Appendix G: Analysis

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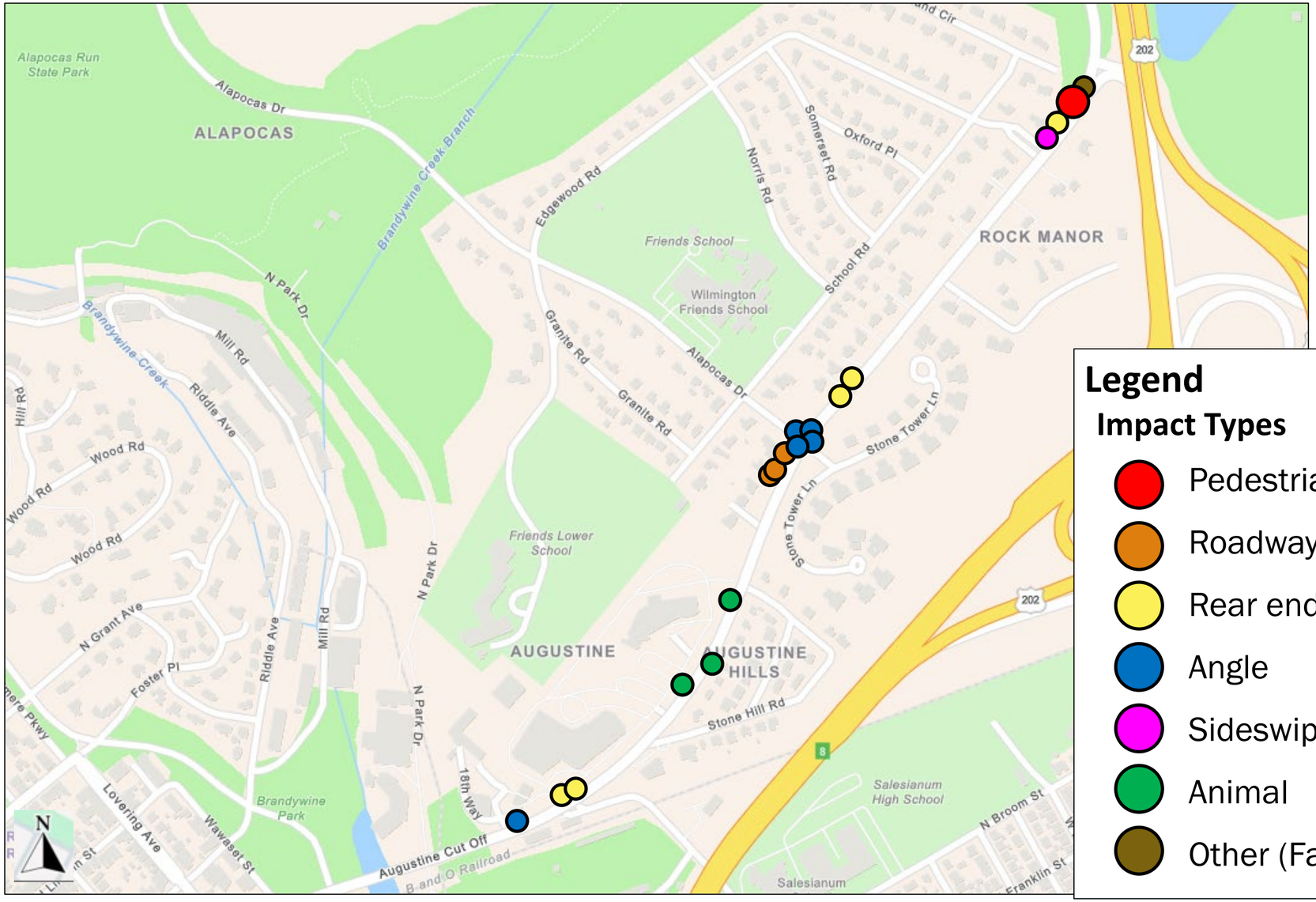
Crash Analysis 11/2019-11/2024



Legend

Impact Types

- Pedestrian Fatality
- Roadway Departure
- Rear end
- Angle
- Sideswipe
- Animal
- Other (Falling Object)

Crash Analysis 8/2015-8/2025

Analysis period extended to address resident concerns

<u>Alapocas Drive intersection</u>

8 reported crashes

- 5 angle crashes
- 3 rear end crashes

- 5 crashes occurred since 2023

<u>South of Alapocas Drive</u>

5 reported crashes

- 4 roadway departure crashes
- 1 pedestrian crash (**fatality**)
  - April 4, 2025 at 11:36 PM
  - Walking on the edge of the road
  - Vehicle fled (details are limited)
  - The incident is under investigation

Speed Limit Analysis

- Speed study conducted November 2024 at Cantera Road and Rock Manor Avenue
- Speeds often exceeded speed limit
- On the hill south of Alapocas Drive, SB speeds higher than NB
- Speeds higher north of Alapocas Drive in straight stretch of road
- North of Alapocas Drive, speeds higher "exiting" City than "entering"

