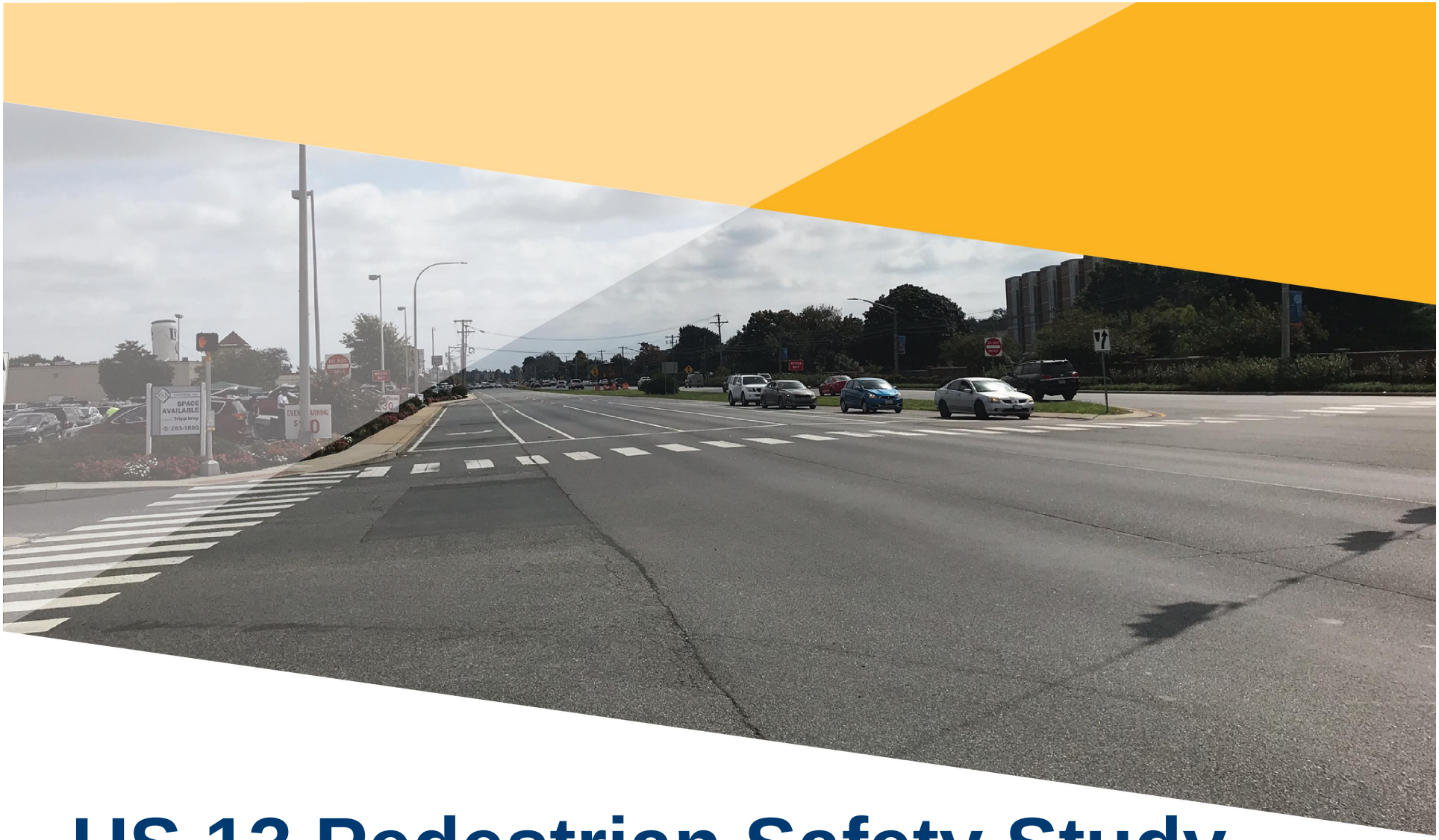


US 13 Pedestrian Safety Study

Scarborough Road to Puncheon Run Connector

June 2020

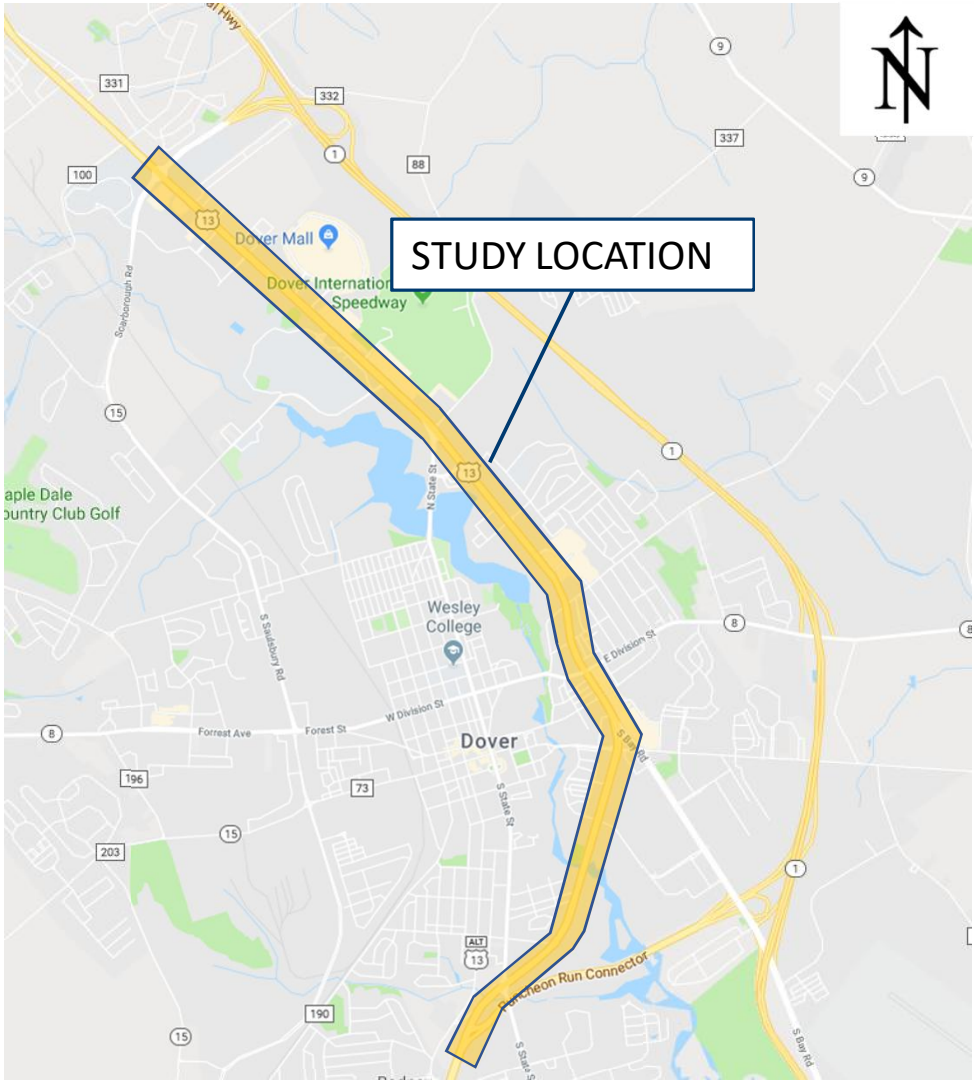
DelDOT WRA

Table of Contents

Project Location/Study Scope

Study Scope

- Review pedestrian crash history
- Observe and collect pedestrian, transit, and traffic data
- Gather adjacent land use data
- Evaluate pedestrian safety along corridor and identify recommendations



EXISTING CONDITIONS

US 13 Corridor

- 5.5-mile Urban Minor Arterial
- Roadway Character
  - Scarborough Road to Bay Road: 6-lane, divided
  - Bay Road to Puncheon Run Connector: 4-lane, divided
  - Variable shoulder widths and turn lanes at major intersections
  - Lighting along entire corridor
- Traffic Control
  - 22 signalized intersections
  - 13 unsignalized median crossovers/U-turn locations
  - Numerous private driveways

US 13 Corridor

- Posted Speed Limit
  - Scarborough Road to N. State Street: 45 MPH
  - N. State Street to North of White Oak Road: 40 MPH
  - North of White Oak Road to E. Water Street: 35 MPH
  - E. Water Street to Puncheon Run Connector: 50 MPH

High Vehicular Volume and Fluctuating Speeds Mixed with Numerous Pedestrian Generators

- Major Pedestrian Generators
  - Delaware State University and Wilmington University
  - Dover Downs Race Track & Casino
  - Dover Mall
  - Multiple Shopping Centers – Dover Town Center, Dover Commons, North Dover Center, Capital Commons, The Centre at Dover
  - Multiple hotels along corridor
  - Multiple stand alone restaurants – Olive Garden, Outback, Bob Evans, Red Lobster, Chick-Fil-A, Starbucks
  - Residential developments and apartment complexes

