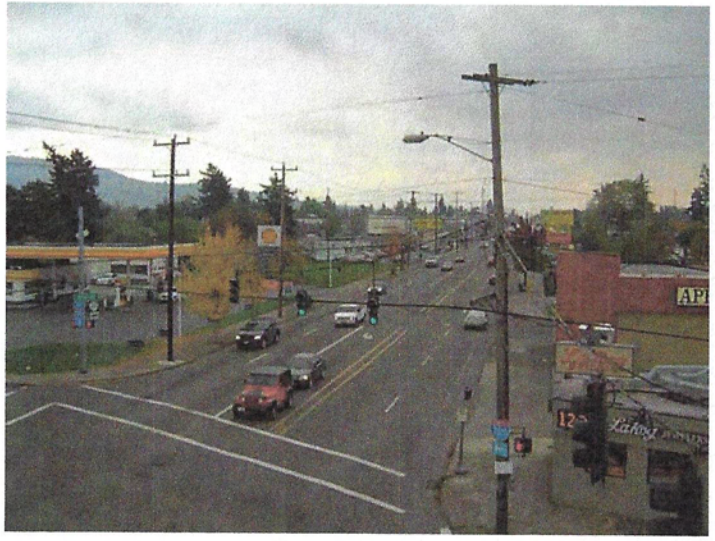
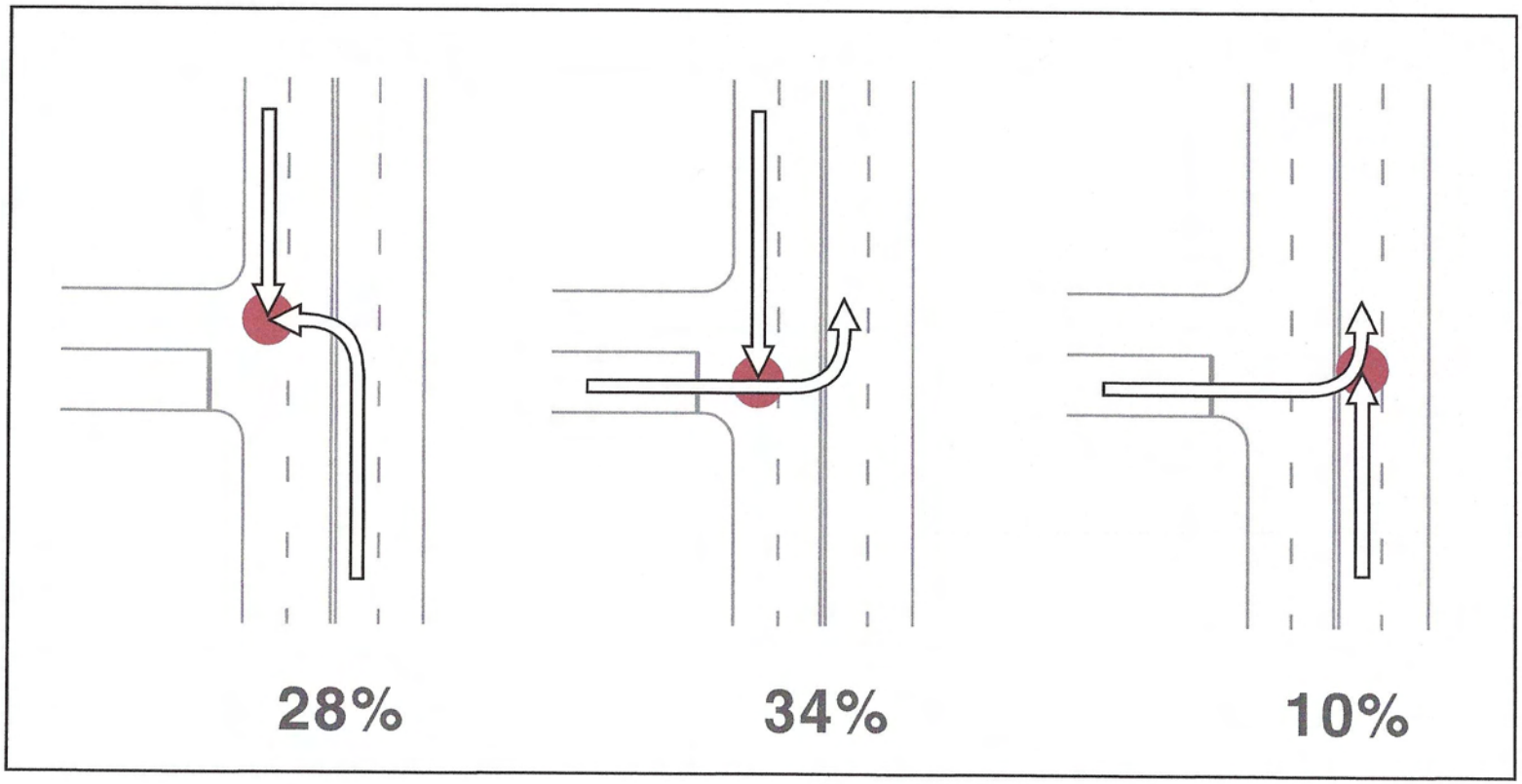