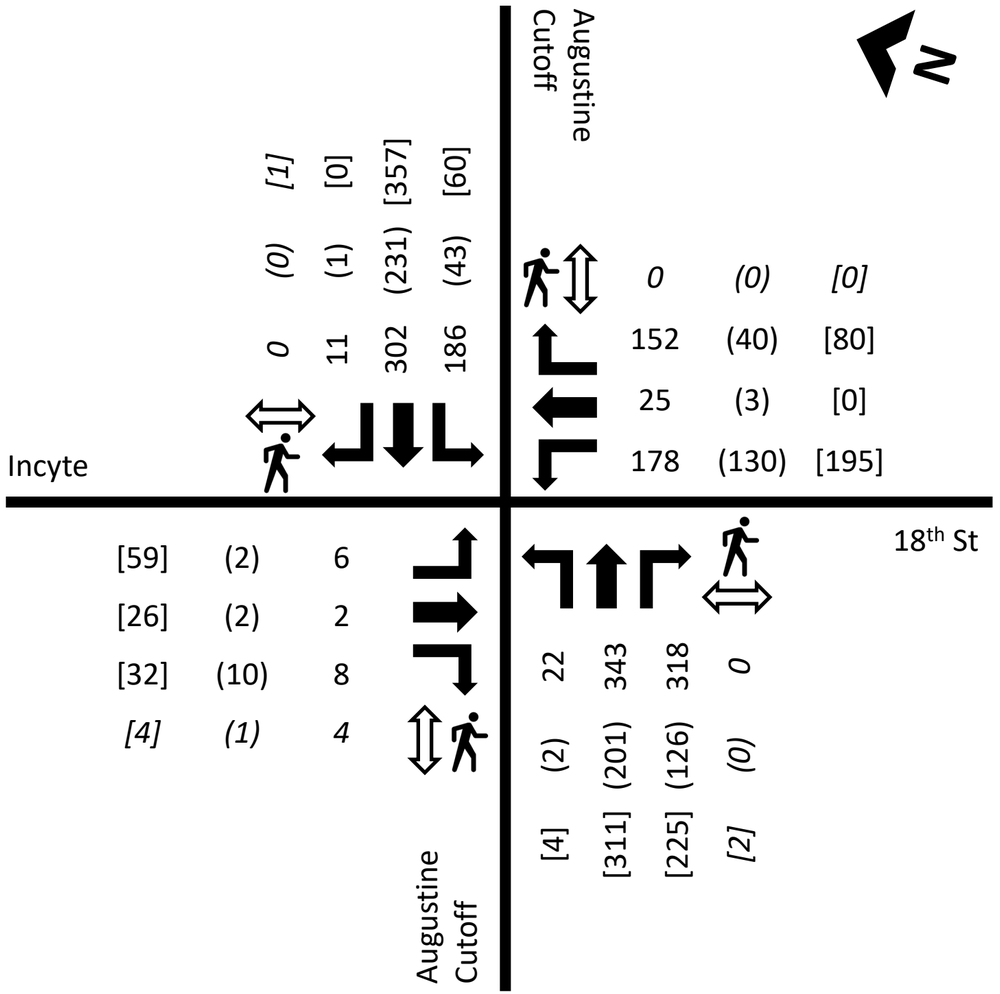
- USLIMITS2 analysis conducted 7/23/25
  - Speed limit of 40 mph recommended due to relatively low crash rate and few intersections

At Cantera Road		
	NB Augustine Cutoff	SB Augustine Cutoff
Speed Limit	35 mph	
Average Speed	36 mph	40 mph
85th-Percentile Speed	43 mph	43 mph
% More than 5 mph Over Limit	32%	36%

At Rock Manor Avenue		
	NB Augustine Cutoff	SB Augustine Cutoff
Speed Limit	35 mph	
Average Speed	43 mph	41 mph
85th-Percentile Speed	48 mph	46 mph
% More than 5 mph Over Limit	62%	50%