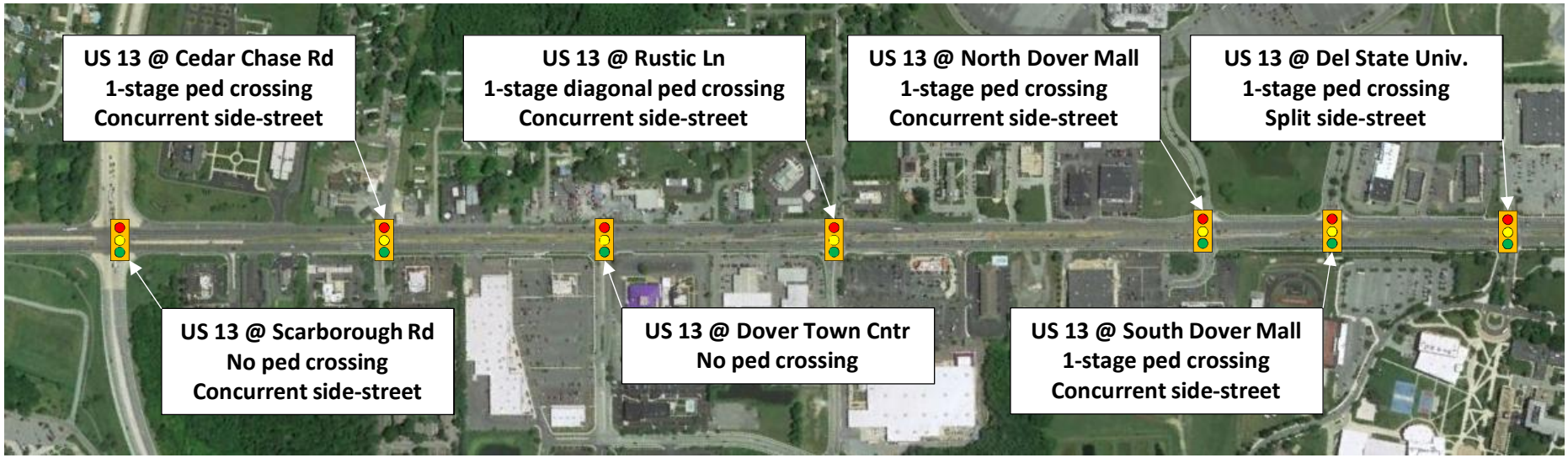
US 13 Corridor

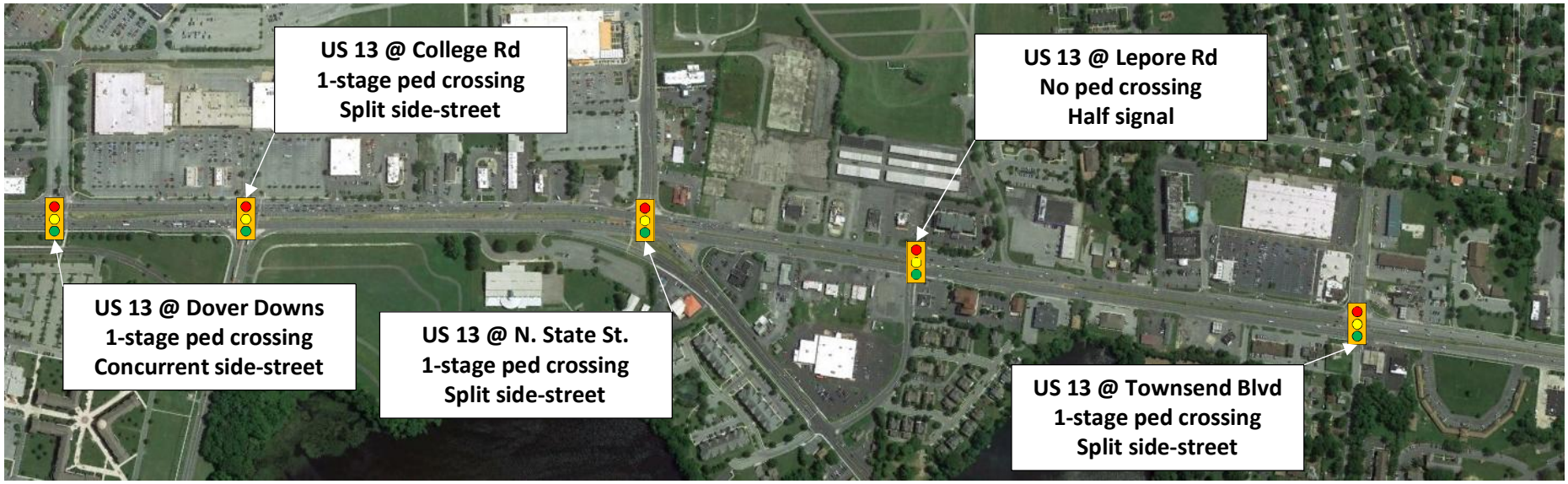
- AADT (2018 DelDOT Traffic Summary)
  - N. of Scarborough Road: 49,541
  - South Dover Mall Entrance to Scarborough Road: 64,578
  - Dover Downs Entrance to South Dover Mall Entrance: 59,871
  - College Road to Dover Downs Entrance: 50,650
  - N. State Street to College Road: 73,949
  - White Oak Road to N. State Street: 52,164
  - Division Street to White Oak Road: 42,820
  - Loockerman Street to Division Street: 49,890
  - Bay Road to Loockerman Street: 56,418
  - MLK Blvd to Bay Road: 23,634
  - S. State Street to MLK Blvd: 30,760
  - Puncheon Run to S. State Street: 25,736
  - South of Puncheon Run: 39,410

High Vehicular Volume and Fluctuating Speeds Mixed with Numerous Pedestrian Generators

US 13 Corridor

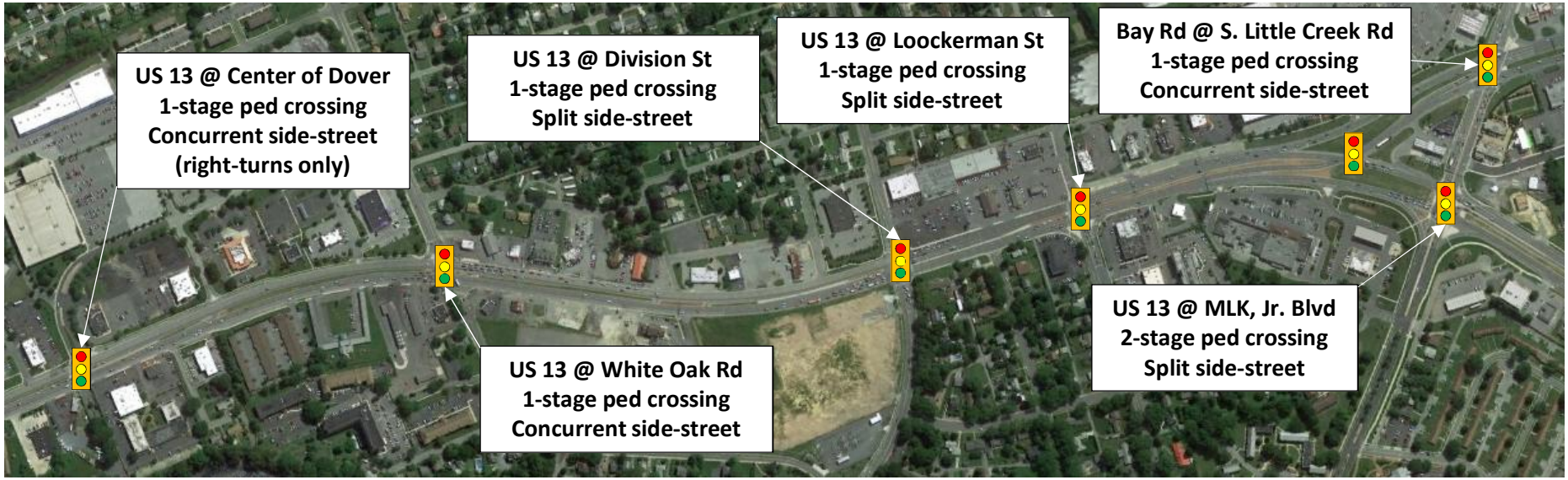
Signalized Pedestrian Crossings of US 13