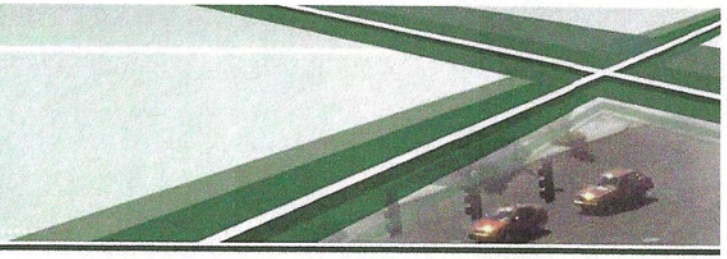
Photo: Kittelson & Associates, Inc.

Consideration 4: Eliminating Left-Turn Movements Improves Safety

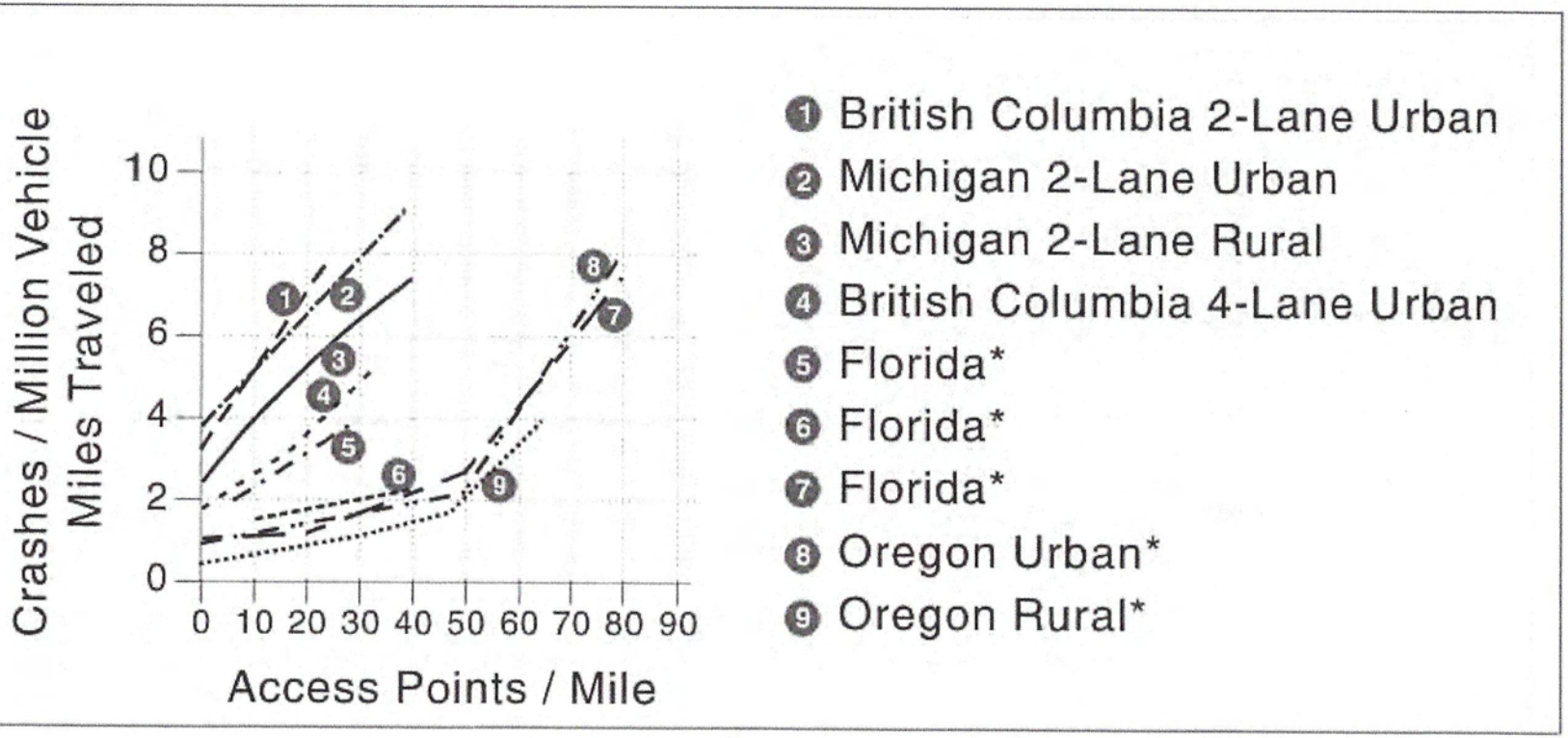
- 72% of crashes at a driveway involve a left-turning vehicle



Consideration 6: Reducing Driveway Density Reduces Crash Rates

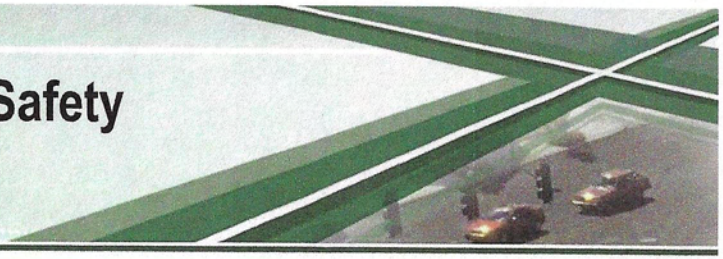


- Research shows as driveway density increases, crash rates also increase



* Road type not specified

Consideration 7: Driveway Design Influences Safety and Mobility



Elements to Consider

- Upstream and downstream sight distance
- Angle at which driveway intersects the major road
- Driveway width and curb radii
- Number of lanes should be sufficient for the volume at the site
- Vertical grade should be level to allow motorists to easily stop with adequate sight distance prior to entering major roadway

Other Treatments to Improve Bicyclist and Pedestrian Safety Near Suburban Intersections

- Provide raised medians to prohibit left turns
  - Reduces number of potential pedestrian-vehicle conflicts