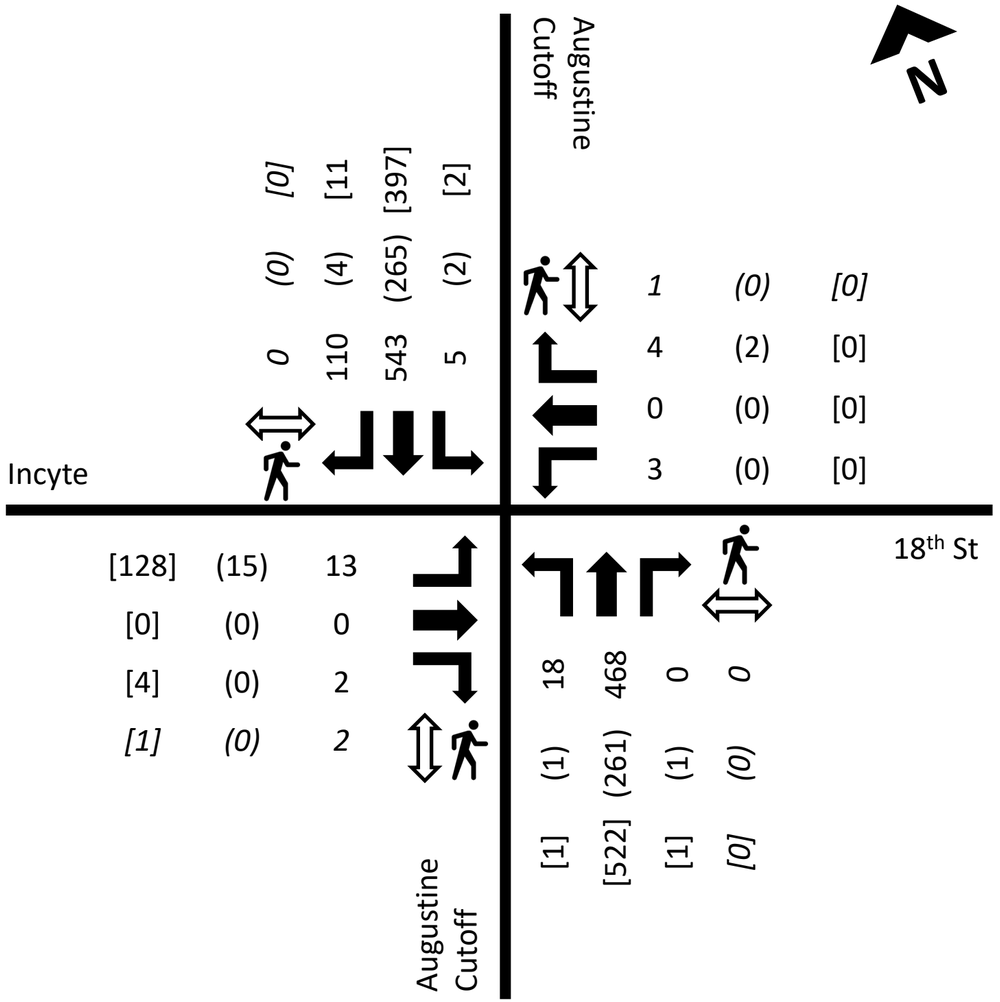
18th Street Volumes

- Collected Tuesday January 28, 2025
  - 6AM – 7PM
  - Typical school and work day
- Pedestrian (italics) included
- Bicycle traffic counted as vehicles since in the road
- 3 peak hours identified and studied
  - AM Peak: 7:30-8:30 AM
  - (Midday Peak): 11:30 AM-12:30 PM
  - [PM Peak]: 4:30-5:30 PM



Cantera Road Volumes

- Collected Tuesday January 28, 2025
  - 6AM – 7PM
  - Typical school and work day
- Pedestrian (italics) included
- Bicycle traffic counted as vehicles since in the road
- 3 peak hours identified and studied
  - AM Peak: 7:30-8:30 AM
  - (Midday Peak): 11:45 AM-12:45 PM
  - [PM Peak]: 4:30-5:30 PM