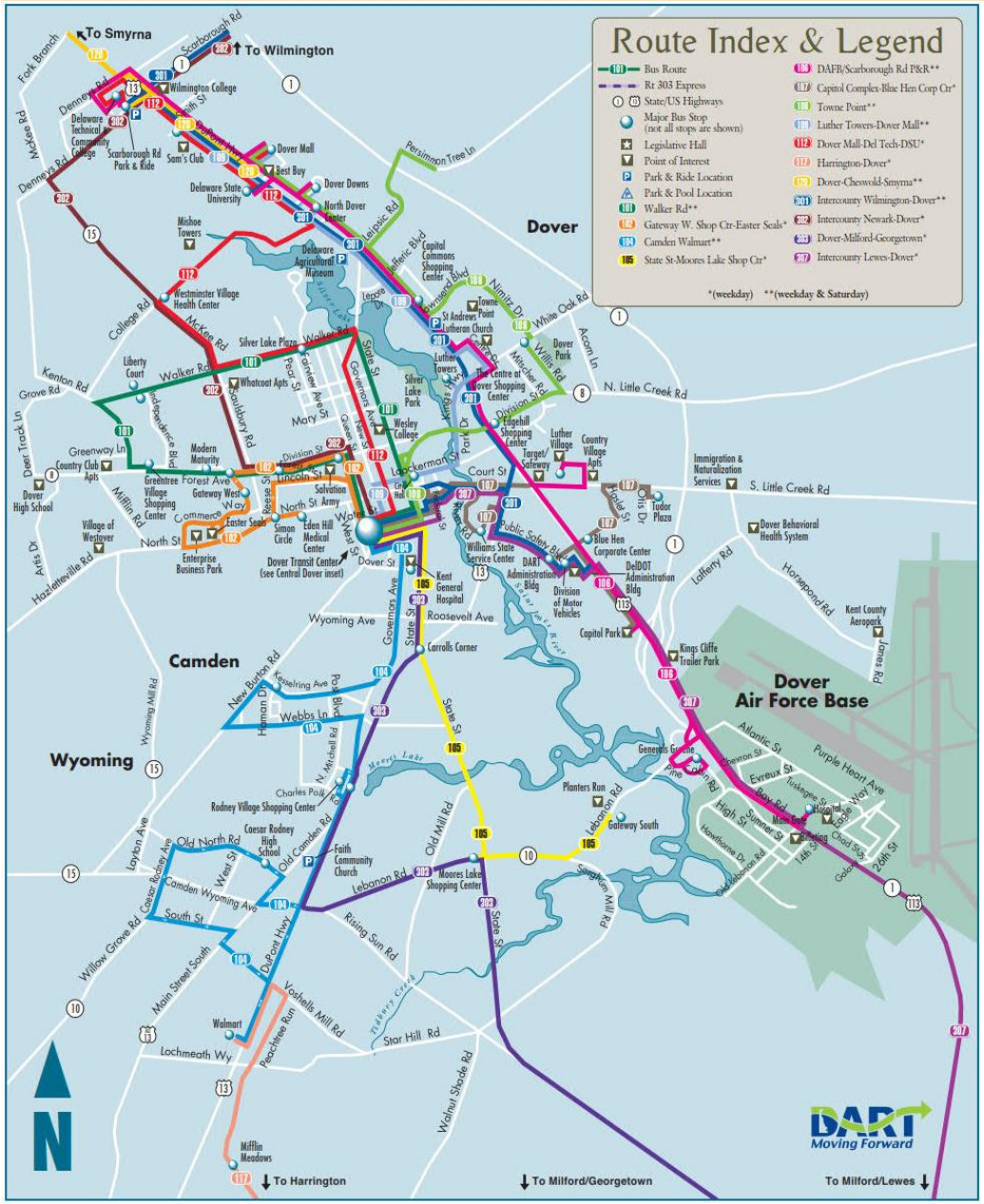


US 13 Corridor

Signalized Pedestrian Crossings of US 13



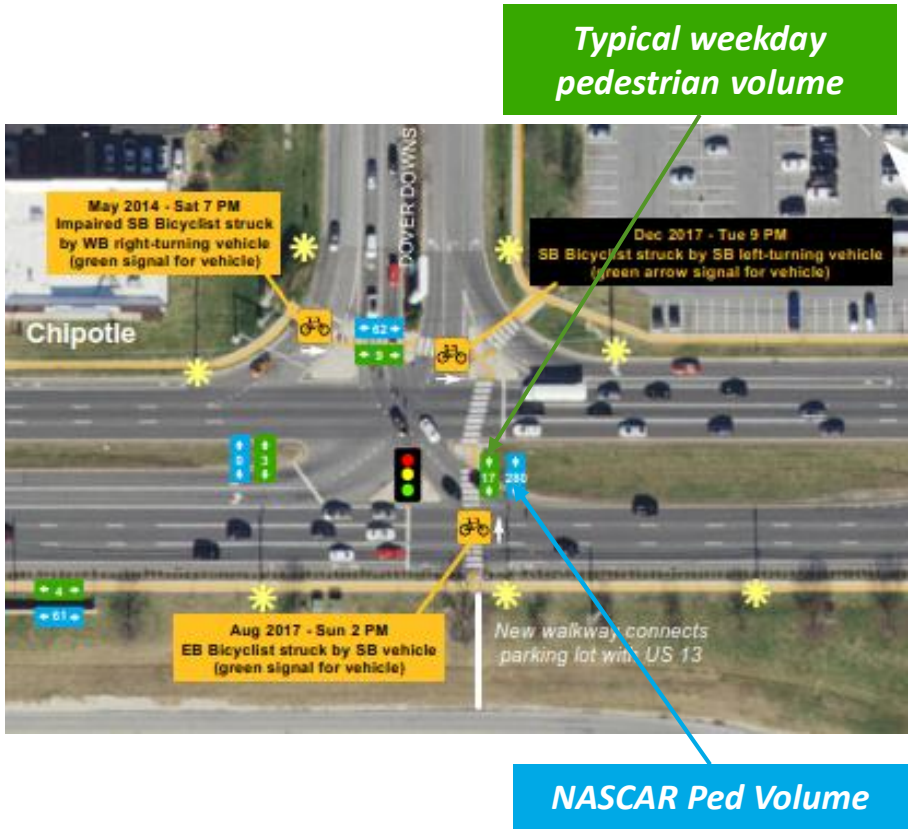
Transit



- Routes operating within study corridor:
  - 106, 107, 108, 109, 112, 301 and 303
- No transit service south of Public Safety Boulevard to S. State Street
- 13 bus stops front US 13
- Majority of bus stops are located on private property or side streets

Pedestrian Counts

- October/November 2018 during typical weekday conditions *
  - AM Peak (7 AM – 9 AM)
  - Midday Peak (11 AM – 1 PM)
  - PM Peak (3 PM – 6 PM)
- October 2018 during a NASCAR event
  - North of Rustic Lane to Townsend Blvd.
  - Sunday October 7, 2018
- Data summarized on Existing Conditions figures



** For the purposes of these observations, a "typical weekday" was considered a non-holiday Tuesday, Wednesday, or Thursday with favorable weather conditions (i.e., minimal precipitation and fair temperatures) while local schools are in session*

Vehicular Speed Studies

- Radar speed studies conducted in July 2019
- Average speeds are up to 8 mph higher than the posted speed limit
- 85th-percentile speeds are up to 15 mph higher than the posted speed limit
- Sections with 35 mph speed limits experience the greatest speed differentials

Location	Posted Speed Limit (mph)	Northbound US 13		Southbound US 13	
		Average Speed (mph)	85th-Percentile Speed (mph)	Average Speed (mph)	85th-Percentile Speed (mph)
Kentwood Drive/Cedar Chase Drive	45	45	50	46	50
Rustic Lane	45	40	45	43	45
Jefferic Blvd.	40	43	46	43	46
Maple Pkwy.	35	40	45	40	44
E. Water St.	35	43	50	43	48
Roosevelt Ave.	50	49	52	49	52

Ped/Bike Crash Trends

(January 2008 to December 2018)

- 52 total ped crashes; 34 total bike crashes
- 100% of ped/bike crashes resulted in an injury or fatality
  - 9 pedestrian fatalities
  - 2 bicyclist fatalities
- During the 3-year period of 2015 to 2017, 4 (80%) of the 5 total fatalities were pedestrians
- 60% of pedestrian crashes occurred at nighttime
  - 47% of these occurred in unlit locations
- 59% of ped/bike crashes occurred from 4 PM to 12 AM
- 50% of ped crashes occurred within 200 feet of a signalized crosswalk
- 48% of pedestrian crashes occurred on a Friday, Saturday or Sunday
- 33% of ped/bike crashes involved a ped/cyclists aged 16 to 25 years old
- 32% of bicycle crashes involved a cyclist traveling in the opposite direction of traffic
- 14% of ped/bike crashes involved an impaired ped/bicyclist

Crash Trends

Study Period		January 2008 to December 2018						January 2015 to December 2019	
Scenario		Pedestrian Crashes		Bicycle Crashes		Peds + Bikes		All Crashes*	
		No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total
Crash Severity	Fatal	9	17%	2	6%	11	13%	8	0.4%
	Injury	43	87%	32	94%	75	87%	744	38%
	PDO**	0	0%	4	24%	8	11%	1182	61%
Lighting Condition	Daylight	22	38%	11	65%	33	45%	1338	69%
	Dark-Lit	13	23%	0	0%	13	18%	465	24%
	Dark-Unlit	21	37%	6	35%	27	36%	62	3.2%
	Dawn/ Dusk	1	2%	0	0%	1	1%	55	2.8%
	Unknown	0	0%	0	0%	0	0%	14	0.7%
Ped/Bike Impairment	Impaired	8	14%	1	6%	9	12%	n/a	n/a
	Not Impaired	49	86%	16	94%	65	88%	n/a	n/a
Totals		57	100%	17	100%	74	100%	1934	100%

** Includes pedestrian/bicycle crashes*
*** PDO = Property Damage Only*

Crash Trends: Lighting Condition

Location (US 13 at)	All Crashes (Jan 2015 – Dec 2019)			Ped + Bike Crashes (Jan 2008 – Dec 2018)		
	Total Crashes	Nighttime Crashes**		Total Crashes	Nighttime Crashes**	
		No.	%		No.	%
Scarborough Rd.	81	31	38%	1	1	100%
Kentwood Dr. / Cedar Chase Dr.	70	23	33%	2	0	0%
Dover Town Center	36	9	25%	0	0	0%
Rustic Lane	69	27	39%	6	3	50%
North Dover Mall Ent.	45	13	29%	0	0	-
South Dover Mall Ent.	51	15	29%	0	0	-
Del. State Univ.	56	20	36%	6	5	83%
Dover Downs	67	28	42%	3	1	33%
College Rd.	156	44	28%	2	0	-
Leipsic Rd. / N. State St.	124	48	39%	3	1	33%
Lepore Dr.	39	14	36%	3	1	33%
Jefferic Blvd.	13	7	54%	0	0	-
Townsend Blvd.	51	10	20%	2	0	-
Centre Dr.	19	8	42%	3	1	33%
White Oak Rd.	84	24	29%	5	1	20%
Division St.	94	17	18%	0	0	-
Loockerman St.	114	36	32%	4	4	100%