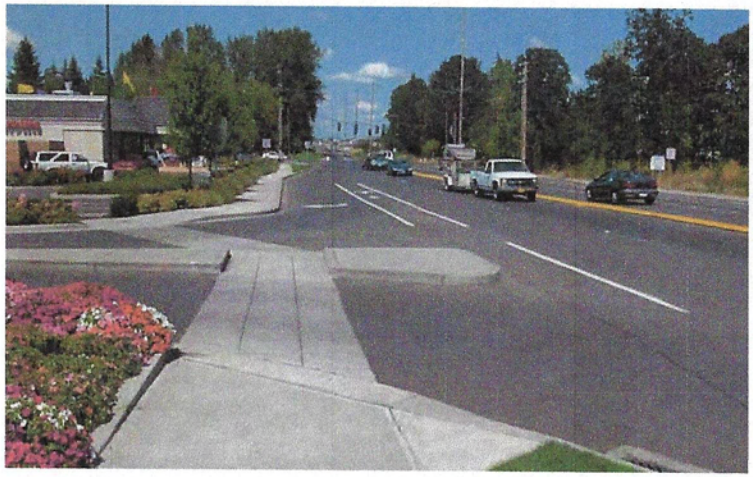
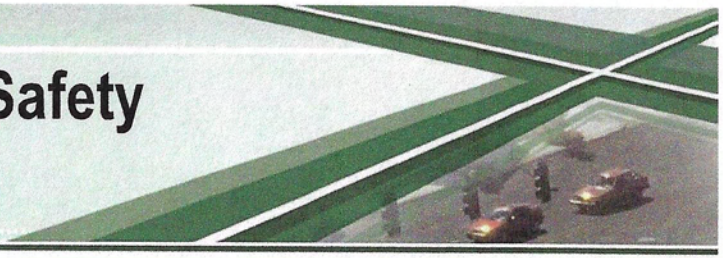


Photo: Ralph Bentley (used with permission)

- Minimize the driveway width as much as possible
  - Reduces pedestrian crossing distance and exposure

- Do not block pedestrian-driver sight lines
  - Make pedestrians and drivers visible to each other

Other Treatments to Improve Motorist Safety Near Urban Intersections (Continued)



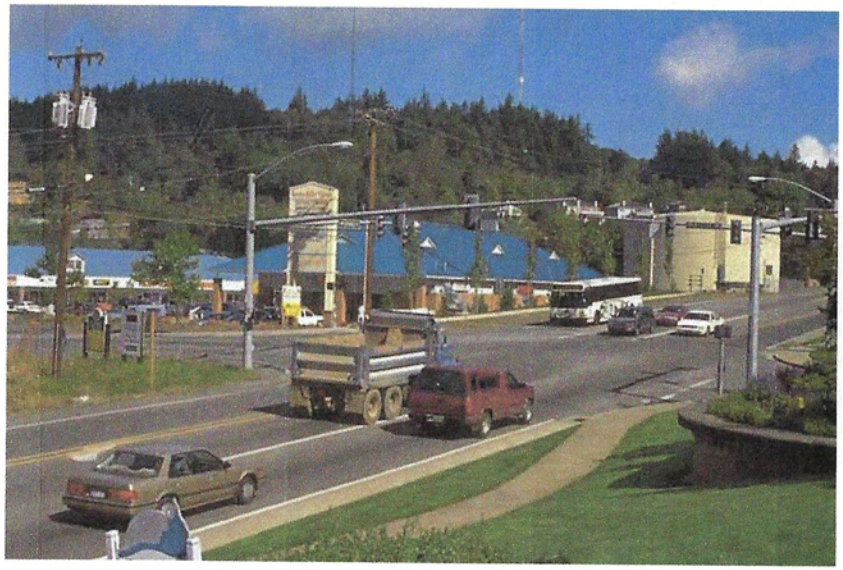
- Place driveways on one-way streets
  - Creates fewer conflict points
- Place left-in driveways near center of block
  - Minimizes interaction with intersection queues
- Position driveways as far upstream from intersections as possible
  - Provides exiting motorists distance to make lane changes

Treatments to Improve Bicyclist and Pedestrian Safety Near Suburban Intersections

Photo: Kittelson & Associates, Inc.

Access Management Near Suburban Intersections

- Suburban areas offer the greatest opportunity to manage access and positively impact safety



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