Cantera Road

Warrants

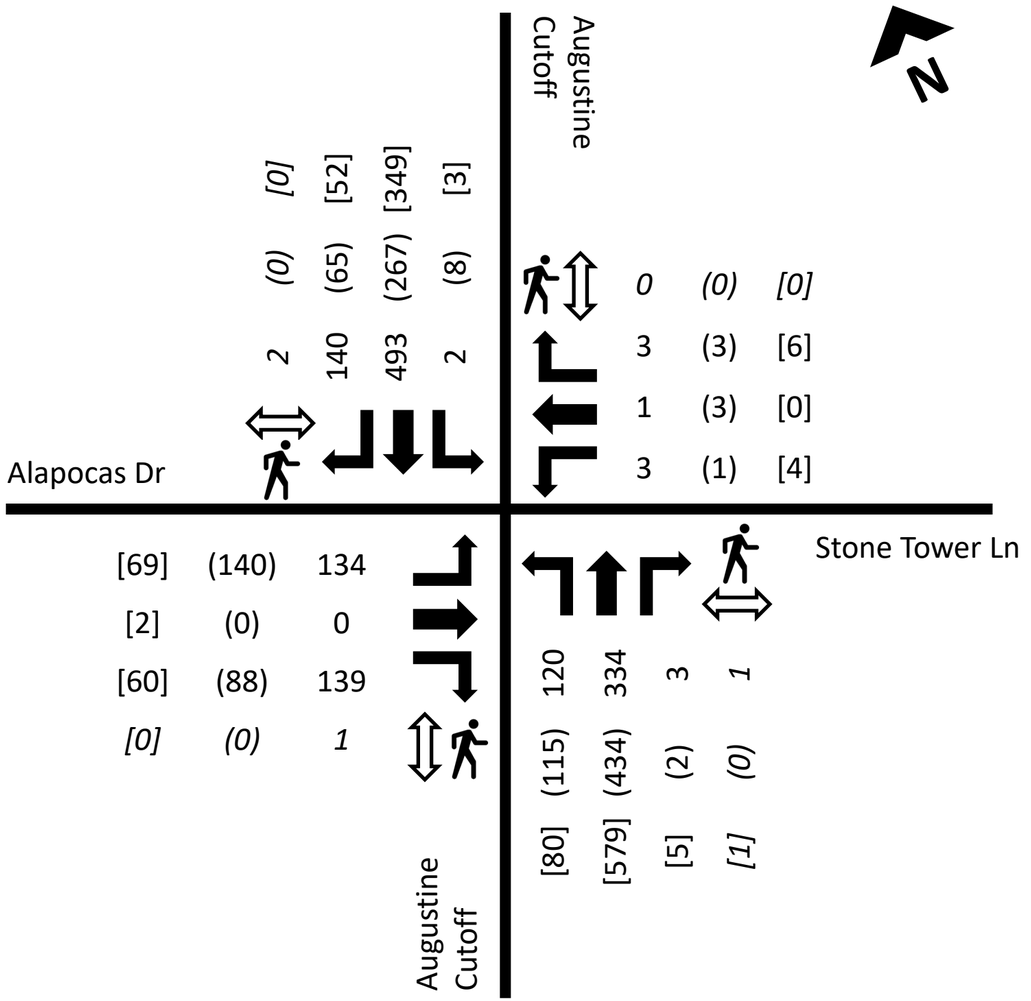
Signal

- Signal warranted due to warrant 3 being met

Warrant	Criteria Needed	Criteria Met	Warrant Met?
1. 8-hour Vehicle Volume			**No**
1A. Minimum Vehicle Volume	8	1	No
1B. Interruption of Continuous Traffic	8	3	No
1C. Combination	8	2	No
2. 4-hour Vehicle Volume	**4**	**3**	**No**
3. Peak Hour Vehicle Volume	**1**	**2**	**Yes**
4. Pedestrian Volume			**No**
4A. 4-hour Pedestrian Volume	4	0	No
4B. Peak Hour Pedestrian Volume	1	0	No
5. School Crossing	**---**	**---**	**No**
6. Coordinated Signal System	**---**	**---**	**No**
7. Crash Experience	**5**	**0**	**No**
8. Roadway Network	**---**	**---**	**No**
9. Grade Crossing	**---**	**---**	**No**

Alapocas Drive Volumes

- Collected Tuesday January 28, 2025
  - 6AM – 7PM
  - Typical school and work day
- Pedestrian (italics) included
- Bicycle traffic counted as vehicles since in the road
- 3 peak hours identified and studied
  - AM Peak: 7:30-8:30 AM
  - (School Dismissal): 2:45-3:45 PM
  - [PM Peak]: 4:30-5:30 PM



Intersection Control Evaluation (ICE)

- Federal standard for determining form of intersection control
  - Extensively researched
  - Transparent
  - Data-driven decision making
  - Considers operations, safety, right-of-way, environment, surrounding land use, social equity, and stakeholder input
- Delaware does not have an official ICE policy, but this project will utilize federal best practices
- Helps ensure decisions are not influenced by pre-conceived notions of the project site
- Will consider:
  - Yield Control
  - Two-Way Stop Control
  - All-Way Stop Control
  - Maintain existing signal
  - Mini Roundabout
  - Full Single-Lane Roundabout
  - Grade Separation

Alapocas Drive ICE Evaluation

Suitability Assessment

Not Appropriate

- Yield Control
  - Sight distance concerns
  - Volumes too high
- Two-way stop control
  - Sight distance concerns
  - Long delays and queues on Alapocas Dr
- Mini roundabout
  - Not appropriate on a road like Augustine Cutoff
- Grade Separated Intersection
  - Not appropriate in a residential area

Potentially Appropriate, Then Eliminated

- All-way stop control
  - Queues on Augustine Cutoff too long
  - Extensive delays on Alapocas Dr

Potentially Appropriate

- Roundabout
- Existing signal

Alapocas Drive

Warrants

Signal

- Signal warranted due to warrants 1, 2, and 3 being met

Warrant	Criteria Needed	Criteria Met	Warrant Met?
1. 8-hour Vehicle Volume			**Yes**
1A. Minimum Vehicle Volume	8	6	No
1B. Interruption of Continuous Traffic	8	8	Yes
1C. Combination	8	7	No
2. 4-hour Vehicle Volume	**4**	**6**	**Yes**
3. Peak Hour Vehicle Volume	**1**	**5**	**Yes**
4. Pedestrian Volume			**No**
4A. 4-hour Pedestrian Volume	4	0	No
4B. Peak Hour Pedestrian Volume	1	0	No
5. School Crossing	**---**	**---**	**No**
6. Coordinated Signal System	**---**	**---**	**No**
7. Crash Experience	**5**	**2**	**No**
8. Roadway Network	**---**	**---**	**No**
9. Grade Crossing	**---**	**---**	**No**

Roundabout

- Capacity sufficient (future growth not a factor in urban environment)
- Volume split requires further analysis (next slide)

AM Peak Period/School Arrival				
Direction	**Volume/Capacity**		**Total Volume Split**	
NB Augustine Cutoff	0.38	Consider Future Growth	80%	Moderately Unbalanced (Analyze Further)
SB Augustine Cutoff	0.52			
EB Alapocas Drive	0.33			
WB Stone Tower Lane	0.01		20%	