% 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*

** *Continuous lighting exists along US 13 corridor*

Crash Trends: Lighting Condition

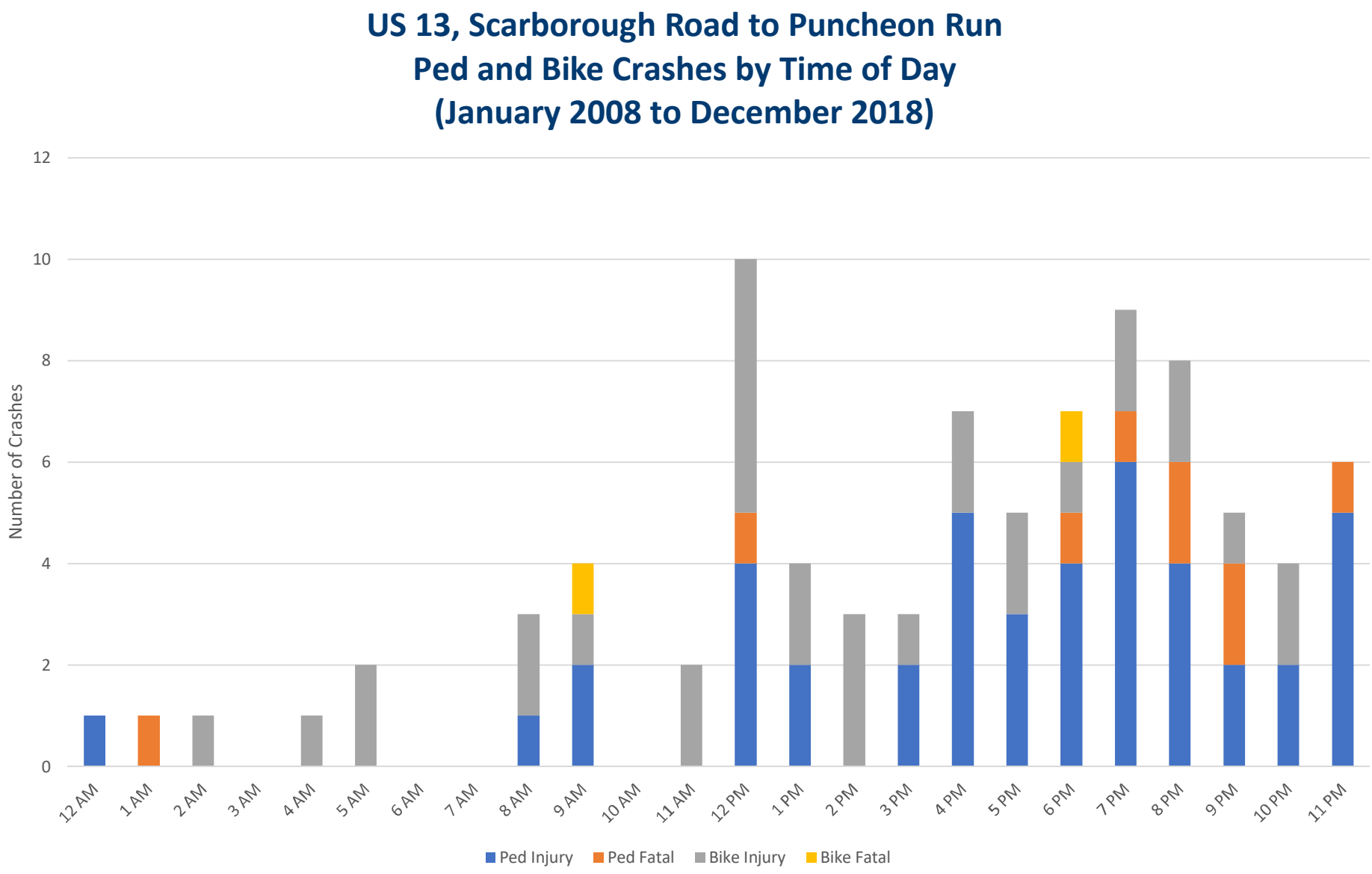
Location (US 13 at)	All Crashes (Jan 2015 – Dec 2019)			Ped + Bike Crashes (Jan 2008 – Dec 2018)		
	Total Crashes	Nighttime Crashes**		Total Crashes	Nighttime Crashes**	
		No.	%		No.	%
Bay Rd.	41	14	34%	1	0	-
MLK Blvd.	83	29	35%	1	1	100%
Public Safety Blvd.	33	13	39%	2	1	50%
Lotus St.	9	3	33%	1	1	100%
Evergreen Dr.	6	5	83%	1	1	100%
Roosevelt Ave.	33	9	27%	0	0	-
S. State St.	99	26	26%	2	2	100%
Puncheon Run Conn.	39	12	31%	0	0	-
Midblock Locations	422	97	23%	38	16	42%
Totals	**1934**	**582**	**30%**	**86**	**40**	**47%**

% 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*

*** Continuous lighting exists along US 13 corridor*

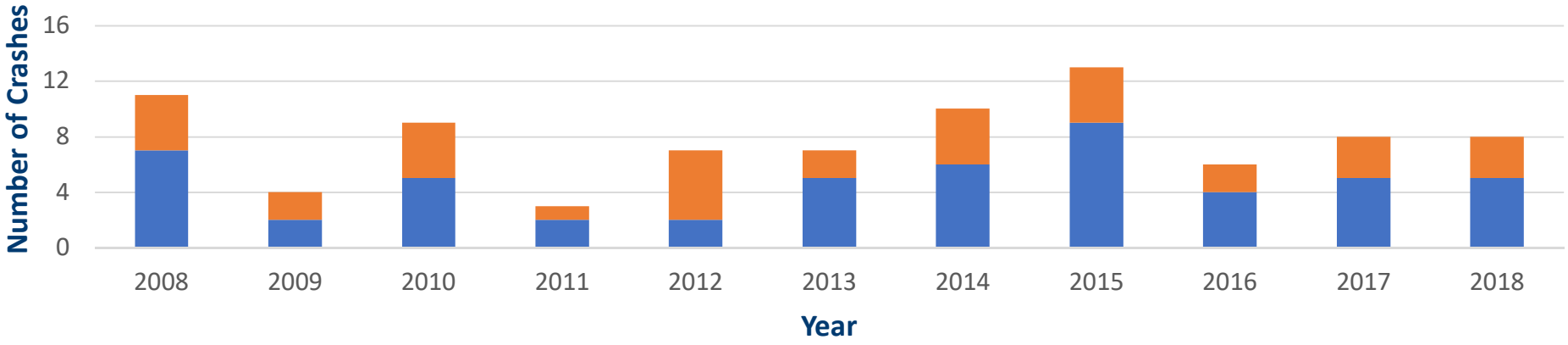
Ped/Bike Crash Trends
(January 2008 to December 2018)



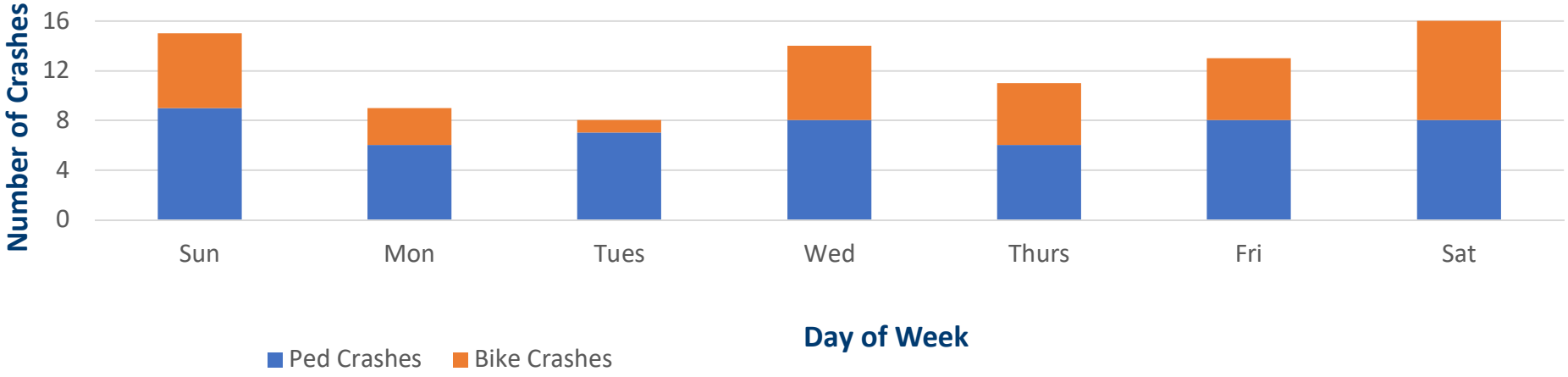
Ped/Bike Crash Trends

(January 2008 to December 2018)

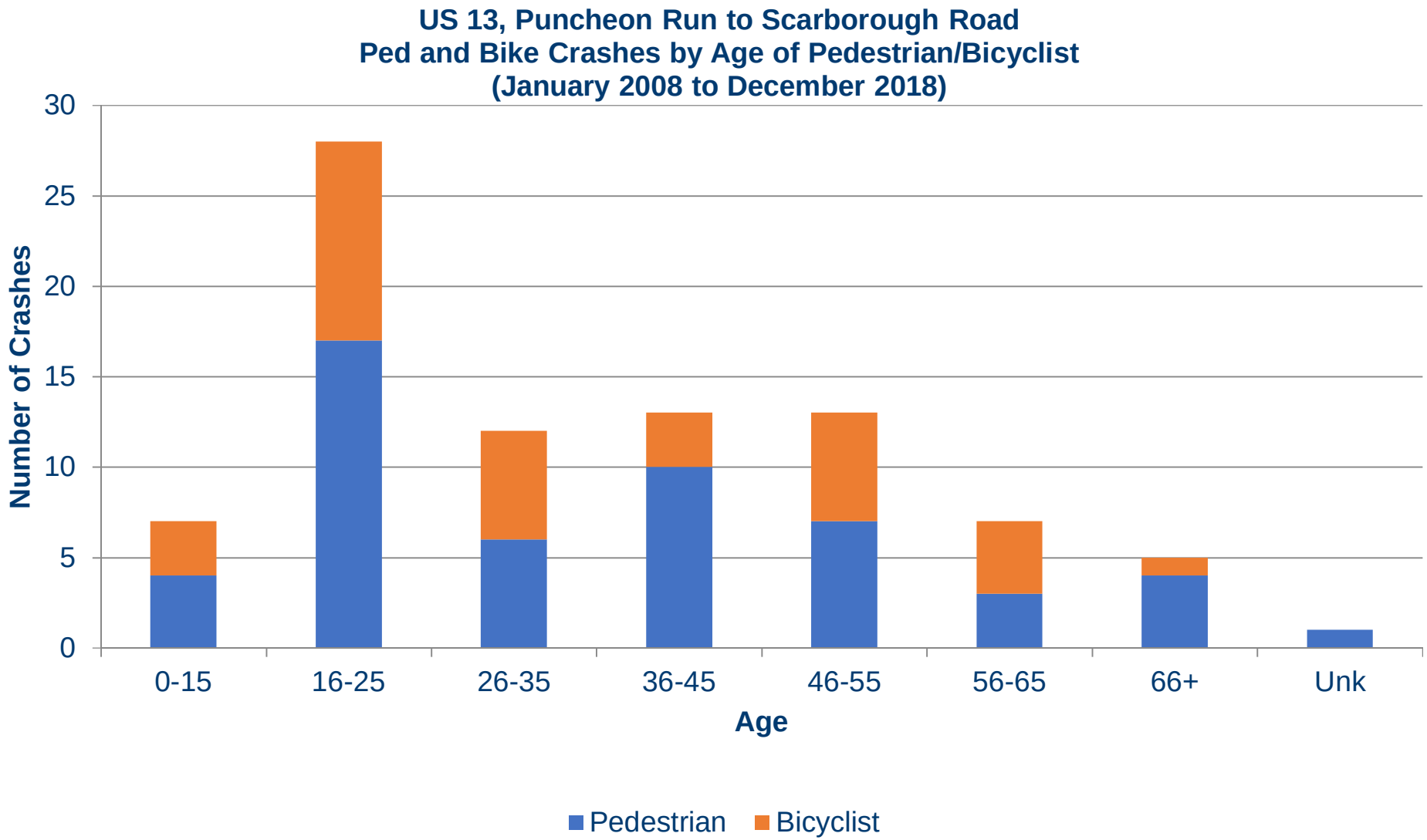
US 13, Puncheon Run to Scarborough Road Ped and Bike Crashes by Year (January 2008 to December 2018)



