



SR 54 Corridor Study

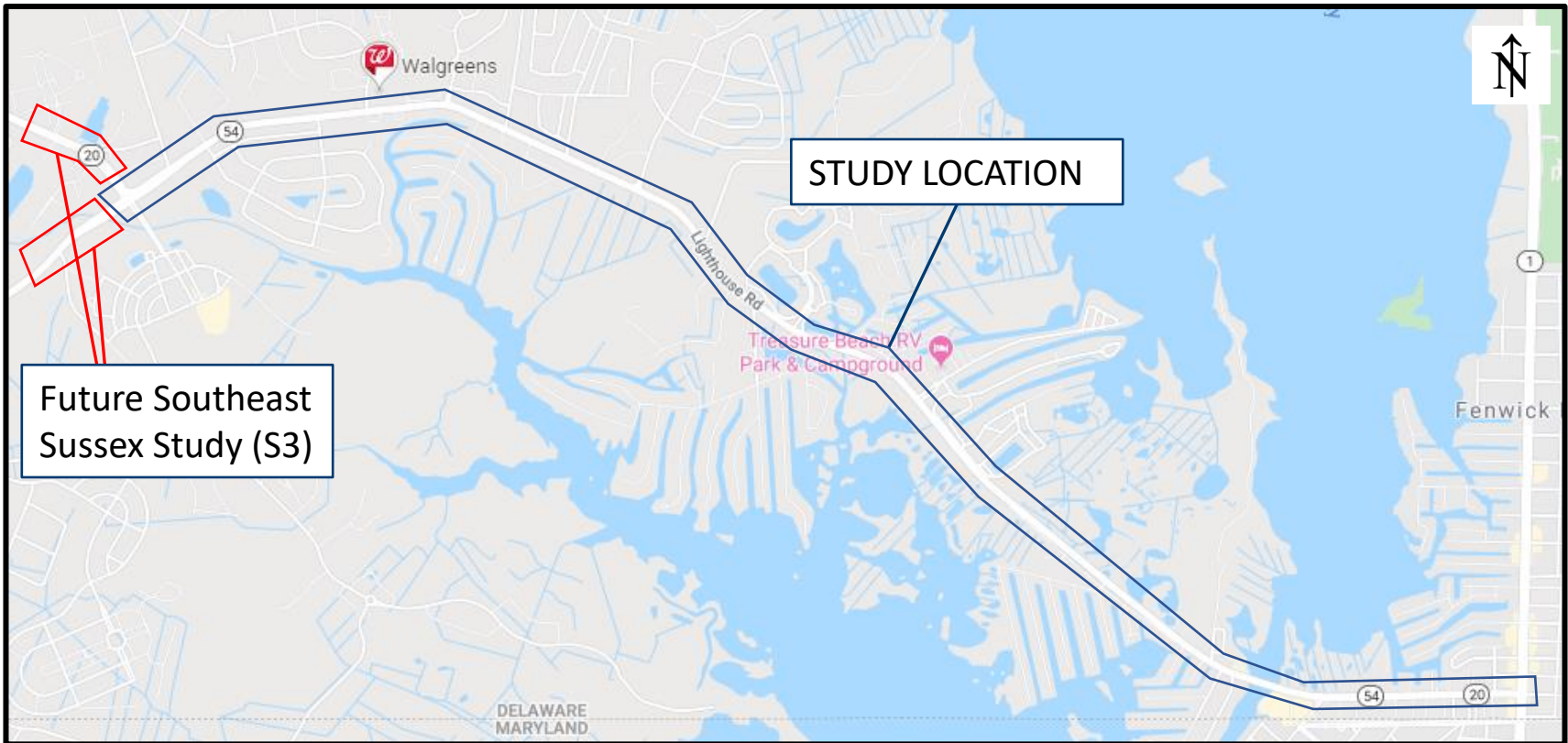
SR 1 to SR 20/Americana Parkway in Sussex County, Delaware

May 2021



Project Location/Study Scope

- Review crash history to identify trends
- Observe and collect pedestrian, bicycle, and traffic data
- Review proposed land development activity along the corridor
- Complete corridor analysis including signalized and unsignalized locations
- Develop short-term and long-term alternatives



- Virtual Field Meeting held December 9, 2020
- Stakeholders
 - DeIDOT
 - Delaware State Police
 - Delaware Transit Corporation
 - Delaware Office of Highway Safety
 - Federal Highway Administration
 - Bike Delaware
 - University of Delaware
 - SSCCAG Community Group
 - Sussex County Council
 - Delaware General Assembly
 - Town of Fenwick Island
 - Town of Selbyville
- Identified potential pedestrian improvements at focus areas based on a review of Existing Condition figures and field conditions
- Field meeting outcomes used to guide this study's assessments

**Delaware's Pedestrian /
Bicycle / Roadway
Safety Audits**

https://deldot.gov/Programs/DS_HSP/index.shtml?dc=pedestrian_safety

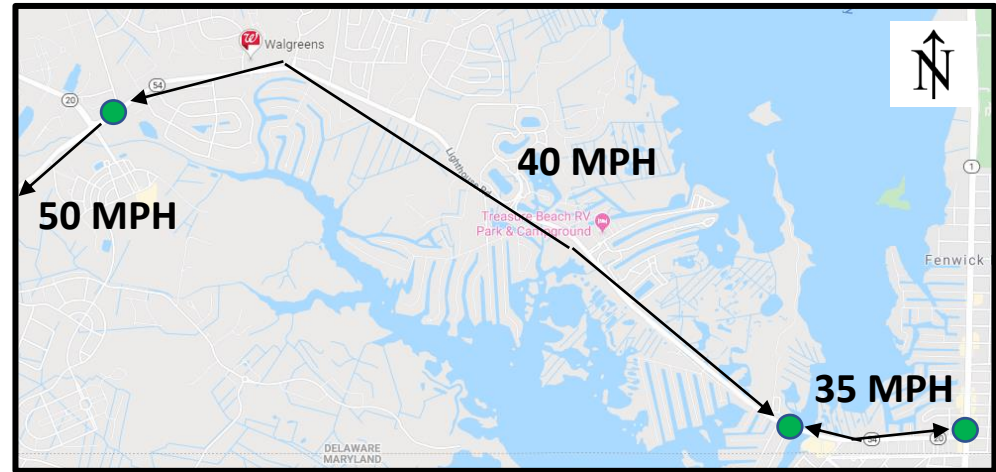
REPORTED DATA

- 4.0-mile Major Collector
- Roadway Characteristics
 - SR 1 to Mallard Lakes Road: two-lane, undivided
 - Mallard Lakes Road to SR 20: two-lane, undivided with two-way left-turn lane, sidewalk provided on both sides of road
 - Variable shoulder widths and turn lanes at major intersections
- Traffic Control
 - 8 signalized intersections
 - 15 unsignalized intersections
 - Numerous unsignalized crossovers/u-turn locations and private driveways
 - Traffic counts conducted May 2019 and July 2019
- No existing transit stops

SR 54 Corridor

Existing Conditions

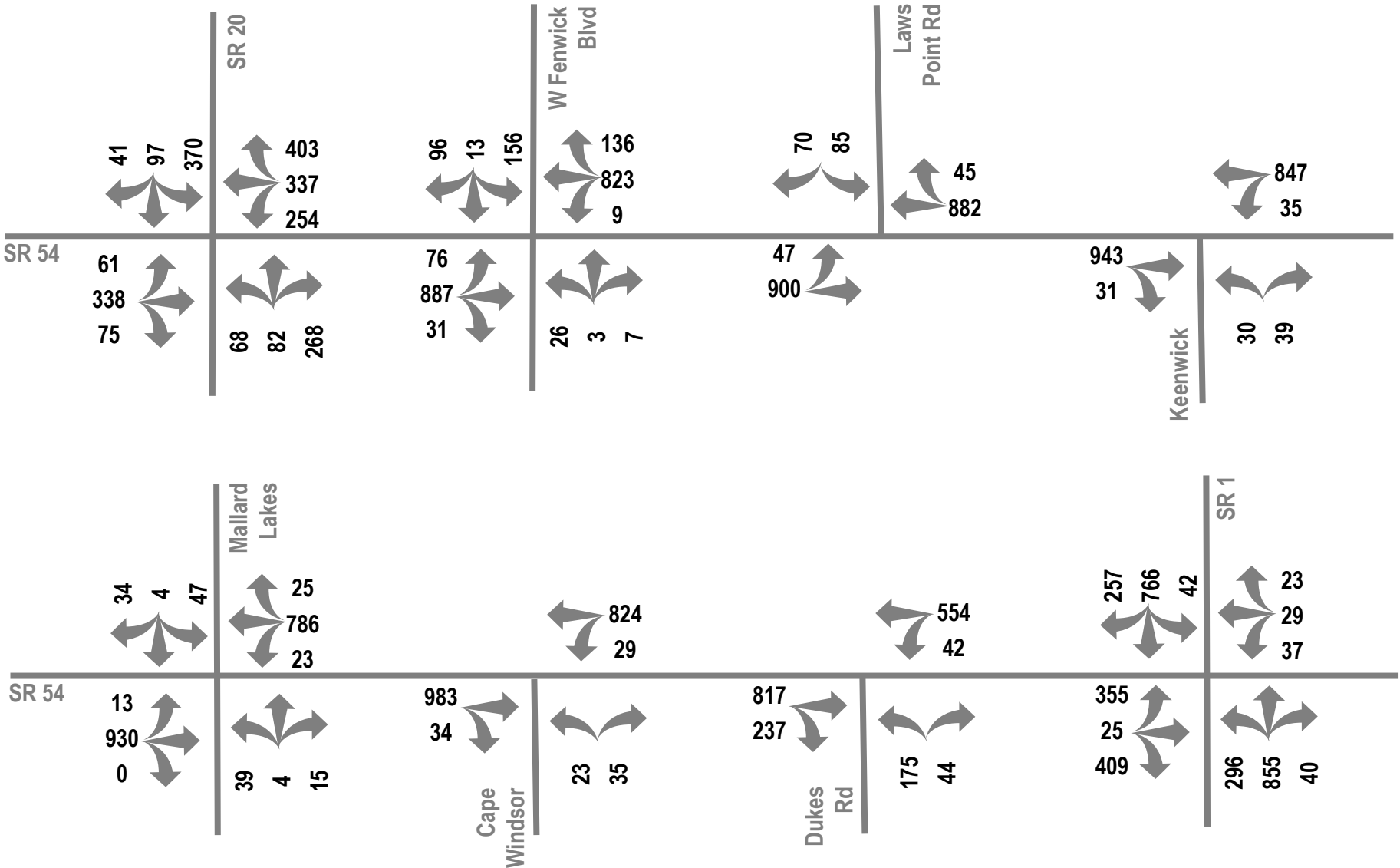
- Posted Speed Limit
 - SR 1 to Madison Avenue: 35 MPH
 - Madison Avenue to Old Mill Bridge Road: 40 MPH
 - Old Mill Bridge Road to SR 20: 50 MPH
- AADT (2019 DeIDOT Traffic Summary)
 - W of SR 20 to Dukes Ave: 7,769
 - Dukes Ave to SR 1: 7,411
- High Pedestrian Activity
 - SR 1 at SR 54 intersection
 - especially Saturdays
 - SR 54 at SR 20
 - SR 54 at W Fenwick Blvd