School Dismissal				
Direction	**Volume/Capacity**		**Total Volume Split**	
NB Augustine Cutoff	0.46	Sufficient Capacity	79%	Moderately Unbalanced (Analyze Further)
SB Augustine Cutoff	0.28			
EB Alapocas Drive	0.22			
WB Stone Tower Lane	0.01		21%	

PM Peak Period				
Direction	**Volume/Capacity**		**Total Volume Split**	
NB Augustine Cutoff	0.52	Consider Future Growth	88%	Moderately Unbalanced (Analyze Further)
SB Augustine Cutoff	0.32			
EB Alapocas Drive	0.14			
WB Stone Tower Lane	0.02		12%	

Signal – Right-Turn Lane Needs

- Sought to determine which approaches need right-turn lanes if signalized
- Uses January 2025 volumes
- Right-turn lanes recommended on NB, SB, and EB approaches

Average Delay per Vehicle	Channelization			Right-Turn Lane			No Turn Lane		
	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak
NB Augustine Cutoff	10 sec	4 sec	7 sec	8 sec	4 sec	8 sec	13 sec	5 sec	8 sec
SB Augustine Cutoff	14 sec	5 sec	9 sec	14 sec	5 sec	10 sec	22 sec	6 sec	10 sec
EB Alapocas Drive	18 sec	7 sec	11 sec	18 sec	7 sec	18 sec	26 sec	9 sec	18 sec
WB Stone Tower Lane	1 sec	1 sec	19 sec	17 sec	1 sec	15 sec	4 sec	4 sec	15 sec

Median / 95th Percentile Queue Length	Channelization (Existing)			Right-Turn Lane			No Turn Lane		
	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak
NB Augustine Cutoff	86 ft / 188 ft	37 ft / 96 ft	86 ft / 173 ft	55 ft / 108 ft	31 ft / 83 ft	86 ft / 173 ft	103 ft / 197 ft	45 ft / 102 ft	102 ft / 206 ft
SB Augustine Cutoff	143 ft / 241 ft	40 ft / 88 ft	83 ft / 152 ft	152 ft / 259 ft	31 ft / 78 ft	83 ft / 152 ft	221 ft / 404 ft	47 ft / 96 ft	93 ft / 157 ft
EB Alapocas Drive	113 ft / 198 ft	17 ft / 42 ft	50 ft / 106 ft	72 ft / 135 ft	13 ft / 37 ft	50 ft / 106 ft	129 ft / 241 ft	32 ft / 65 ft	59 ft / 100 ft
WB Stone Tower Lane	0 ft / 1 ft	0 ft / 1 ft	6 ft / 27 ft	1 ft / 11 ft	0 ft / 1 ft	3 ft / 18 ft	3 ft / 17 ft	9 ft / 31 ft	9 ft / 30 ft

Alapocas Drive Capacity Analysis

Signal vs. Roundabout

- Multiple model simulations averaged
- Uses January 2025 volumes
- Accounts for volumes and traffic movements at adjacent intersections
- Roundabout option represents a significant improvement compared to a signal

Average Delay per Vehicle	Existing Signal			Roundabout			Proposed Signal		
	AM Peak	School Dismissal	PM Peak	AM Peak	School Dismissal	PM Peak	AM Peak	School Dismissal	PM Peak
NB Augustine Cutoff	9 sec	10 sec	7 sec	7 sec	11 sec	8 sec	10 sec	11 sec	7 sec
SB Augustine Cutoff	14 sec	12 sec	8 sec	15 sec	6 sec	6 sec	13 sec	12 sec	8 sec
EB Alapocas Drive	24 sec	20 sec	14 sec	5 sec	4 sec	4 sec	16 sec	16 sec	15 sec
WB Stone Tower Lane	20 sec	14 sec	8 sec	2 sec	4 sec	2 sec	18 sec	17 sec	6 sec
Intersection	*14 sec*	*13 sec*	*8 sec*	*10 sec*	*8 sec*	*7 sec*	*13 sec*	*13 sec*	*9 sec*

Median / 95th Percentile Queue Length	Existing Signal			Roundabout			Proposed Signal		
	AM Peak	School Dismissal	PM Peak	AM Peak	School Dismissal	PM Peak	AM Peak	School Dismissal	PM Peak
NB Augustine Cutoff	71 ft / 166 ft	109 ft / 255 ft	92 ft / 212 ft	49 ft / 131 ft	66 ft / 223 ft	37 ft / 120 ft	75 ft / 175 ft	117 ft / 291 ft	101 ft / 208 ft
SB Augustine Cutoff	153 ft / 330 ft	86 ft / 177 ft	77 ft / 173 ft	102 ft / 307 ft	28 ft / 71 ft	28 ft / 74 ft	147 ft / 320 ft	86 ft / 183 ft	79 ft / 172 ft
EB Alapocas Drive	122 ft / 272 ft	97 ft / 214 ft	49 ft / 116 ft	38 ft / 87 ft	29 ft / 67 ft	20 ft / 50 ft	85 ft / 215 ft	77 ft / 172 ft	41 ft / 90 ft
WB Stone Tower Lane	4 ft / 21 ft	4 ft / 22 ft	3 ft / 20 ft	1 ft / 12 ft	1 ft / 10 ft	1 ft / 10 ft	3 ft / 21 ft	5 ft / 23 ft	6 ft / 44 ft