US 13, Puncheon Run to Scarborough Road Ped and Bike Crashes by Day of Week (January 2008 to December 2018)



Ped/Bike Crash Trends
(January 2008 to December 2018)



Ped/Bike Crash Trends

By Distance Between Signalized Intersections

Segment		Length (miles)	Total Access Points	Access Points Per Mile	Ped + Bike Crashes	Ped + Bike Crashes Per Mile
From	To					
Scarborough Road	Kentwood Dr. / Cedar Chase Dr.	0.23	5	22	7	30.4
Kentwood Dr. / Cedar Chase Dr.	Dover Town Center	0.19	9	47	0	0.0
Dover Town Center	Rustic Lane	0.20	8	40	3	15.0
Rustic Lane	North Dover Mall Ent.	0.31	7	23	9	29.0
North Dover Mall Ent.	South Dover Mall Ent.	0.11	0	0	0	0
South Dover Mall Ent.	Del. State Univ.	0.15	1	7	2	13.3
Del. State Univ.	Dover Downs Ent.	0.23	2	9	6	26.1
Dover Downs Ent.	College Road	0.16	1	6	3	18.8
College Road	Leipsic Rd / N. State St.	0.34	9	26	9	26.5
Leipsic Rd / N. State St.	Lepore Rd.	0.23	11	48	5	21.7
Lepore Rd.	Townsend Blvd.	0.38	16	42	3	7.9
Townsend Blvd.	Centre Dr.	0.22	12	55	5	22.7
Centre Dr.	White Oak Rd.	0.30	14	47	10	33.3

Segments with higher Ped + Bike Crashes per Mile compared to other locations along the corridor

Ped/Bike Crash Trends

By Distance Between Signalized Intersections

Segment		Length (miles)	Total Access Points	Access Points Per Mile	Ped + Bike Crashes	Ped + Bike Crashes Per Mile
From	To					
White Oak Rd.	Division St.	0.36	16	44	2	5.6
Division St.	Loockerman St.	0.15	7	47	4	26.7
Loockerman St.	MLK Blvd.	0.30	7	23	4	13.3
MLK Blvd.	Public Safety Blvd.	0.37	10	27	2	5.4
Public Safety Blvd.	Roosevelt Ave.	0.67	26	39	4	6.0
Roosevelt Ave.	S. State St.	0.33	8	24	2	6.1
S. State St.	Puncheon Run Conn.	0.31	11	35	2	6.5

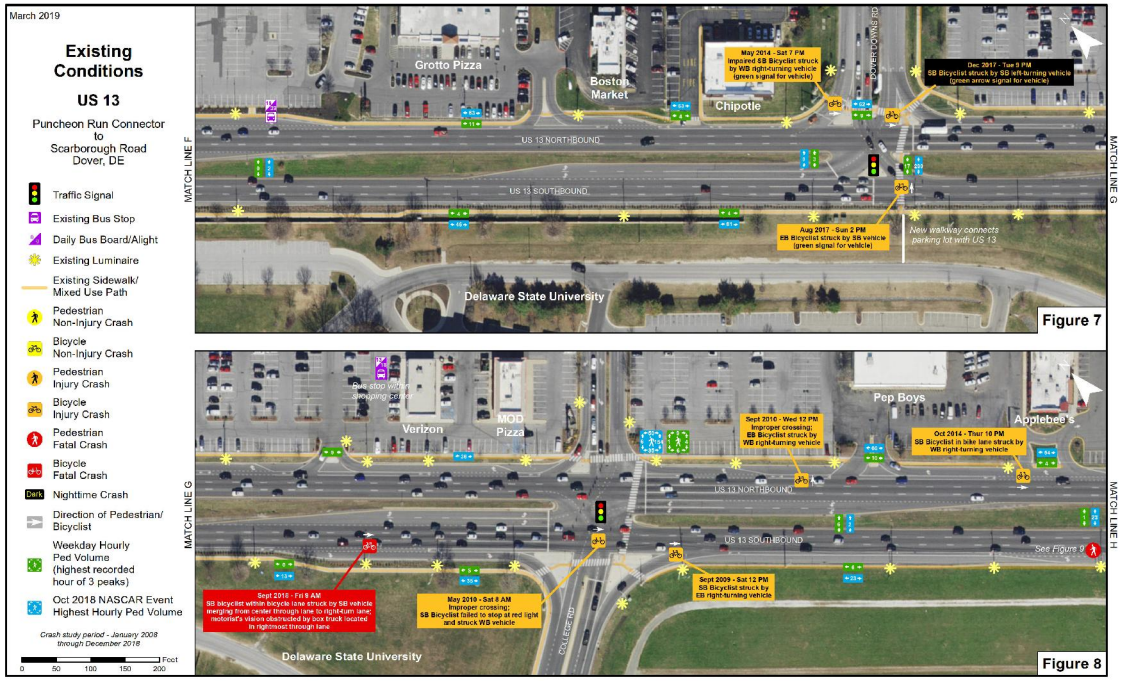
Segments with higher Ped + Bike Crashes per Mile compared to other locations along the corridor

Existing Conditions Figures

LEGEND

- Traffic Signal
- Existing Bus Stop
- Daily Bus Board/Alight
- Existing Luminaire
- Existing Sidewalk/ Mixed Use Path
- Pedestrian Non-Injury Crash
- Bicycle Non-Injury Crash
- Pedestrian Injury Crash
- Bicycle Injury Crash
- Pedestrian Fatal Crash
- Bicycle Fatal Crash
- Dark — Nighttime Crash
- Direction of Pedestrian/ Bicyclist
- Weekday Hourly Ped Volume (highest recorded hour of 3 peaks)
- Oct 2018 NASCAR Event Highest Hourly Ped Volume

- Traffic Control
- Bus Stop Locations
- Transit Ridership
- Lighting
- Sidewalk
- Pedestrian Crash History
- Pedestrian Volumes



Field Meeting

- Held March 22, 2019
- Stakeholders
  - DelDOT Traffic
  - DelDOT Planning
  - DelDOT PAR/ADA
  - OHS
  - DSP
  - DTC
  - FHWA
  - Bike Delaware
  - Dover/Kent MPO
  - City of Dover
- 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

RELEVANT PROJECTS

Relevant Projects

- US 13 Corridor Lighting Improvements
  - Lighting analysis completed in 2018
  - Lighting recommendations implemented by City of Dover with DelDOT purchased luminaires
  - Additional lighting installed at US 13 and Scarborough Road
- Corridor Signal Retiming along US 13 implemented in June, 2017
  - Corridor signal retiming planned along US 13 for 2020
- US 13 @ Delaware State University Signal Improvements
  - Convert side street to split phasing to address pedestrian safety
- US 13 Dover Sidewalks (T201601201)
  - Continuous sidewalk along east side of US 13 from Townsend Blvd. to Leipsic Road
  - Completed in 2019
- Crawford Carroll Avenue Extension (T201609502)
  - Extends Crawford Carroll Avenue to the south behind Lowes and connects to US 13 at the northern Dover Mall access point
  - Proposed to be deleted from FY21-26 CTP

Relevant Projects

- SR 1, Scarborough Road C-D Roads
  - New SB C/D road adjacent to SR 1 to allow for additional access to the properties west of SR 1. Includes on and off ramps for NB SR 1 at Leipsic Road
  - PE funding in FY21-FY23
  - Construction funding FY25-FY26
- 2018/2019 HEP Sites
  - US 13 @ Loockerman Street (2018 Site S-3)
  - US 13 @ Scarborough Road (2018 Site S-4)
  - Martin Luther King Jr. Boulevard (2019 Site E)
    - Includes US 13 @ MLK Jr. Blvd
  - N.E. Kings Highway/White Oak Road (2019 Site F)
    - Includes US 13 @ White Oak Rd (2019 Site S-3)

Relevant Projects

- Major Developer Projects
  - Capitol Station
    - West side of US 13, north side of Division Street
    - Currently under construction
  - Lidl
    - West side of US 13, south of White Oak Road
    - Completed late 2019
  - Berry Van Lines Property (aka Dover Commons)
    - East side of US 13, south side of Leipsic Road
    - Various plan submissions
    - Currently seeking entrance plan approval (as of April 2020)

Corridor-Wide Recommendations

Speed Limit Assessment

- Speed data collected for US 13 and input into FHWA's USLIMITS2 program to determine appropriate speed limit recommendations

Segment	Posted Speed Limit (mph)	# Travel Lanes per Direction	Typ. Travel Lane Width	50th-Percentile Speed (mph)	85th-Percentile Speed (mph)	USLIMITS2 Recommended Speed (mph)	Final Recommended Posted Speed (mph)
Scarborough Road to N. State Street	45	3	11 ft	40	45	40	**40**
N. State Street to White Oak Road	40	3	11 ft	43	46	45	40
White Oak Road to E. Water Street	35	3	11 ft	40	45	40	35
E. Water Street to Puncheon Run Conn.	50	2	12 ft	49	52	50	50

Recommended change in posted speed limit

- Recommend lowering the posted speed limit from 45 mph to 40 mph between Scarborough Road and N. State Street
  - Speed limit change should occur north of Rustic Lane to provide a transition from the 55 mph section north of Scarborough Road

Sidewalk Gap Assessment

	Beginning Point	Ending Point	Distance
Southbound US 13	Bus stop north of Scarborough Rd	McDonalds (north of Holiday Blvd	1,072 ft
	Holiday Blvd	Exxon Entrance	260 ft
	NW island at N. State Street intersection	TD Bank	360 ft
	TD Bank southern property line	Lepore Road	550 ft
	Dover Pawn northern property line	110 ft north of Townsend Blvd	860 ft
	290 ft south of Loockerman Street	445 ft south of Loockerman Street	155 ft
	Public Safety Boulevard	450 ft south of Lotus Street	2,460 ft
	470 ft north of Roosevelt Avenue	Roosevelt Avenue	470 ft
	395 ft south of Roosevelt Avenue	Southern study area limits (Puncheon Run Conn.)	3,000 ft
Northbound US 13	Southern study area limits (Puncheon Run Conn.)	740 ft south of Roosevelt Avenue	2,610 ft
	NE corner of Evergreen Drive intersection	N/A	30 ft
	700 ft north of Evergreen Drive	Laurel Drive	1,675 ft
	MLK Boulevard	Bay Road	655 ft
	Spring Garden Lane	Maple Parkway	600 ft
	Frontage of Dover Food Mart (north side of Leispic Rd)	N/A	185 ft
	830 ft north of Leipsic Road	1,120 ft north of Leipsic Road	290 ft
	Frontage of DSP Museum	N/A	135 ft
	Frontage of DSP Headquarters	N/A	340 ft
	Wawa northern entrance	Maxwell Street	155 ft
	765 ft north of Rustic Lane	Northern study area limits (Scarborough Road)	2,300 ft