Westbound SR 54 at Keenwick

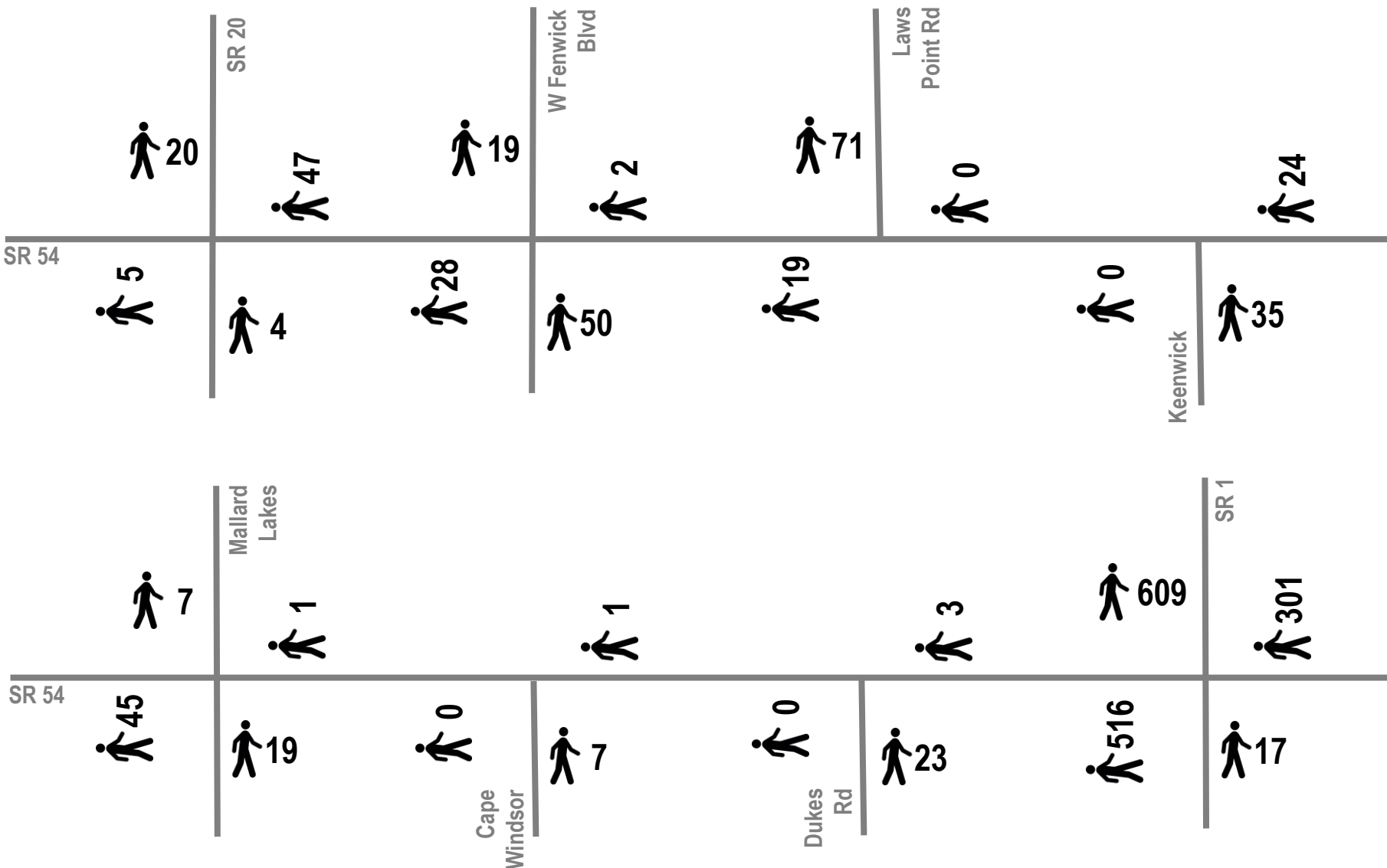
SR 54 Corridor

Traffic Counts: Saturday Peak



SR 54 Corridor

Traffic Counts: Peds/Bikes

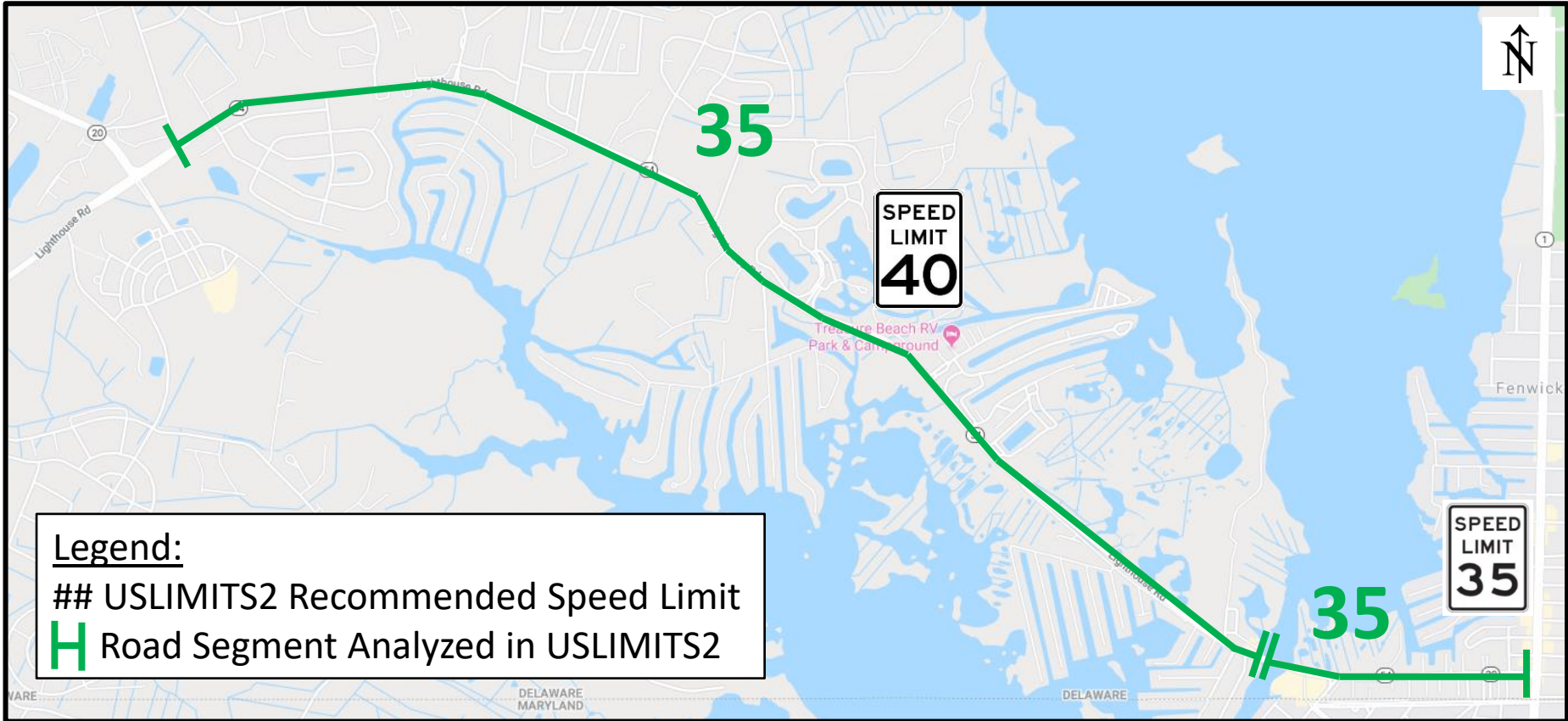


*See slide 18 for sidewalk gap assessments

- Radar speed studies conducted in August 2019
- Average speeds are between 32 and 36 mph
- 85th-percentile speeds are lower or equal to the posted 40 mph speed limit zone
- 85th-percentile speeds are 4-5 mph higher than the posted 35 mph speed limit

Location	Posted Speed Limit (mph)	Eastbound SR 54		Westbound SR 54	
		Average Speed (mph)	85 th -Percentile Speed (mph)	Average Speed (mph)	85 th -Percentile Speed (mph)
Lighthouse Cove Lane	35 mph	36 mph	40 mph	35 mph	39 mph
Salty Way	40 mph	35 mph	38 mph	36 mph	40 mph
Bluewater Run	40 mph	32 mph	36 mph	32 mph	37 mph