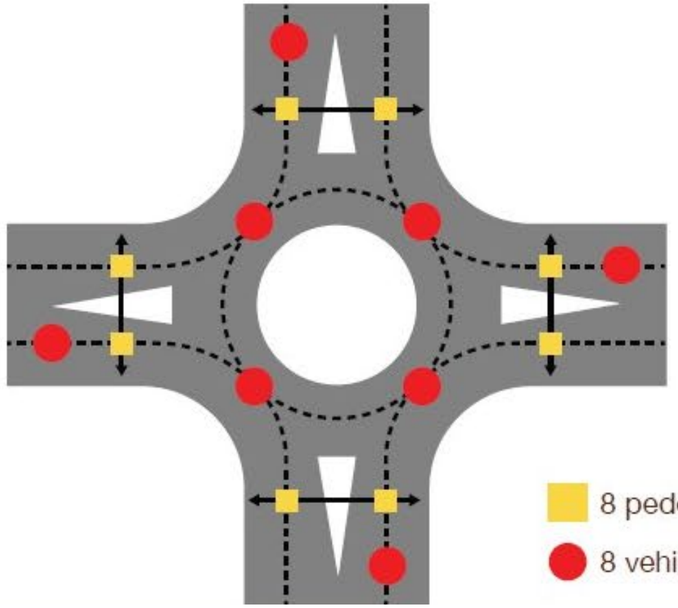
Alapocas Drive Roundabout vs. Signal

	Single-Lane Roundabout	*Signalized Intersection*
Safety		
Conflict Points	*8 vehicle conflict points* *8 pedestrian conflict points*	*32 vehicle conflict points* *24 pedestrian conflict points*
Crash Severity	*Eliminates most dangerous crash types*	*Does not eliminate most dangerous crash types*
Traffic Calming Benefit	*Yes*	*No*
Bike/Pedestrian Design		
Bike/Pedestrian Crossing Distance	*Shorter*	*Longer*
Median Refuge Islands	*Yes*	*No*
Signal Controlled Crossing	*No*	*Yes*
Motor Vehicle Operations		
Delay	*Lower*	*Higher*
Queue Length	*Shorter*	*Longer*
Additional Considerations		
Space Required	*Lower*	*Higher*
Long-Term Operational Costs	*Lower*	*Higher*
Long-Term Landscaping Costs	*Higher*	*Lower*

Alapocas Drive

Conflict Points

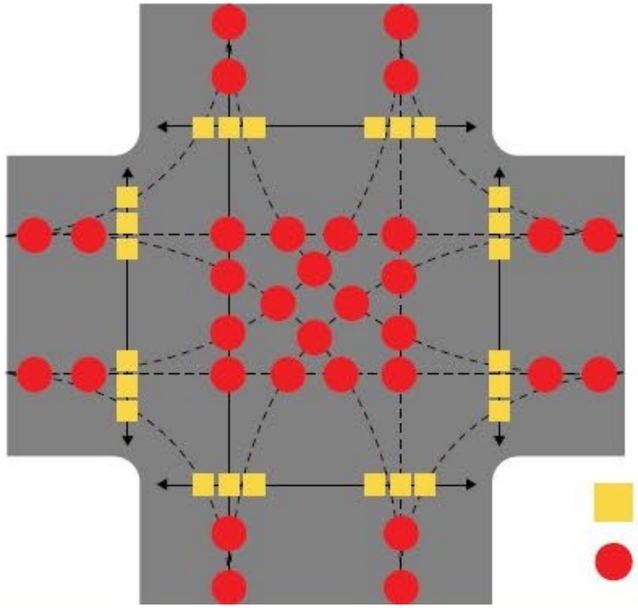
ROUNDABOUT



8 pedestrian conflicts

8 vehicle conflicts

INTERSECTION



24 pedestrian conflicts

32 vehicle conflicts

Courtesy: Montana DOT

Existing Roundabouts

- Neighborhoods/Residential
  - 5th Street at Old Elm Avenue (Delaware City)
  - St Annes Church Road at Wallasey Drive and Tywyn Drive (Middletown) – 2 roundabouts
  - Barratts Chapel Road at Cornellian Drive/Buffalo Road (Frederica)
  - Beaver Dam Road at Quiet Harbor Way (Lewes)
  - New Road at Lynn Road (Lewes)
  - Sand Hill Road at Clark Drive (Georgetown)
  - Sheep Pen Road at Wright Way/Olney Way (Millsboro) – 2 roundabouts
- Schools
  - Woodlawn Road at The Pilot School (Talleyville)
  - Bunker Hill Road at School Drive (Middletown)
- Businesses
  - Brick Mill Road at Dove Run Centre Drive (Middletown)