Recommendation: Continue to add sidewalks/sidepaths through capital and developer projects

Bus Stop Amenities Assessment

Lighting, Bench, Shelter, Ridership Data

Direction	Location	Shelter/ Bench?	Lit?	Weekday Ridership *(December 2019)*			Bench Warranted? *	Shelter Warranted? *
				Boardings	Alightings	Total		
Northbound	Centre Drive & Olive Garden	None	N	7	11	18	No	No
	Centre at Dover & Red Lobster	None	Y	9	8	17	No	No
	US 13 &Townsend Blvd	Shelter	Y	7	9	16	N/A	N/A
	US 13 & Jefferic Blvd	None	N	3	7	10	No	No
	US 13 & North Dover Center Staples	Bench	Y	9	13	22	N/A	No
	US 13 & Best Buy/Michaels	None	N	19	38	57	Yes	No
	US 13 & Rustic Lane	None	N	3	12	15	No	No
	US 13 & Smith Street	None	N	1	4	5	No	No
Southbound	US 13 & Denneys Road	Shelter	Y	3	6	9	N/A	N/A
	US 13 & KW Blvd (Sam's Club)	Shelter	N	33	26	62	N/A	N/A
	US 13 & Rustic Lane	None	N	15	11	26	Yes	No
	US 13 & Delaware State University	Shelter	Y	72	57	129	N/A	N/A
	US 13 & DE Agricultural Museum	None	Y	4	2	6	No	No

** US 13 is considered to have moderate transit density; therefore, DTC's applicable criteria are as follows:*

- *Bench: 10 or more boardings per day*
- *Shelter: 20 or more boardings per day*

Bus Stop Amenities Assessment

Summary and Recommendations

- DTC's criteria for moderate transit density areas:
  - Bench – 10 or more boardings per day
  - Shelter – 20 or more boardings per day
- Bench criteria met at following bus stops:
  - NB US 13 at Best Buy/Michaels

    (current conditions: sidewalk connectivity; lighting; no bus pad; bus stops in right-turn lane)
  - SB US 13 at Rustic Lane

    (current conditions: sidewalk connectivity; lighting; no bus pad; bus pulloff)
- DTC requests for improvements:
  - Improve existing stops along US 13 including US 13 & DE Agricultural Museum, US 13 & Best Buy/Michaels and US 13 & Smith Street.
  - Evaluate locations along US 13 for bus pulloffs: US 13 SB in front of Delaware State University and/or near College Road, US 13 NB in front of North Dover Center, US 13 NB in front of Centre at Dover (Red Lobster) and US 13 NB on the far side of Division Street
  - Implement pedestrian connectivity in areas underserved by transit along US 13 south of Public Safety Boulevard, including US 13 SB south of Lotus Street (existing bus pad across from McDonalds), US 13 on both sides south of Roosevelt Avenue and US 13 north of Webbs Lane (existing bus pad)
- **RECOMMENDATIONS:**
  - Install a bench at the NB US 13 bus stop at Best Buy/Michaels
  - Install a bench at the SB US 13 bus stop at Rustic Lane
  - Install lighting at all bus stops along corridor that currently are unlit
  - Investigate the feasibility of DTC's requests for transit stop improvements, in conjunction with other pedestrian safety improvements.

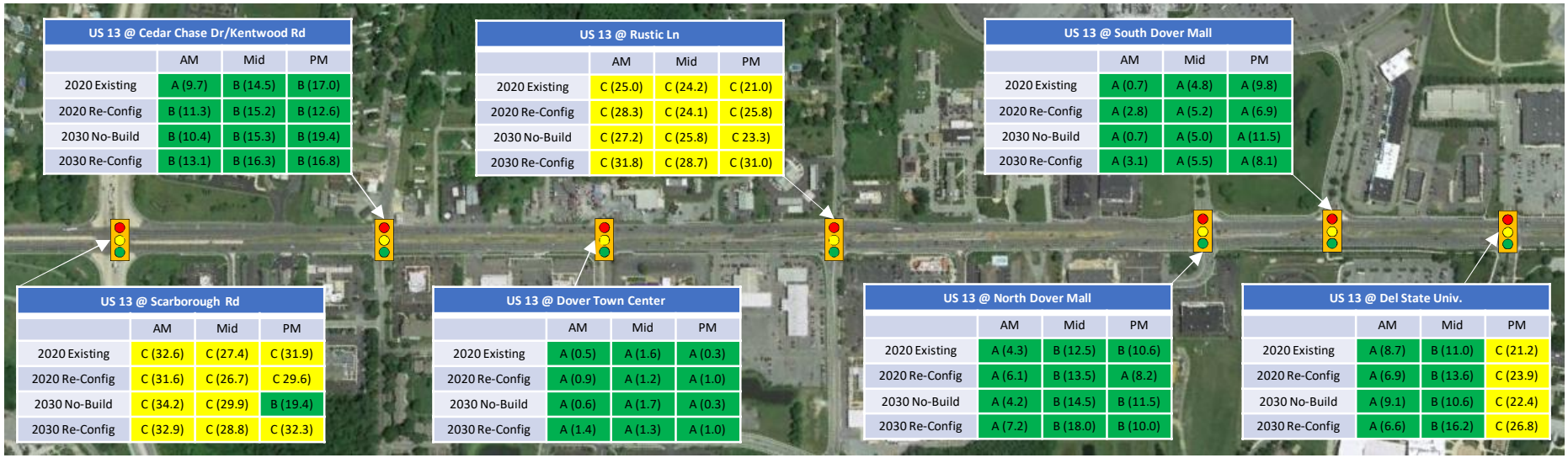
Road Re-Configuration
Feasibility Assessment

Field Meeting Suggestion:
- **Consider the impacts of a road re-configuration along US 13**

- Reduce thru lanes along the US 13 corridor from 3 lanes to 2 lanes northbound and southbound from Scarborough Road to Bay Road
- *Synchro* models were built for existing AM, Midday, and PM peak periods
- *Synchro* models were built for a road re-configuration scenario during AM, Midday, and PM peak periods with optimized splits and corridor offsets
- Maintained existing cycle lengths
- Assumed that all traffic would remain on US 13 and not detour to other viable routes
- Analyzed 2020 volumes and projected 2030 volumes

Road Re-Configuration

Level of Service Comparison (2020 vs. 2030)



US 13 @ Cedar Chase Dr/Kentwood Rd

	AM	Mid	PM
2020 Existing	A (9.7)	B (14.5)	B (17.0)
2020 Re-Config	B (11.3)	B (15.2)	B (12.6)
2030 No-Build	B (10.4)	B (15.3)	B (19.4)
2030 Re-Config	B (13.1)	B (16.3)	B (16.8)

US 13 @ Rustic Ln

	AM	Mid	PM
2020 Existing	C (25.0)	C (24.2)	C (21.0)
2020 Re-Config	C (28.3)	C (24.1)	C (25.8)
2030 No-Build	C (27.2)	C (25.8)	C 23.3)
2030 Re-Config	C (31.8)	C (28.7)	C (31.0)

US 13 @ South Dover Mall

	AM	Mid	PM
2020 Existing	A (0.7)	A (4.8)	A (9.8)
2020 Re-Config	A (2.8)	A (5.2)	A (6.9)
2030 No-Build	A (0.7)	A (5.0)	A (11.5)
2030 Re-Config	A (3.1)	A (5.5)	A (8.1)

US 13 @ Scarborough Rd

	AM	Mid	PM
2020 Existing	C (32.6)	C (27.4)	C (31.9)
2020 Re-Config	C (31.6)	C (26.7)	C 29.6)
2030 No-Build	C (34.2)	C (29.9)	B (19.4)
2030 Re-Config	C (32.9)	C (28.8)	C (32.3)

US 13 @ Dover Town Center

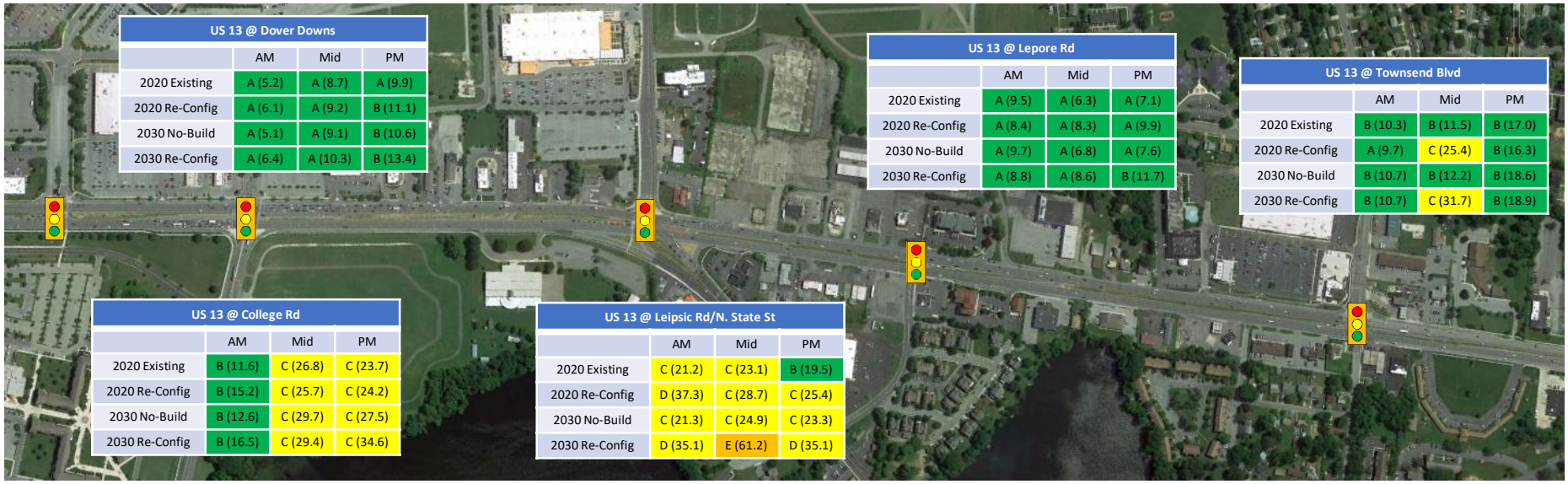
	AM	Mid	PM
2020 Existing	A (0.5)	A (1.6)	A (0.3)
2020 Re-Config	A (0.9)	A (1.2)	A (1.0)
2030 No-Build	A (0.6)	A (1.7)	A (0.3)
2030 Re-Config	A (1.4)	A (1.3)	A (1.0)

US 13 @ North Dover Mall

	AM	Mid	PM
2020 Existing	A (4.3)	B (12.5)	B (10.6)
2020 Re-Config	A (6.1)	B (13.5)	A (8.2)
2030 No-Build	A (4.2)	B (14.5)	B (11.5)
2030 Re-Config	A (7.2)	B (18.0)	B (10.0)

US 13 @ Del State Univ.