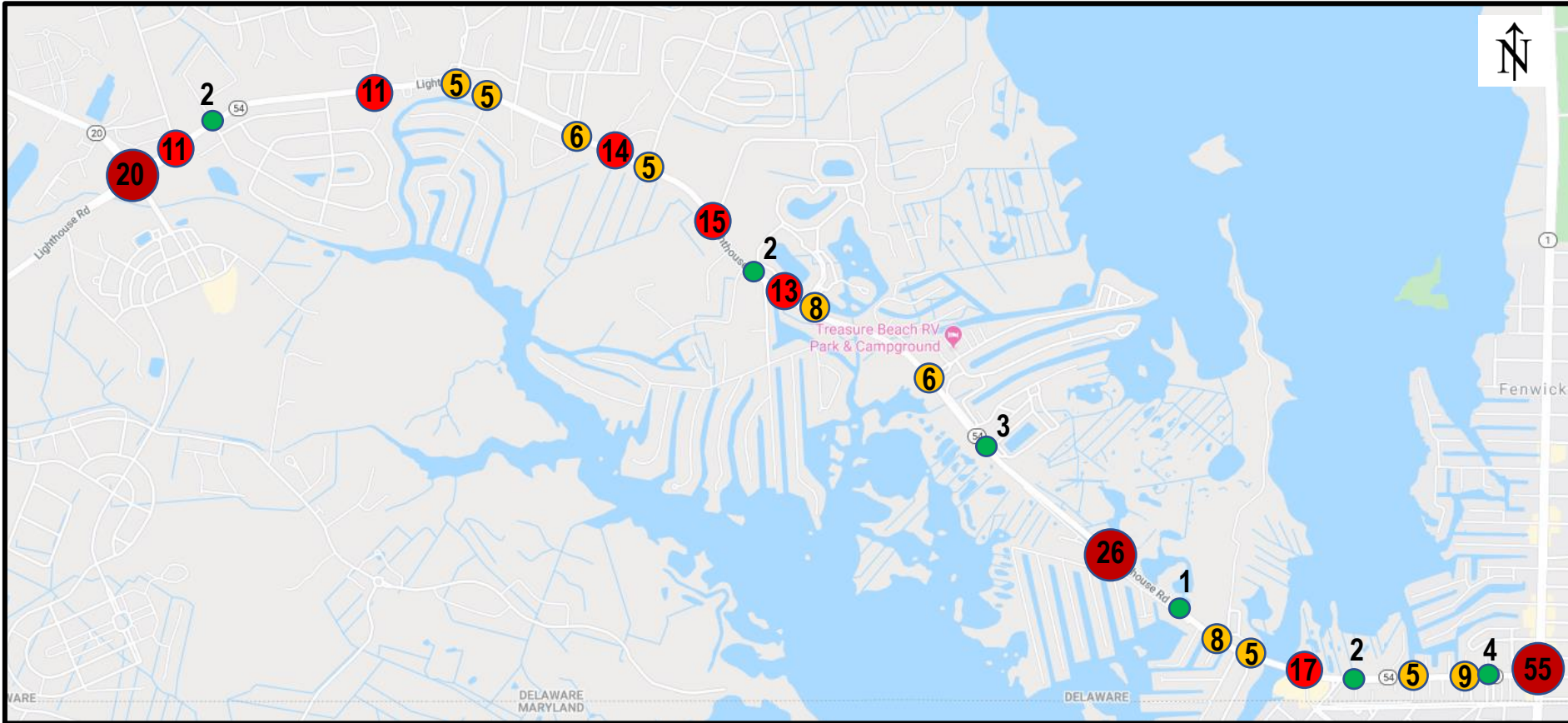
USLIMITS2 Analysis



Crash Trends

(January 2014 to May 2020)

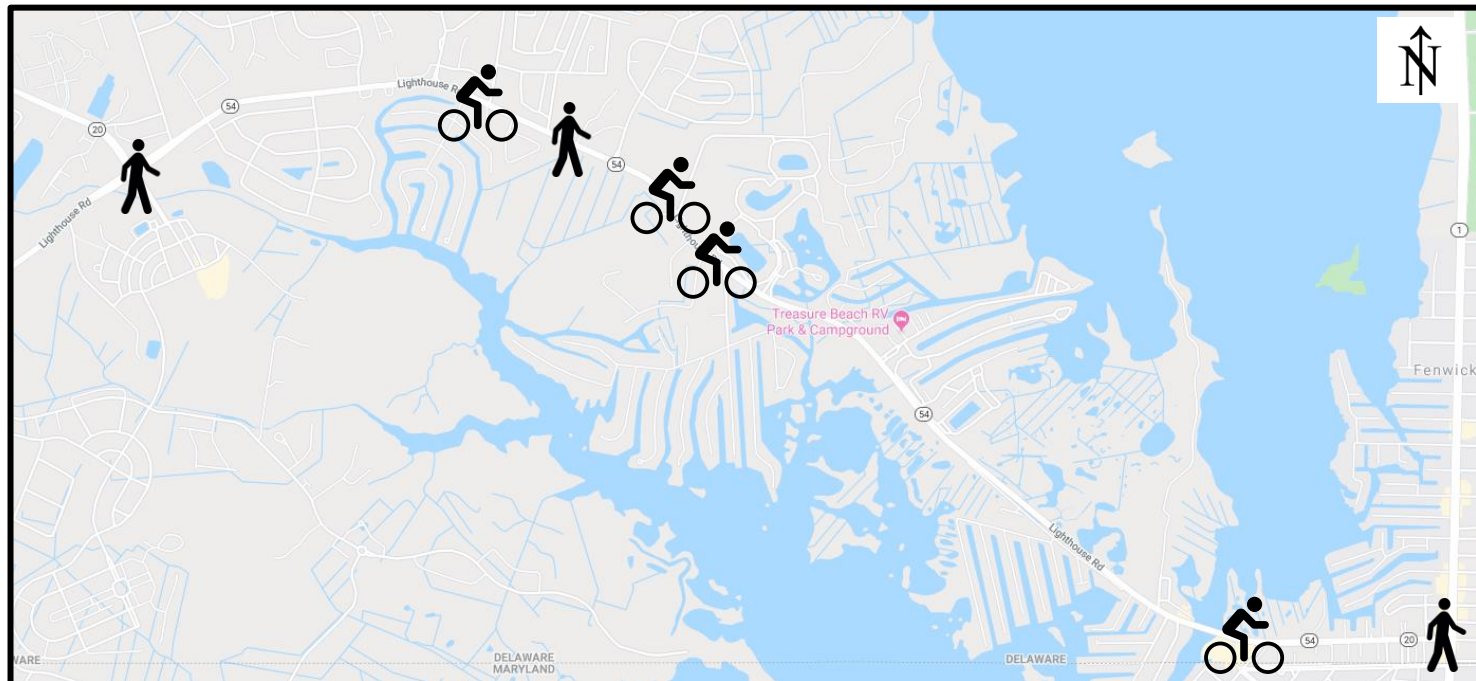
289 crashes



Crash Trends: Ped/Bike

(January 2014 to May 2020)

- 7 total crashes; 4 bike, 3 ped
- 5 ped/bike crashes occurred within 200 feet of a signalized crosswalk
- 5 ped/bike crashes occurred on a Saturday or Sunday
- 4 ped/bike crashes occurred at nighttime
 - 3 of these occurred in unlit locations
- 3 ped/bike crashes involved an impaired ped/bicyclist
- 0 ped/bike fatal crashes



Crash Trends: Lighting

(January 2014 to May 2020)

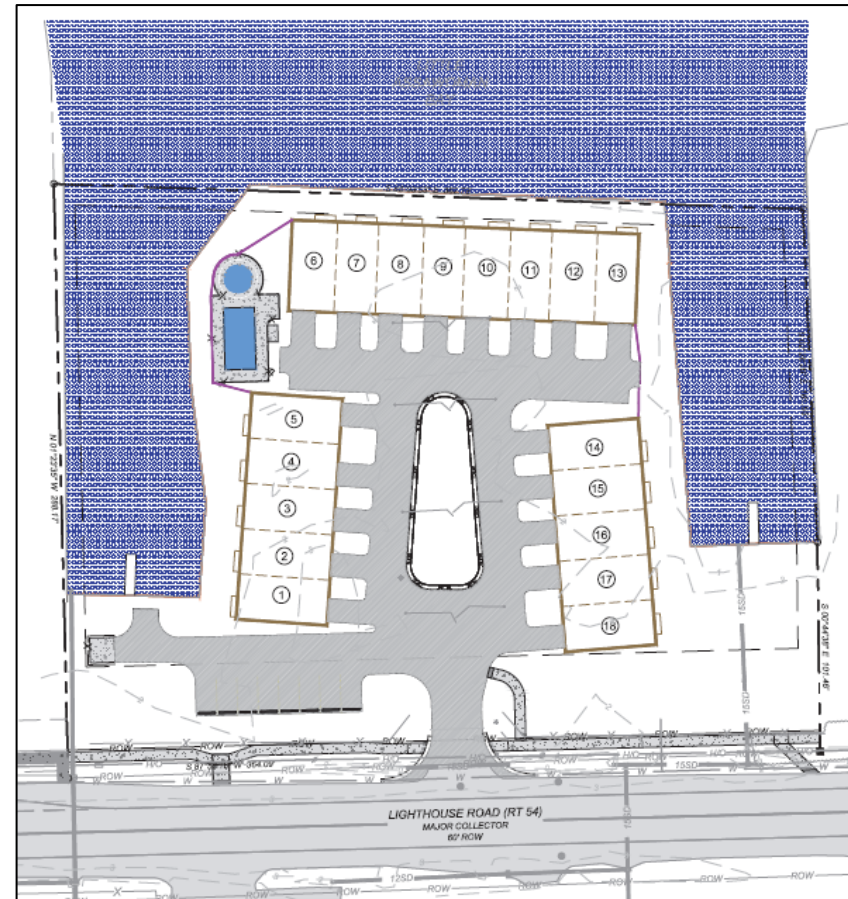
Location (SR 54 at)	All Crashes			Ped + Bike Crashes			Form A Score
	Total Crashes	Nighttime Crashes		Total Crashes	Nighttime Crashes		
		No.	%		No.	%	
SR 20	20	5	25%	1	1	100%	14
Old Mill Bridge Rd	11	4	36%	0	0	-	11
Bluewater Run	2	0	0%	0	0	-	-
W Fenwick Blvd	11	1	9%	0	0	-	-
Leisure Dr/Salty Way	10	2	20%	1	0	0%	-
Teaberry Circle	6	0	0%	0	0	-	-
Laws Point Rd	14	3	21%	1	1	100%	12
Bayville Shores Dr	5	1	20%	0	0	-	-
Bayville Rd	15	9	60%	1	0	0%	13
Keenwick Rd	13	5	38%	1	1	100%	14
Mallard Lakes Rd	8	4	50%	0	0	-	14
Pirates Trail/Mallard Cove	9	1	11%	0	0	-	-
Cape Windsor	26	4	15%	0	0	-	-
Bennett Ave	8	1	13%	0	0	-	-
Madison Ave	5	3	60%	0	0	-	6
Dukes Ave	17	4	24%	1	0	0%	-
Beacon Dr	9	0	0%	0	0	-	-
SR 1	55	18	33%	1	1	100%	19
Totals	236	65	28%	7	4	57%	-