Alapocas Drive

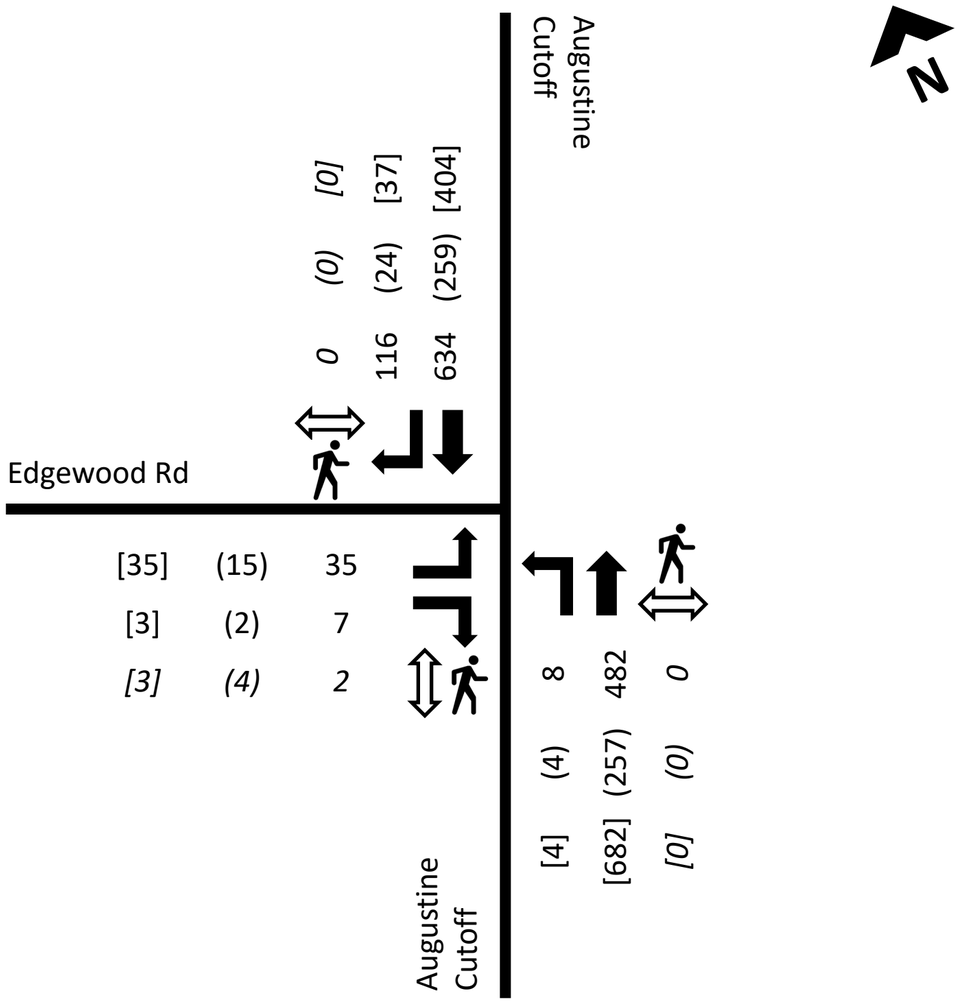
Roundabout Neighborhood Access

In Construction/Approved Roundabouts

- Lorewood Grove Road west of SR 1 (Middletown) – 2 roundabouts
- Plantation Road at Plantations Boulevard/Mitchell Drive (Lewes)
- Kings Highway at Clay Road (Lewes) – future development on east side
- Kings Highway at the Lodge at Historic Lewes (Lewes)

Edgewood Road Volumes

- Collected Tuesday January 28, 2025
  - 6AM – 7PM
  - Typical school and work day
- Pedestrian (italics) included
- Bicycle traffic counted as vehicles since in the road
- 3 peak hours identified and studied
  - AM Peak: 7:30-8:30 AM
  - (Midday Peak): 11:30 AM-12:30 PM
  - [PM Peak]: 4:30-5:30 PM



Edgewood Road

Warrants

Signal

- Signal not warranted due to no individual warrants being met

Roundabout

- Roundabout not appropriate due to required footprint impacting private property

Warrant	Criteria Needed	Criteria Met	Warrant Met?
1. 8-hour Vehicle Volume			**No**
1A. Minimum Vehicle Volume	8	0	No
1B. Interruption of Continuous Traffic	8	0	No
1C. Combination	8	0	No
2. 4-hour Vehicle Volume	**4**	**0**	**No**
3. Peak Hour Vehicle Volume	**1**	**0**	**No**
4. Pedestrian Volume			**No**
4A. 4-hour Pedestrian Volume	4	0	No
4B. Peak Hour Pedestrian Volume	1	0	No
5. School Crossing	**---**	**---**	**No**
6. Coordinated Signal System	**---**	**---**	**No**
7. Crash Experience	**5**	**1**	**No**
8. Roadway Network	**---**	**---**	**No**
9. Grade Crossing	**---**	**---**	**No**