	AM	Mid	PM
2020 Existing	A (8.7)	B (11.0)	C (21.2)
2020 Re-Config	A (6.9)	B (13.6)	C (23.9)
2030 No-Build	A (9.1)	B (10.6)	C (22.4)
2030 Re-Config	A (6.6)	B (16.2)	C (26.8)



US 13 @ Dover Downs

	AM	Mid	PM
2020 Existing	A (5.2)	A (8.7)	A (9.9)
2020 Re-Config	A (6.1)	A (9.2)	B (11.1)
2030 No-Build	A (5.1)	A (9.1)	B (10.6)
2030 Re-Config	A (6.4)	A (10.3)	B (13.4)

US 13 @ Lepore Rd

	AM	Mid	PM
2020 Existing	A (9.5)	A (6.3)	A (7.1)
2020 Re-Config	A (8.4)	A (8.3)	A (9.9)
2030 No-Build	A (9.7)	A (6.8)	A (7.6)
2030 Re-Config	A (8.8)	A (8.6)	B (11.7)

US 13 @ Townsend Blvd

	AM	Mid	PM
2020 Existing	B (10.3)	B (11.5)	B (17.0)
2020 Re-Config	A (9.7)	C (25.4)	B (16.3)
2030 No-Build	B (10.7)	B (12.2)	B (18.6)
2030 Re-Config	B (10.7)	C (31.7)	B (18.9)

US 13 @ College Rd

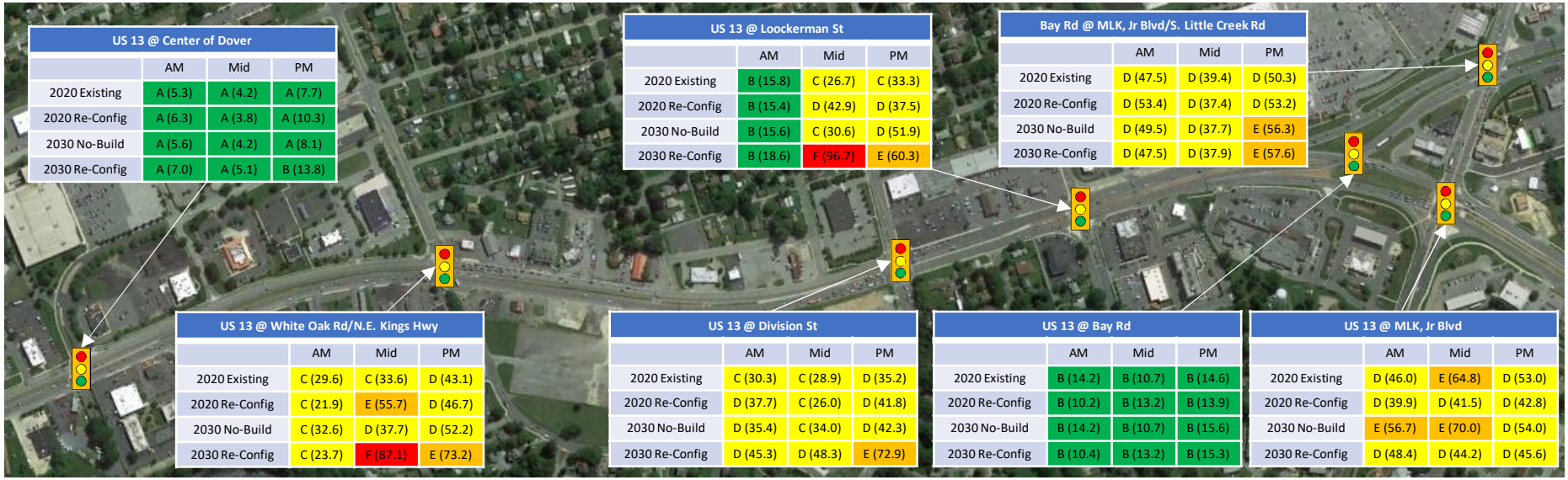
	AM	Mid	PM
2020 Existing	B (11.6)	C (26.8)	C (23.7)
2020 Re-Config	B (15.2)	C (25.7)	C (24.2)
2030 No-Build	B (12.6)	C (29.7)	C (27.5)
2030 Re-Config	B (16.5)	C (29.4)	C (34.6)

US 13 @ Leipsic Rd/N. State St

	AM	Mid	PM
2020 Existing	C (21.2)	C (23.1)	B (19.5)
2020 Re-Config	D (37.3)	C (28.7)	C (25.4)
2030 No-Build	C (21.3)	C (24.9)	C (23.3)
2030 Re-Config	D (35.1)	E (61.2)	D (35.1)

Road Re-Configuration

Level of Service Comparison (2020 vs. 2030)



US 13 @ Center of Dover

	AM	Mid	PM
2020 Existing	A (5.3)	A (4.2)	A (7.7)
2020 Re-Config	A (6.3)	A (3.8)	A (10.3)
2030 No-Build	A (5.6)	A (4.2)	A (8.1)
2030 Re-Config	A (7.0)	A (5.1)	B (13.8)

US 13 @ Loockerman St

	AM	Mid	PM
2020 Existing	B (15.8)	C (26.7)	C (33.3)
2020 Re-Config	B (15.4)	D (42.9)	D (37.5)
2030 No-Build	B (15.6)	C (30.6)	D (51.9)
2030 Re-Config	B (18.6)	F (96.7)	E (60.3)

Bay Rd @ MLK, Jr Blvd/S. Little Creek Rd

	AM	Mid	PM
2020 Existing	D (47.5)	D (39.4)	D (50.3)
2020 Re-Config	D (53.4)	D (37.4)	D (53.2)
2030 No-Build	D (49.5)	D (37.7)	E (56.3)
2030 Re-Config	D (47.5)	D (37.9)	E (57.6)

US 13 @ White Oak Rd/N.E. Kings Hwy

	AM	Mid	PM
2020 Existing	C (29.6)	C (33.6)	D (43.1)
2020 Re-Config	C (21.9)	E (55.7)	D (46.7)
2030 No-Build	C (32.6)	D (37.7)	D (52.2)
2030 Re-Config	C (23.7)	F (87.1)	E (73.2)

US 13 @ Division St

	AM	Mid	PM
2020 Existing	C (30.3)	C (28.9)	D (35.2)
2020 Re-Config	D (37.7)	C (26.0)	D (41.8)
2030 No-Build	D (35.4)	C (34.0)	D (42.3)
2030 Re-Config	D (45.3)	D (48.3)	E (72.9)

US 13 @ Bay Rd

	AM	Mid	PM
2020 Existing	B (14.2)	B (10.7)	B (14.6)
2020 Re-Config	B (10.2)	B (13.2)	B (13.9)
2030 No-Build	B (14.2)	B (10.7)	B (15.6)
2030 Re-Config	B (10.4)	B (13.2)	B (15.3)

US 13 @ MLK, Jr Blvd

	AM	Mid	PM
2020 Existing	D (46.0)	E (64.8)	D (53.0)
2020 Re-Config	D (39.9)	D (41.5)	D (42.8)
2030 No-Build	E (56.7)	E (70.0)	D (54.0)
2030 Re-Config	D (48.4)	D (44.2)	D (45.6)

- Capacity analysis results
  - Intersections north of White Oak Road experience minimal impacts on overall intersection delay
  - Several intersections south of White Oak Road degrade in 2030 even without the road re-configuration
  - White Oak Road and Loockerman Street are the most critical intersections with the road re-configuration
  - Specific turning movements at all intersections may experience much greater delay due to lower proportions of green time

Road Re-Configuration
Feasibility Assessment

- Corridor travel time, speed and delay comparisons

	MOE	2020 Existing	2020 Re-Config	2030 Existing	2030 Re-Config
AM Peak	Delay (s/veh)	NB: 198.2 SB 180.8	NB: 157.8 SB: 227.0	NB: 223.1 SB: 207.5	NB: 189.1 SB: 255.1
	Total Travel Time (minutes)	NB: 11.9 SB: 11.5	NB: 12.7 SB: 13.3	NB: 12.5 SB: 11.9	NB: 13.2 SB: 13.8
	Avg. Speed (mph)	NB: 33 SB: 33	NB: 31 SB: 28	NB: 32 SB: 32	NB: 30 SB: 27
Midday Peak	Delay (s/veh)	NB: 271.9 SB: 228.3	NB: 291.4 SB: 274.8	NB: 297.7 SB: 273.6	NB: 346.4 SB: 335.0
	Total Travel Time (minutes)	NB: 12.9 SB: 12.3	NB: 13.2 SB: 13.1	NB: 13.3 SB: 13.0	NB: 14.1 SB: 13.8
	Avg. Speed (mph)	NB: 29 SB: 31	NB: 29 SB: 29	NB: 29 SB: 29	NB: 30 SB: 27
PM Peak	Delay (s/veh)	NB: 327.6 SB: 395.2	NB: 243.5 SB: 293.6	NB: 388.0 SB: 431.8	NB: 302.1 SB: 358.5
	Total Travel Time (minutes)	NB: 13.2 SB: 14.5	NB: 13.0 SB: 14.2	NB: 14.2 SB: 15.1	NB: 14.1 SB: 15.1
	Avg. Speed (mph)	NB: 26 SB: 24	NB: 27 SB: 25	NB: 24 SB: 23	NB: 25 SB: 23