% Nighttime Crashes ≥ 35%*

* DelDOT's Lighting Design Guidelines (October 2012) indicates lighting may be installed where the percentage of nighttime crashes is 35 percent or greater

- 2019 Signal Retiming
 - SR 1 to SR 20
 - Implemented November 2019
- Southeast Sussex Study (S3)
 - North and west of the SR 54 Corridor Study location
 - Will include assessment of nearby Arrington Drive/Tidal Road, Old Mill Bridge Road, and W Fenwick Boulevard “quadrant”
- SR 54 Multi-Modal Improvements
 - Blue Beard Trail to Monroe Avenue
 - FY25 in CTP

- Developer Projects
 - Zonko Property
 - South side of SR 54 at Bayville Road
 - Canon Property
 - North side of SR 54 at Bennett Ave
 - 70 single family homes, hotel, & restaurant
 - Potential roundabout included on Bennett Ave
 - Lighthouse View Phase 2B
 - 8 multi-family midrise housing units
 - Fenwick Light (The Townes at Bayshore Village)
 - 18 multi-family midrise housing units



Fenwick Light Proposed Development

SR 54 Corridor Travel Times

Bluetooth Data



	Time Period	Scenario	Travel Time	% Difference
EB SR 54	AM	Jan 2019 TTR	408 s	
		Feb 2020 TTR	414 s	+ 1%
	Mid	Jan 2019 TTR	432 s	
		Feb 2020 TTR	432 s	- 0%
	PM	Jan 2019 TTR	420 s	
		Feb 2020 TTR	413 s	- 2%
	Summer Saturday	July 2019 TTR	1,272 s	
		July 2020 TTR	1,146 s	- 10%
WB SR 54	AM	Jan 2019 TTR	438 s	
		Feb 2020 TTR	395 s	- 10%
	Mid	Jan 2019 TTR	432 s	
		Feb 2020 TTR	432 s	- 0%
	PM	Jan 2019 TTR	450 s	
		Feb 2020 TTR	414 s	- 8%
	Summer Saturday	July 2019 TTR	990 s	
		July 2020 TTR	1,044 s	+ 5%

Zone S012 SR 54 SR 1 to SR 20 runs Traffic Responsive

SR 1 and SR 20 are not included in Zone S012 but are included in the Green Band Analysis

SR 54 Corridor Travel Times

Summer Saturday



SR 54 EB vehicles departing SR 20



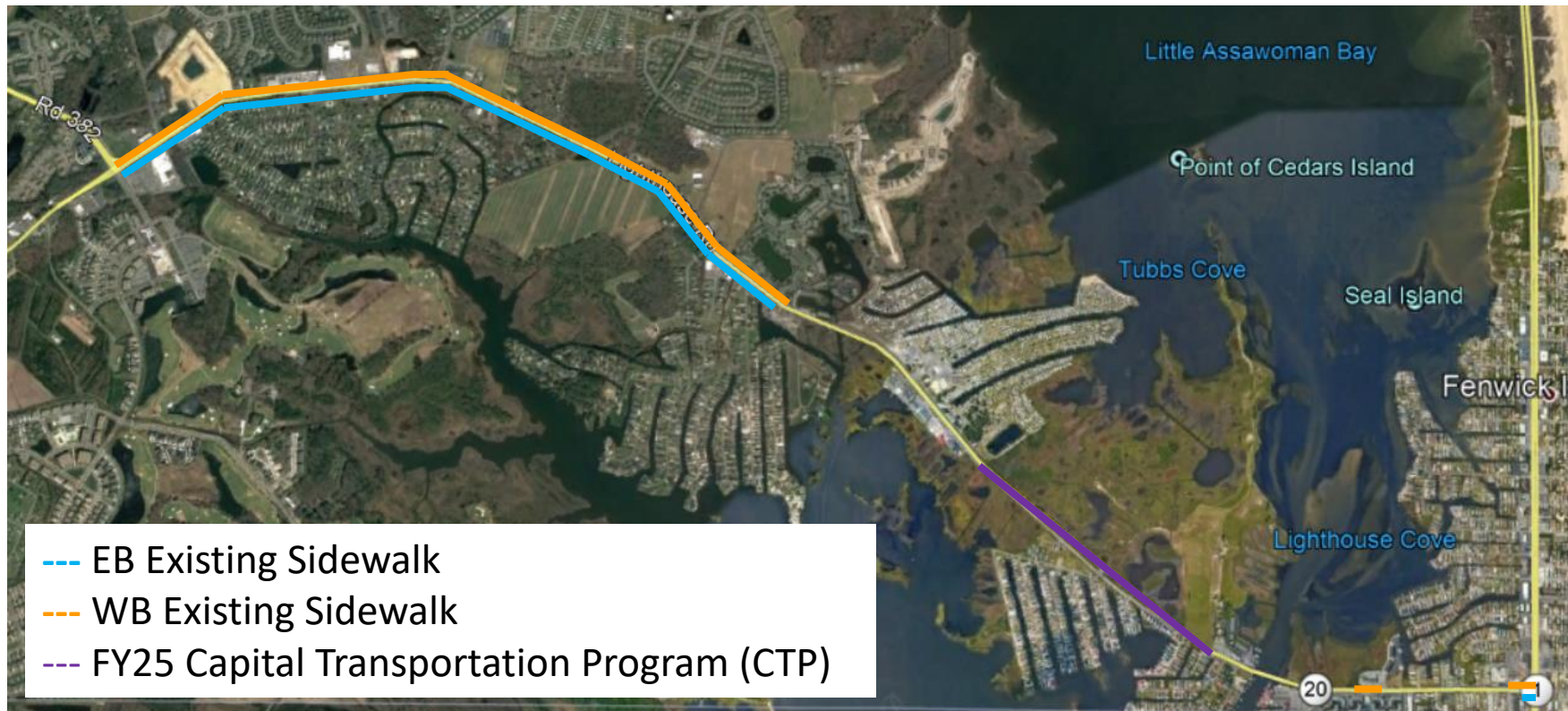
SR 54 EB vehicles approaching SR 20



SR 54 at SR 20 queuing

Sidewalk Gap Assessment

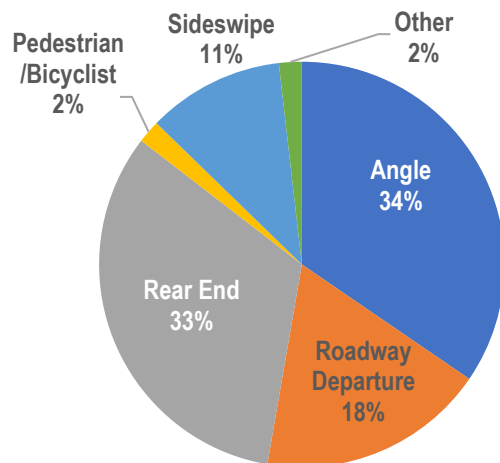
Direction	Beginning Point	Ending Point	Distance
Westbound SR 54	125 ft east of Virginia Avenue	Beacon Drive	1,700 ft
	390 ft east of Dukes Road	Mallard Lakes	9,045 ft
Eastbound SR 54	300 ft west of Mallard Lakes	120 ft east of SR 1	11,445 ft



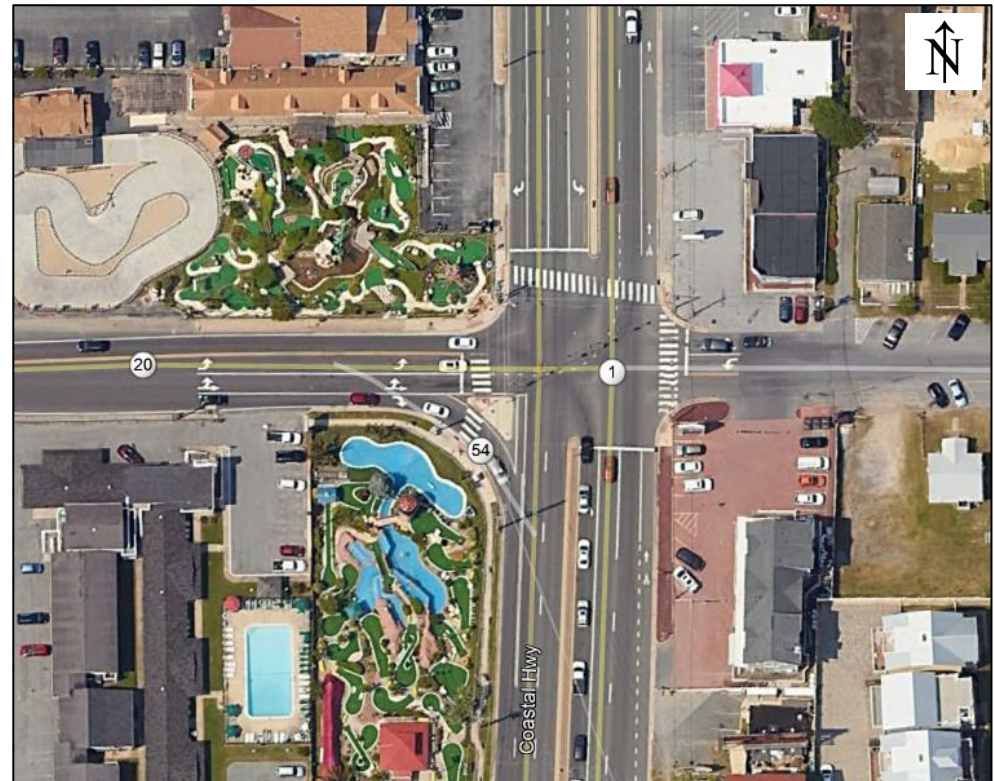
SIGNALIZED INTERSECTIONS

Existing Conditions:

- Pedestrian accommodations on north, east, and west legs of the intersection
- Mini-golf courses located on the west side
- Lighthouse Road Beach is located 450 feet east of the intersection
- MD State line is located 300 feet south of the intersection
- NB / SB left-turn operate as protected + permissive phasing
- EB / WB operate with split phasing