Edgewood Road Capacity Analysis

Delay and Queueing Analysis

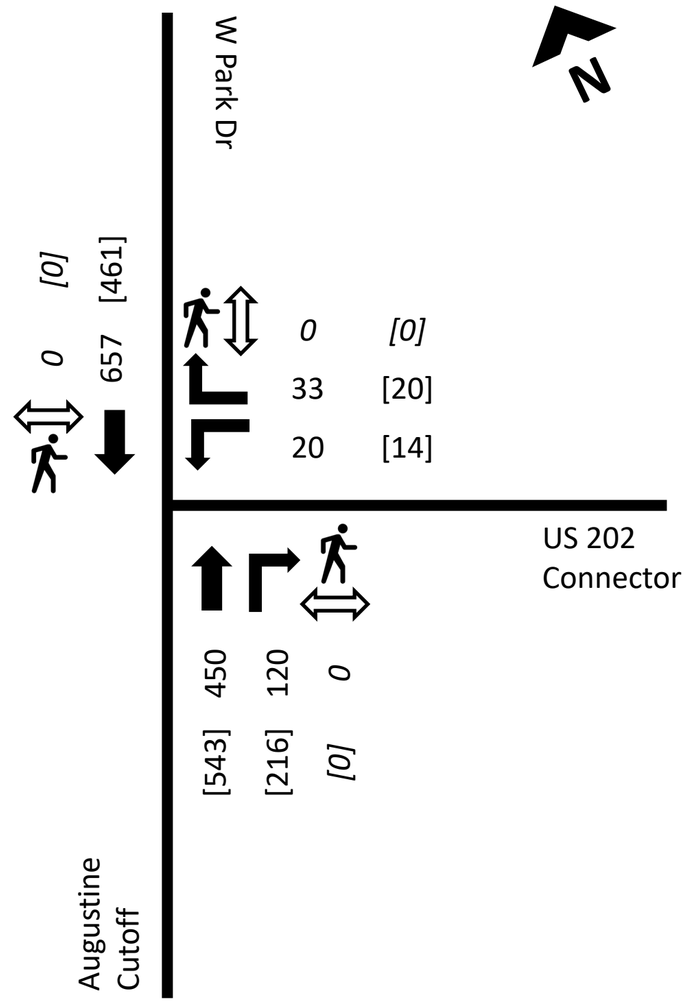
- Uses January 2025 volumes
- Removal of the NB Augustine Cutoff left-turn lane to Edgewood Road would have negligible impacts to operations

Average Delay per Vehicle	Existing Configuration			Removal of NB Left Turn Lane		
	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak
NB Augustine Cutoff Left	9.7 sec	7.9 sec	8.4 sec	0.3 sec	0.1 sec	0.1 sec
NB Augustine Cutoff Through	---	---	---			
SB Augustine Cutoff Through	---	---	---	---	---	---
EB Edgewood Road	28.1 sec	12.4 sec	26.1 sec	28.1 sec	12.4 sec	26.1 sec
Intersection	*1.0 sec*	*0.4 sec*	*0.9 sec*	*1.1 sec*	*0.4 sec*	*0.9 sec*

95th Percentile Queue Length	Existing Signal			Removal of NB Left Turn Lane		
	AM Peak	Midday Peak	PM Peak	AM Peak	Midday Peak	PM Peak
NB Augustine Cutoff Left	1 ft	0 ft	0 ft	1 ft	0 ft	0 ft
NB Augustine Cutoff Through	---	---	---			
SB Augustine Cutoff Through	---	---	---	---	---	---
EB Edgewood Road	21 ft	3 ft	18 ft	21 ft	3 ft	18 ft

US 202 Connector Volumes

- Collected Wednesday May 8, 2025
  - 7:15-8:15AM, 4:15-5:15PM (based on peak hours in historical counts)
  - Typical school and work day
- Pedestrian (italics) included
- No bicycles observed in road
- 2 peak hours identified and studied
  - AM Peak
  - [PM Peak]



US 202 Connector Observations

- Current storage:
  - Left Lane: approximately 360 ft or 18 vehicles
  - Right Lane: approximately 260 ft or 13 vehicles
- AM Peak (4/29/25 7:20-7:55 AM)
  - Longest queue in a single lane: 7 vehicles
  - Highest total queue between both lanes: 11 vehicles
- PM Peak (4/28/25 3:45-4:05 PM)
  - Longest queue in a single lane: 5 vehicles
  - Highest total queue between both lanes: 9 vehicles

One vs. Two Right-Turn Lanes

- Multiple model simulations averaged
- Uses May 2025 volumes
- A single turn lane increases queues and delays
- All scenarios remain within the storage capacity of the turn lane(s)

	Existing – Two Turn Lanes		One Turn Lane	
	AM Peak	PM Peak	AM Peak	PM Peak
Avg. Delay/Vehicle	16 sec	26 sec	25 sec	48 sec
Median / 95th Percentile Queue Length	41 ft / 96 ft	86 ft / 146 ft	80 ft / 185 ft	186 ft / 326 ft
Turn Lane Storage Length	Approximately 360 ft			