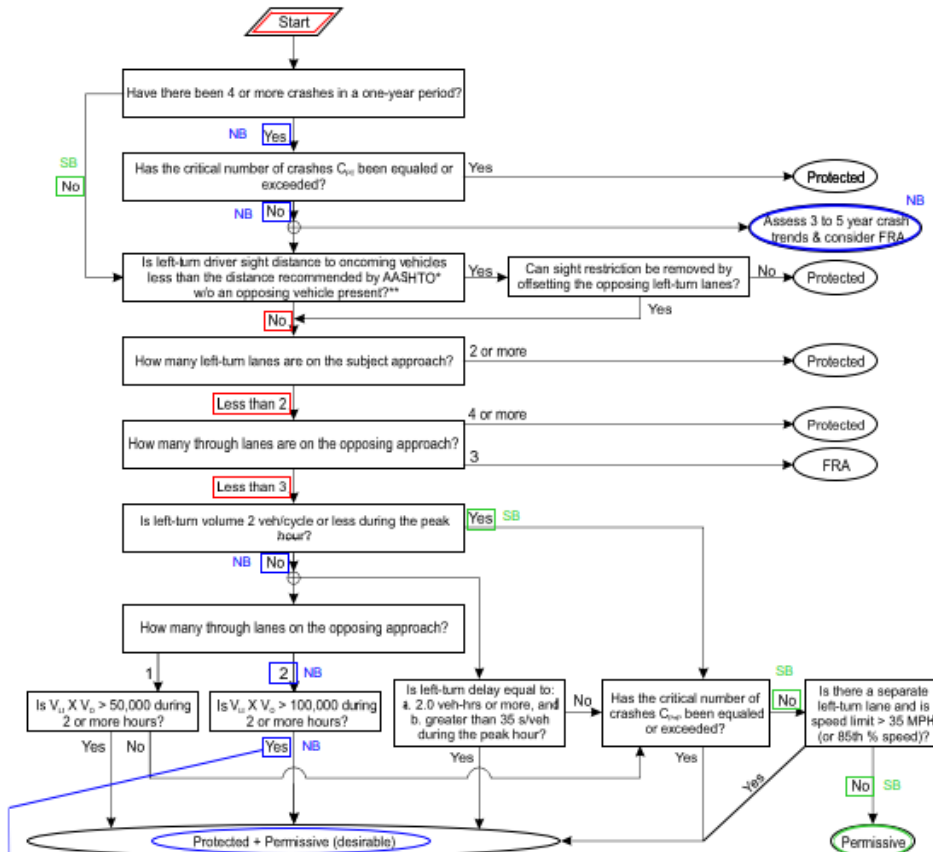


55 crashes
(Jan 2014 – May 2020)



SR 1 at SR 54

Left-Turn Phasing Analysis



Northbound SR 1 left-turn



Southbound SR 1 left-turn

*AASHTO, *A Policy on Geometric Design of Highways and Streets*, 2011 (or current), Chapter 9, 9.5.3 Intersection Control, Case F - Left Turn From the Major Road. Calculated based on Equation 9-1 and Table 9-13, adjusted for number of lanes, as needed.

Variables:
 V_{lt} = left-turn volume on the subject approach, veh/h
 V_{o} = through plus right-turn volume on the approach opposing the subject left-turn movement, veh/h

Source:
 Adapted from FHWA's *Signal Timing Manual*

Number of Left-turn Movements on Subject Road	Period During Which Crashes are Considered (years)	Critical Left-Turn-Related Crash Count When Considering Protected-only, C_{cr} (crashes/period)	When Considering Prot.+Perm., C_{cp} (crashes/period)
One	1	6	4
One	2	11	6
One	3	14	7
Both	1	11	6
Both	2	18	9
Both	3	26	13

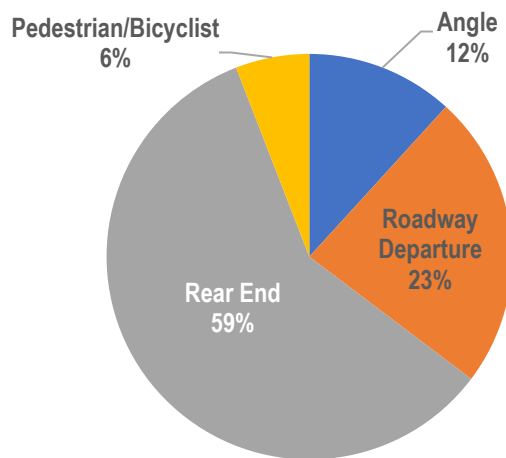
SR 1 Northbound Left.
 Fri. PM: 446,154
 Sat. AM: 394,592

SR 54 at Dukes Rd

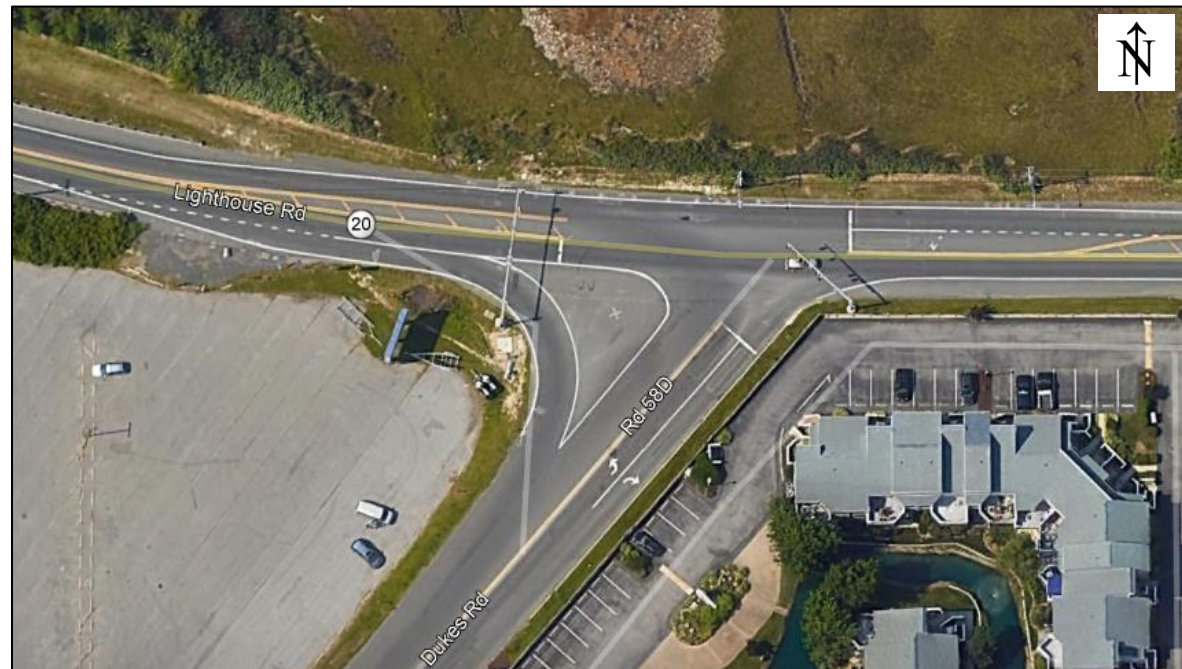
Existing Conditions

Existing Conditions:

- Inlet located on the north side of the intersection
- Commercial properties located on the southwest corner of the intersection
- Residential properties located on the southeast corner of the intersection
- No existing pedestrian accommodations
- Westbound SR 54 left-turn operates as protected + permissive phasing

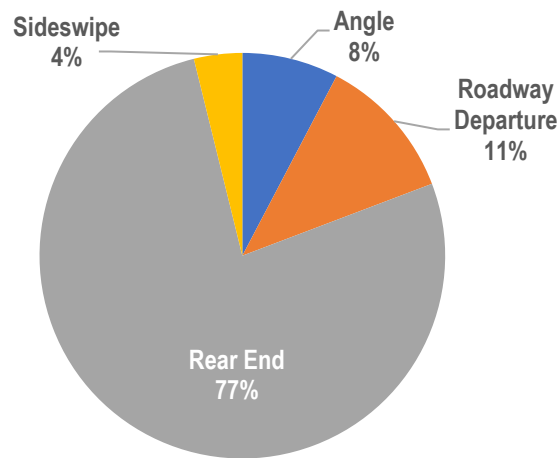


17 crashes
(Jan 2014 – May 2020)



Existing Conditions:

- Inlet located on the north side of the intersection
- Residential properties located on the south side of the intersection
- No existing pedestrian accommodations
- Westbound SR 54 left-turn operates as protected + permissive phasing
- Westbound bike signal



26 crashes
(Jan 2014 – May 2020)

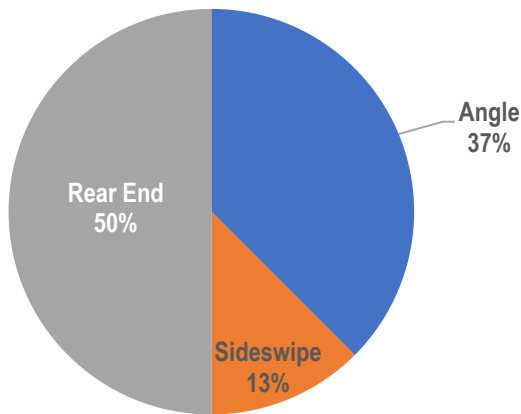


SR 54 at Mallard Lakes

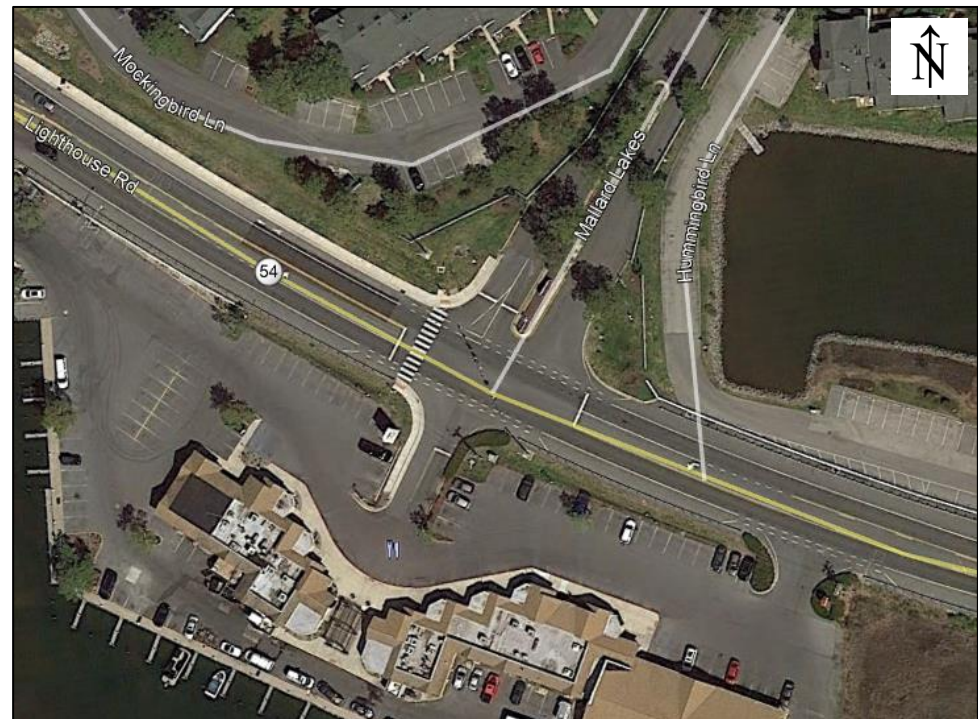
Existing Conditions

Existing Conditions:

- Residential properties located on the north side of the intersection
- Commercial properties located on the south side of the intersection
- Pedestrian accommodations on the west leg of the intersection
- EB and WB SR 54 left-turns operate as protected + permissive phasing
- NB and SB movements operate as split phased



8 crashes
(Jan 2014 – May 2020)

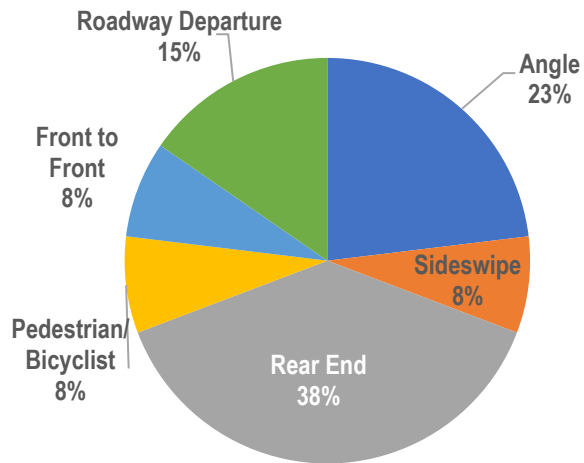


SR 54 at Keenwick Rd

Existing Conditions

Existing Conditions:

- Residential properties surrounding the intersection
- Pedestrian accommodations on the south and east legs of the intersection
- Westbound SR 54 left-turn operates as protected + permissive phasing



13 crashes
(Jan 2014 – May 2020)

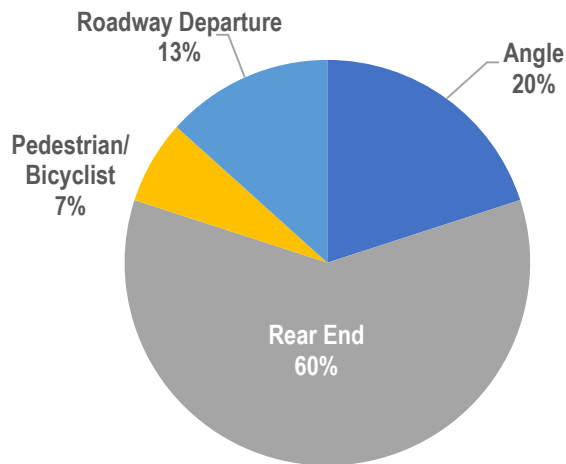


SR 54 at Laws Point

Existing Conditions

Existing Conditions:

- Residential properties surrounding the intersection
- Pedestrian accommodations on the north and west legs of the intersection
- Eastbound SR 54 left-turn operates as protected + permissive phasing



15 crashes
(Jan 2014 – May 2020)

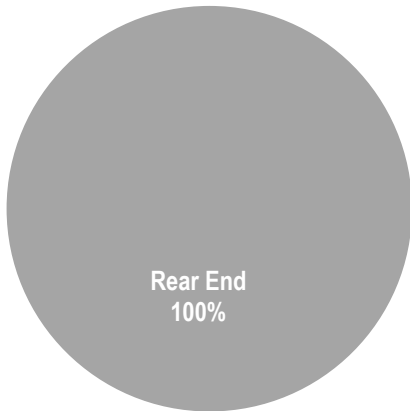


SR 54 at W Fenwick Blvd

Existing Conditions

Existing Conditions:

- Commercial properties surrounding the intersection
- Pedestrian accommodations on the north, south, and west legs of the intersection
- EB and WB SR 54 left-turns operate as protected + permissive phasing
- NB and SB operate as permissive phasing



11 crashes
(Jan 2014 – May 2020)

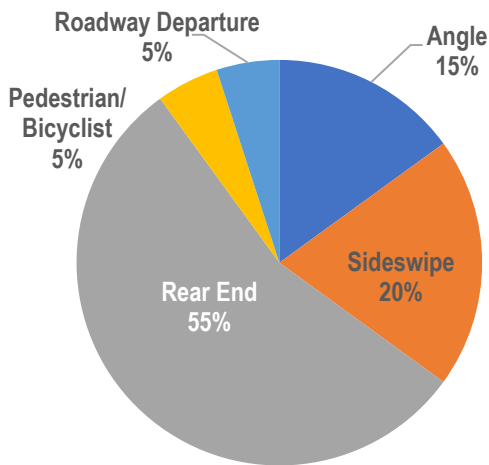


SR 54 at SR 20

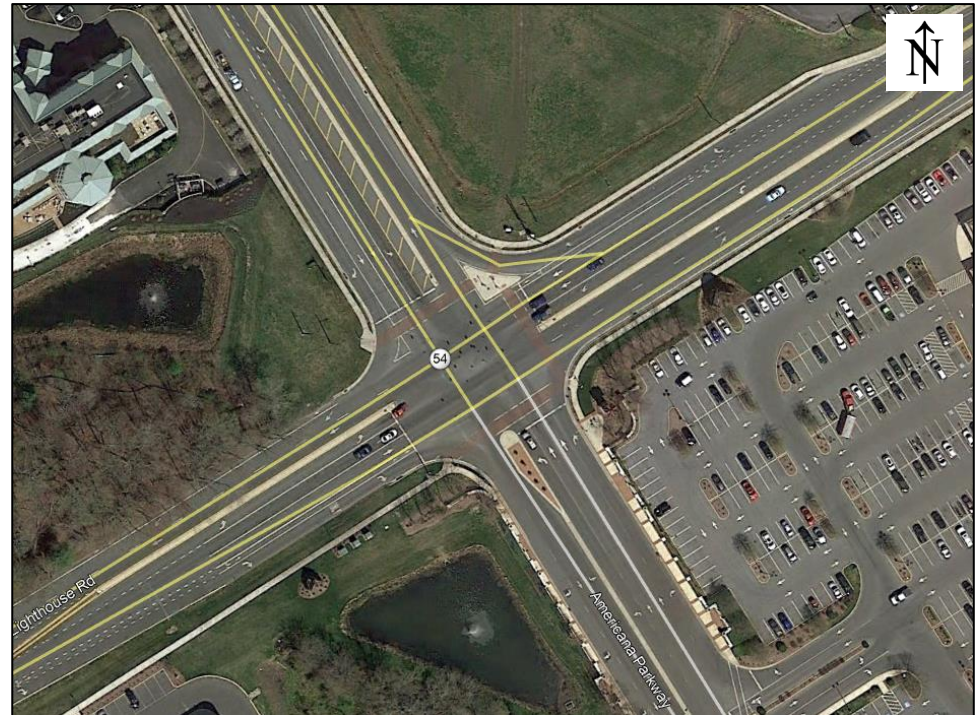
Existing Conditions

Existing Conditions:

- Commercial and residential properties surrounding the intersection
- Pedestrian accommodations on the north, south, and east legs of the intersection
- EB and WB SR 54 left-turns operate as protected only phasing
- NB and SB operate as split-phased



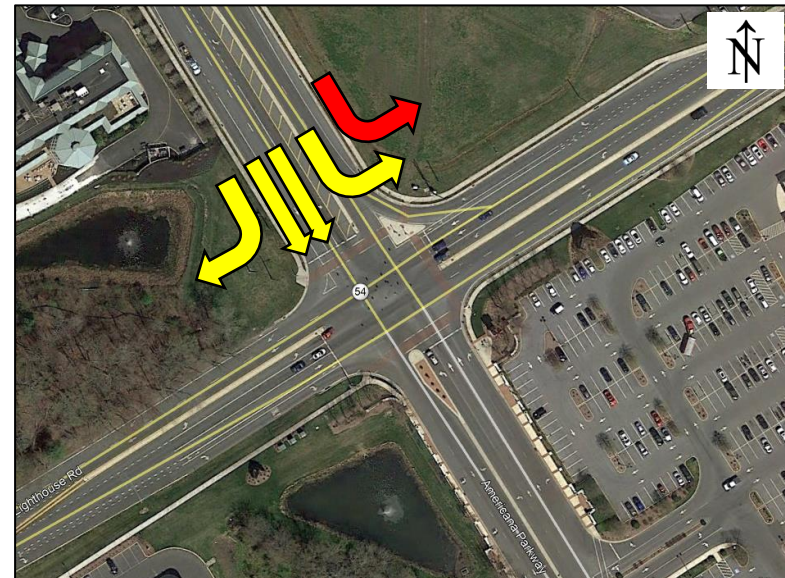
20 crashes
(Jan 2014 – May 2020)



SR 54 at SR 20

Intersection Capacity

- Restriping SB approach lanes allows for dual left-turn lanes
- No additional right-of-way required
- Reduces summer Saturday peak hour SB delay from 203 seconds to 73 seconds
- Allows for shorter cycle lengths
- May relieve cut-thru traffic along Tidal Road, Old Mill Bridge Road, Herring Way, and W Fenwick Boulevard



UNSIGNALIZED INTERSECTIONS

SR 54 at Bluewater Run

Existing Conditions

Existing Conditions:

- Commercial and residential properties surrounding the intersection
- Pedestrian accommodations on the north and south legs of the intersection
- Stop-controlled northbound and southbound
- Southbound restricted to right-turn only

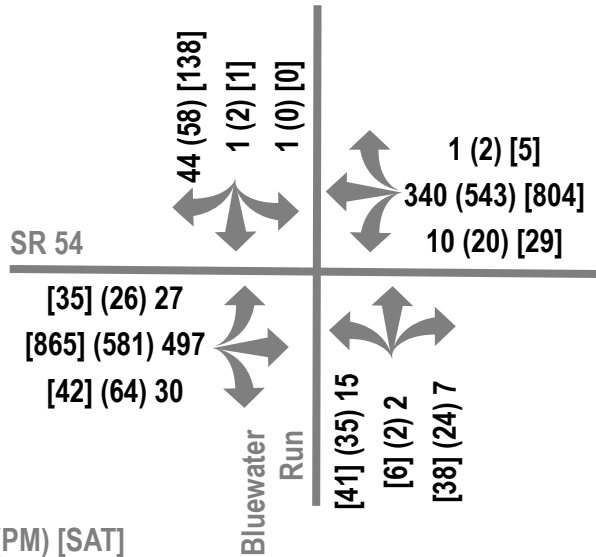


2 crashes
(Jan 2014 – May 2020)



SR 54 at Bluewater Run

Signal Warrant Analysis



Summer Saturday (10:30 AM – 10:45 AM)	Northbound	Southbound
Number of Vehicles Observed/Measured	17	8
Total Delay	0.10 vehicle-hours	0.07 vehicle-hours
Average Delay per Vehicle*	21 seconds	30 seconds
Average Delay per Stopped Vehicle	21 seconds	30 seconds
Percent of Vehicles Stopped	100%	100%

*Additional studies to be completed summer 2021

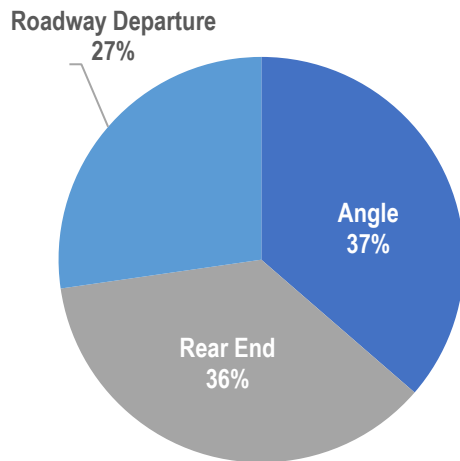
DE MUTCD Warrant	Major Street Volume (VPH)	Minor Street Volume (VPH)	No. of Hours Required	No. of Hours Meets Criteria	Warrant Criteria Met?
1 – Eight-Hour Vehicular Volume	(Any of the three conditions must be met)				
Cond. A – Min. Vehicular Volume	420	105	8	0	No (Met with SB R volume included)
Cond. B – Interruption of Cont. Traffic	630	53	8	3	
Cond. C – Combination of Conditions • 80% of Cond. A • 80% of Cond. B	336 504	84 42	8 8	0	
2 – Four-Hour Vehicular Volume	(See Figure 4C-1 or 4C-2)		4	3	
Warrants 3 – 9	-	-	-	-	No

SR 54 at Old Mill Bridge Road

Existing Conditions

Existing Conditions:

- Commercial properties surrounding the intersection
- Pedestrian accommodations on the north leg of the intersection
- Stop-controlled southbound
- Southbound restricted to right-turn only

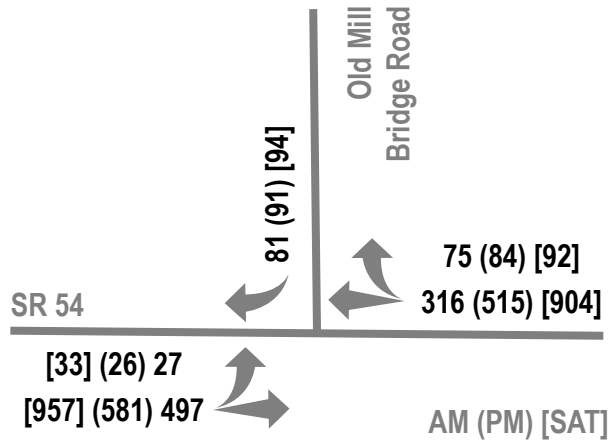


11 crashes
(Jan 2014 – May 2020)



SR 54 at Old Mill Bridge Road

Signal Warrant Analysis



Summer Saturday (11:15 AM – 11:30 AM)	Southbound
Number of Vehicles Observed/Measured	25
Total Delay	0.07 vehicle-hours
Average Delay per Vehicle	9 seconds
Average Delay per Stopped Vehicle	19 seconds
Percent of Vehicles Stopped	76%

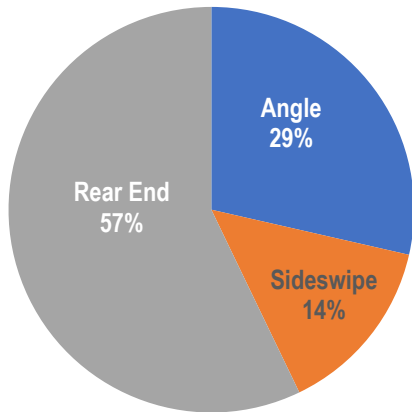
DE MUTCD Warrant	Major Street Volume (VPH)	Minor Street Volume (VPH)	No. of Hours Required	No. of Hours Meets Criteria	Warrant Criteria Met?
1 – Eight-Hour Vehicular Volume	(Any of the three conditions must be met)				
Cond. A – Min. Vehicular Volume	420	105	8	0	No (Met with EB R volumes included)
Cond. B – Interruption of Cont. Traffic	630	53	8	4	
Cond. C – Combination of Conditions • 80% of Cond. A • 80% of Cond. B	336 504	84 42	8 8	1	
2 – Four-Hour Vehicular Volume	(See Figure 4C-1 or 4C-2)		4	0	
3 – Peak Hour Volume	(Either of these two conditions must be met)				
Condition A	Delay > 4 Veh.-Hrs. Approach Volume > 100 vph Entering Volume > 800 vph		1	0	No
Condition B	(See Figure 4C-3 or 4C-4)		1	0	
Warrants 4 – 9	-	-	-	-	No

SR 54 at Bennett Ave

Existing Conditions

Existing Conditions:

- Residential properties surrounding the intersection
- No existing pedestrian accommodations
- Stop-controlled northbound Monroe Ave and southbound Bennett Ave



7 crashes
(Jan 2014 – May 2020)



SR 54 at Bennett Ave

Proposed Development

Canon Property

- North side of SR 54 at Bennett Ave
- 70 single family homes, hotel, & restaurant
- Potential roundabout included
- Would require realignment with Monroe Ave

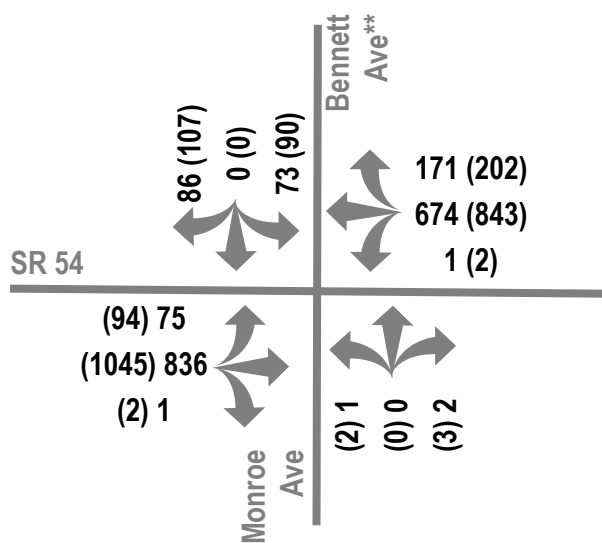


SR 54 at Bennett Ave

Direction	Scenario	Stops per Vehicle	Delay	Travel Time	Average Speed	Green Band
EB SR 54	Existing	0.49	47.9 s	142.2 s	24 mph	82 s
	With Bennett/ Monroe signal	0.74	46.4 s	140.2 s	24 mph	82 s ¹
WB SR 54	Existing	0.49	22.6 s	87.9 s	28 mph	93 s
	With Bennett/ Monroe signal	0.74	45.8 s	109.3 s	23 mph	62 s ²

1 EB corridor throughput is constrained by the intersection of SR 1 at SR 54; this particular segment is not “critical”

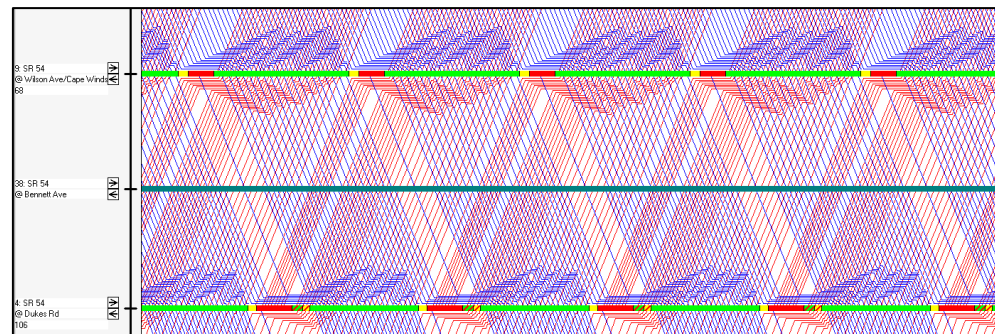
2 WB corridor throughput is constrained by the intersections of SR 54 at SR 20 and at West Fenwick Boulevard; this particular segment is not “critical”



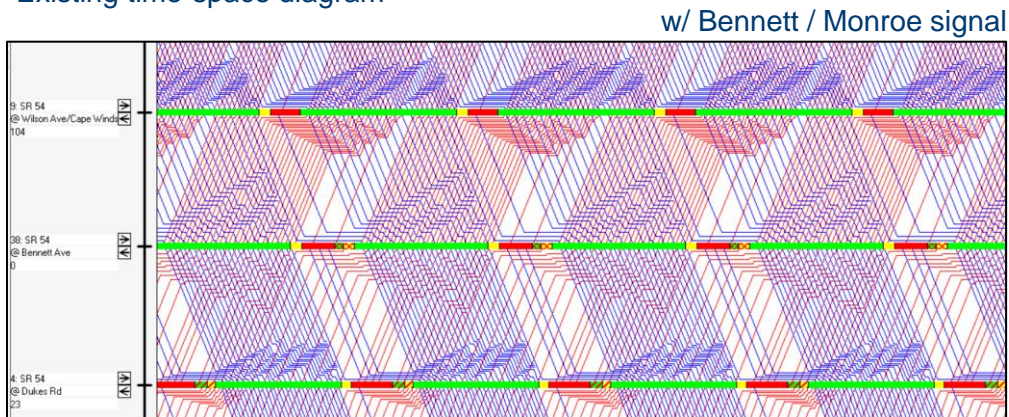
Prop. Summer Weekday
(Prop. Summer SAT)

*Proposed Summer Saturday peak hour volumes meet the minimum needed to warrant a signal

**Bennett Ave PDCA projected volumes as of 04/14/2021



Existing time-space diagram



w/ Bennett / Monroe signal

Roundabouts

SR 54 at Bennett Avenue

- Requires realignment with Monroe Ave
- Requires additional right-of-way
- Provides capacity for future development
- Reduces conflict points
- 1 angle crash susceptible to correction



Proposed Summer Saturday Peak

Direction	Entry Volume	Entry Capacity	V/C Ratio		Percent Total Volume	
NB	5	410	0.01	V/C exceeds 0.7, may be unsuitable	6%	Severely unbalanced flow (90%+ on major road), inappropriate location
SB	131	580	0.23			
EB	1111	1290	0.86			
WB	988	1290	0.77			

Roundabouts

SR 54 at Pirates Trail

- Would require collaboration with Treasure Beach RV Park and Campground
- Reduces conflict points
- 1 angle crash susceptible to correction



Direction	Entry Volume	Entry Capacity	V/C Ratio		Percent Total Volume	
NB	0	850	0.00	Sufficient capacity	2%	Severely unbalanced flow (90%+ on major road), inappropriate location
SB	19	820	0.02			
EB	453	1350	0.34		98%	
WB	513	1360	0.38			

PM Peak

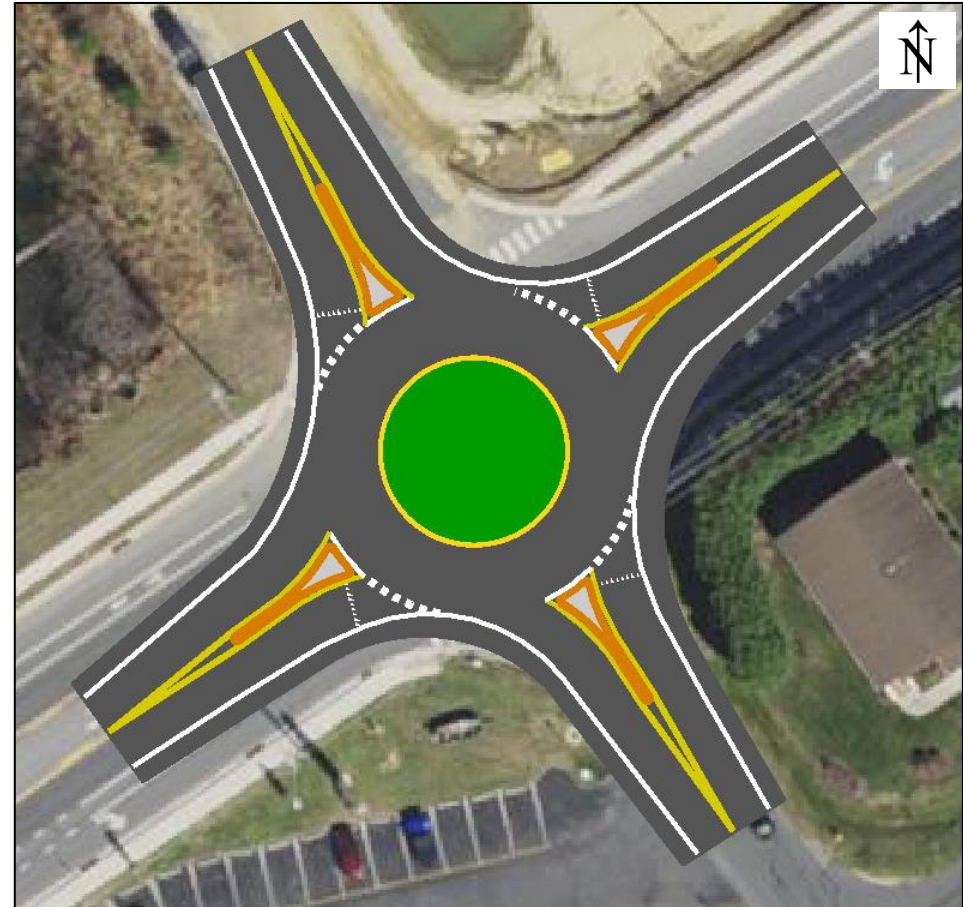
Direction	Entry Volume	Entry Capacity	V/C Ratio		Percent Total Volume	
NB	6	460	0.01	V/C exceeds 0.7, may be unsuitable	7%	Severely unbalanced flow (90%+ on major road), inappropriate location
SB	137	630	0.22			
EB	1008	1290	0.78		93%	
WB	792	1320	0.60			

Summer Saturday Peak

Roundabouts

SR 54 at Bluewater Run

- Would allow SB L and T movements
- Allows for closure of median at Old Mill Bridge and have EB L vehicles u-turn at Bluewater Run
- Reduces left-turn conflict points
- 1 angle crash susceptible to correction



Direction	Entry Volume	Entry Capacity	V/C Ratio		Percent Total Volume	
NB	85	550	0.15	V/C exceeds 0.7, may be unsuitable	11%	Moderately unbalanced flow (70% - 90% on major road), additional analysis required
SB	139	560	0.25			
EB	942	1330	0.71			
WB	838	1270	0.66			

Summer Saturday Peak

RECOMMENDATIONS

December 9, 2020 Virtual Meeting Comments & Improvement Matrix (1 of 2)



Location	Timeframe	Recommendation
Corridor Wide	Short-Term	Install lighting at priority intersections/segments <ul style="list-style-type: none"> • Install a combination of DelDOT lighting and leased lighting at SR 54 and SR 20, extending to Bluewater Run • Install full DelDOT lighting at the intersections of and between Keenwick Road and Mallard Lakes Road
	Short-Term	Install 35 MPH speed limit zone on SR 54 between Madison Avenue and Old Mill Bridge Road, lowering the posted speed limit from 40 MPH to 35 MPH
	Short-Term	Refresh pedestrian accommodations along SR 54 corridor as necessary
	Short-Term	Adjust timings and offsets to improve corridor travel times
	Short-Term	Coordinate with the Southeast Sussex Study (S3)
	Mid-Term / Long-Term	Re-evaluate traffic impacts along SR 54 between SR 20 and W Fenwick Boulevard due to cut-thru traffic along Tidal Road and Herring Way after the Southeast Sussex Study (S3) is completed
	Long-Term	Coordinate with DTC to continue to close gaps in access to transit along the SR 54 corridor, providing new stops with appropriate bus pull offs, pedestrian infrastructure, and lighting to all future bus stops
	Long-Term	Through various projects, continue to close gaps in sidewalks/sidepaths along the SR 54 corridor, evaluating complete streets, roadway reconfigurations, and utilizing Old Lighthouse Road if available.

December 9, 2020 Virtual Meeting Comments & Improvement Matrix (2 of 2)

Location	Timeframe	Recommendation
SR 1 at SR 54	Short-Term	Complete summer observations of the eastbound SR 54 right-turn to determine improvements/removal of the existing free movement
	Short-Term	Install Bicyclist / Pedestrian Crossing Warning Signs (W11-15), Downward Diagonal Arrows (W16-7p), and Yield lines on the eastbound SR 54 right-turn to southbound SR 1 to improve bicyclist / pedestrian safety
	Short-Term	Install Flashing Red Arrow (FRA) left-turn phasing for the northbound left-turn at SR 1 and SR 54
SR 54 at Dukes Road	Mid-Term	Install pedestrian accommodations at the signalized intersection of SR 54 at Dukes Road
SR 54 at Bennett Avenue	Mid-Term / Long-Term	Install a traffic signal at the intersection of SR 54 and Bennett Avenue / realigned Monroe Avenue to accommodate future development growth
SR 54 at Mallard Lakes	Mid-Term	Install pedestrian accommodations on the north, south, and east legs of the signalized intersection of SR 54 at Mallard Lakes
SR 54 at W Fenwick Boulevard	Short-Term	Install pedestrian accommodations on the east leg of the signalized intersection of SR 54 and W Fenwick Boulevard
SR 54 at Bluewater Run	Short-Term	Complete additional time of day delay observations and evaluation for traffic exiting Bluewater Run
	Long-Term	Re-evaluate a traditional roundabout after the Southeast Sussex Study (S3) is completed
SR 54 at SR 20	Mid-Term	In response to the safety concerns with the westbound right-turn and pedestrians, consider adding the west leg crosswalk to tie in existing desire lines
	Mid-Term / Long-Term	Restripe the southbound approach at the intersection of SR 54 and SR 20 to include dual left-turn lanes onto eastbound SR 54 to increase capacity and efficiency of the intersection. Re-evaluate inbound and outbound lane configurations after the Southeast Sussex Study (S3) is completed

THANK YOU!

APPENDIX

Appendix

Roundabout Alternative: “Dutch Left”

- A modified roundabout, “Dutch Left”, includes a center turn loop, prioritizing thru traffic
- Traffic calming devices are used to control speed in the intersection
- Allows for ped/bike crossings
- Ideal for intersections with unbalanced flow
- Bike DE presentation: ["Dutch Left" Presentation](#)

SR 9 / 6th St at Chestnut St, New Castle, DE
Existing Conditions



SR 9 / 6th St at Chestnut St, New Castle, DE
Proposed “Dutch Left” Conditions