Road Re-Configuration
Feasibility Assessment

- Corridor travel times, speed and delay comparisons
  - Minor increases in travel times between 2020 existing conditions and 2020 and 2030 conditions with the road re-configuration (approximately 1 minute)
  - Speeds generally decrease with the road re-configuration when comparing 2020 and 2030 conditions (≤ 5 mph)
- Road Re-configuration Advantages
  - Theoretically slower speeds
  - More space for cyclists
  - Possibly use additional space for a bus/bike/right-turn lane and consider the use of queue jumpers to improve transit operations
- Road Re-configuration Disadvantages
  - No benefit to pedestrian crossing distances across US 13 as overall cross-section does not change
  - Loss of capacity
  - Increase in intersection and movement delays
  - Increase in travel times
  - Geometric improvements to curb lines are required to achieve speed reduction and pedestrian safety benefits (i.e., striping changes alone would not be effective for this location)

Road Re-Configuration
Feasibility Assessment

- Recommendations
  - The function of US 13 needs to be discussed with stakeholders:
    - A through highway with higher speeds or;
    - An urban street with lower speeds and more interruption to through traffic
  - Begin high-level conceptual layout of a road re-configuration to identify any geometric design concerns
  - As part of future Pave & Rehab projects, ensure that pavement marking improvements include a reduction in lane widths throughout the corridor to effectively reduce travel speeds
  - Upon completion of other pedestrian safety improvements, re-evaluate pedestrian crashes to determine if a road re-configuration would provide additional pedestrian safety benefits

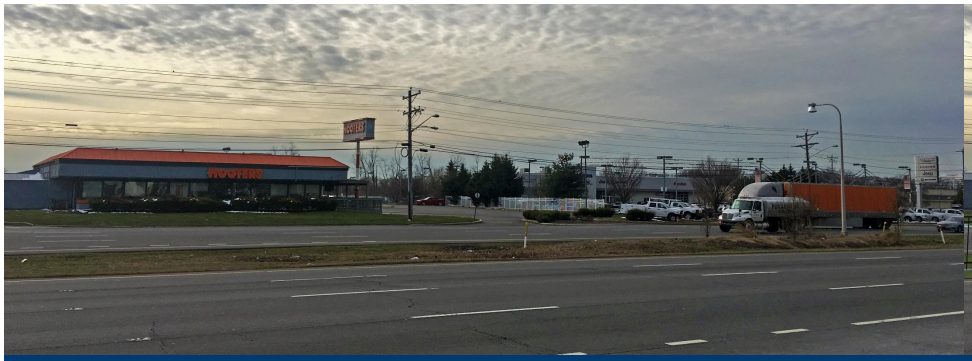
Barrier Treatment Assessment

- Purpose of barrier treatments
  - Discourage pedestrians from crossing roadway in non-ideal areas such as midblock locations along a high-speed/high-volume arterial roadway where motorists do not expect pedestrians to be crossing

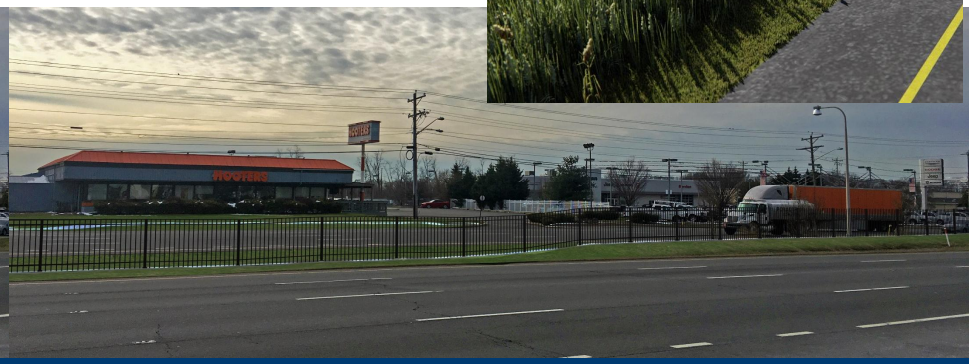
- Considerations for barrier treatments locations
  - Installation within median
    - Decorative fencing, concrete barrier, HTCB, guardrail with/without landscaping/vegetation screen
  - Installation along roadside between sidewalk and roadway
    - Post and chain fencing, concrete barrier, guardrail with/without landscaping/vegetation screen

Barrier Treatment Assessment

- Median barrier locations are currently being prioritized along US 13 in New Castle County from US 40 to Wilmington



Before



Artist Rendering

- Post & chain fence with landscaping was recently installed along US 13 near Delaware State University

Barrier Treatment Assessment

- Assessment methodology
  - Identify locations with high number of pedestrian crashes potentially correctable with the presence of barrier
  - Review pedestrian demand, median characteristics, roadside characteristics, and adjacent land uses at identified segments

Segment		Length (miles)	# of Ped Crashes Potentially Correctable with Barrier Installation*
From	To		
Scarborough Road	Kentwood Dr. / Cedar Chase Dr.	0.23	1
Kentwood Dr. / Cedar Chase Dr.	Dover Town Center	0.19	0
Dover Town Center	Rustic Lane	0.20	1
Rustic Lane	North Dover Mall Ent.	0.31	6
North Dover Mall Ent.	South Dover Mall Ent.	0.11	0
South Dover Mall Ent.	Del. State Univ.	0.15	0
Del. State Univ.	Dover Downs Ent.	0.23	0
Dover Downs Ent.	College Road	0.16	0
College Road	Leipsic Rd / N. State St.	0.34	3
Leipsic Rd / N. State St.	Lepore Rd.	0.23	1
Lepore Rd.	Townsend Blvd.	0.38	0
Townsend Blvd.	Centre Dr.	0.22	2
Centre Dr.	White Oak Rd.	0.30	3
White Oak Rd.	Division St.	0.36	0
Division St.	Loockerman St.	0.15	0
Loockerman St.	MLK Blvd.	0.30	2
MLK Blvd.	Public Safety Blvd.	0.37	0
Public Safety Blvd.	Roosevelt Ave.	0.67	2
Roosevelt Ave.	S. State St.	0.33	0
S. State St.	Puncheon Run Conn.	0.31	1

** For the purposes of this assessment, pedestrian crashes that occurred at mid-block locations and involved a pedestrian that "improperly crossed" were considered potentially correctable with the presence of barrier*

Priority Segment for Barrier Treatments

Barrier Treatment Assessment

Rustic Lane to North Dover Mall Entrance

- Segment Length: 0.31-mile
- 6 total pedestrian crashes
  - All may be correctable by installation of barrier treatment
  - 3 pedestrian fatalities (Aug 2008, Mar 2011, Oct 2015)
- Frequent mid-block pedestrian crossings
  - Majority occur closer to Rustic Lane between Chick-Fil-A (south side) and Starbucks (north side)
- Median width within segment ≈ 40 ft (south leg at Rustic = 32 ft; north leg at North Dover Mall = 18 ft);
- 1 median opening at Delaware State Police Headquarters
- Existing sidewalk
  - NB US 13 (east side): provided from Rustic Lane to border of Starbucks property and then from northern border of Subaru property to North Dover Mall (4 ft buffer between sidewalk & roadway)
  - SB US 13 (west side): provided along entire segment (4 ft buffer between sidewalk & roadway)

Barrier Treatment Assessment

Rustic Lane to North Dover Mall Entrance, continued

- Adjacent land use
  - Commercial properties along both sides of roadway
  - Delaware State Police Headquarters on east side of roadway
  - Dover Mall exists behind DSP HQ
- Transit operations
  - SB bus stop on south side of Rustic Lane, with bus pulloff
  - NB bus stop on north side of Rustic Lane
  - Pedestrians observed getting off of bus, crossing midblock to get to bus in opposite direction of travel
- **Barrier options for this location: Median barrier**
  - **Mid-Term Recommendation: Signalize median opening at DSP Headquarters and install a new crosswalk to avoid having an unsignalized crossover/break in the median barrier near pedestrian generators**
  - **Long-Term Recommendation: Install median barrier along median segments between signalized pedestrian crossings between Rustic Lane and North Dover Mall Entrance**

Barrier Treatment Assessment

College Road to Leipsic Road/N. State Street

- Segment Length: 0.34-mile
- 3 total pedestrian crashes
  - All may be correctable by installation of barrier treatment
  - 2 pedestrian crashes (injuries) occurred during fall NASCAR events (Sept 2010 and Sept 2013)
  - 1 pedestrian fatality (July 2017)
- Minimal mid-block pedestrian crossings with the exception of heavy mid-block activity during NASCAR observation period
- Median width ≈ 40 ft; 1 existing median opening
- Existing sidewalk
  - NB US 13 (east side): located along majority of segment. Gaps at older commercial properties; buffer is not continuous between sidewalk and roadway
  - SB US 13 (west side): located along majority of segment; ~4 ft wide with varying buffer width
- Adjacent Land Use: Commercial property on east side, vacant field and Ag Museum on west side. Vacant field is used for parking/camping during NASCAR and other events
- **Barrier option for this location: Median barrier**
  - **Close existing unsignalized median opening as part of median barrier installation**

Barrier Treatment Assessment

Centre Drive to White Oak Road

- Segment Length: 0.30-mile
- 3 total pedestrian crashes
  - All may be correctable by installation of barrier treatment
  - No pedestrian fatalities
- Relatively minimal mid-block pedestrian crossings
- Median width ≈ 25 ft (Centre Dr south leg ~ 10 ft and White Oak Rd north leg ≈ 15 ft); One median opening at Red Lobster/Olive Garden
- Existing sidewalk and mixed-use path
  - NB US 13 (east side): sidewalk with buffer along entire segment
  - SB US 13 (west side): sidewalk along majority of segment, gaps due to numerous access points, varying presence of buffer
- Adjacent Land Use: Predominantly commercial on both sides of road
- **Barrier options for this location: Median barrier**
  - **Consider signalization of the existing median opening and installing a crosswalk (see location-specific assessment for US 13 @ Red Lobster for more information)**

Location-Specific Assessments

LOCATION-SPECIFIC ASSESSMENTS:
US 13 AT RUSTIC LANE

US 13 at Rustic Lane

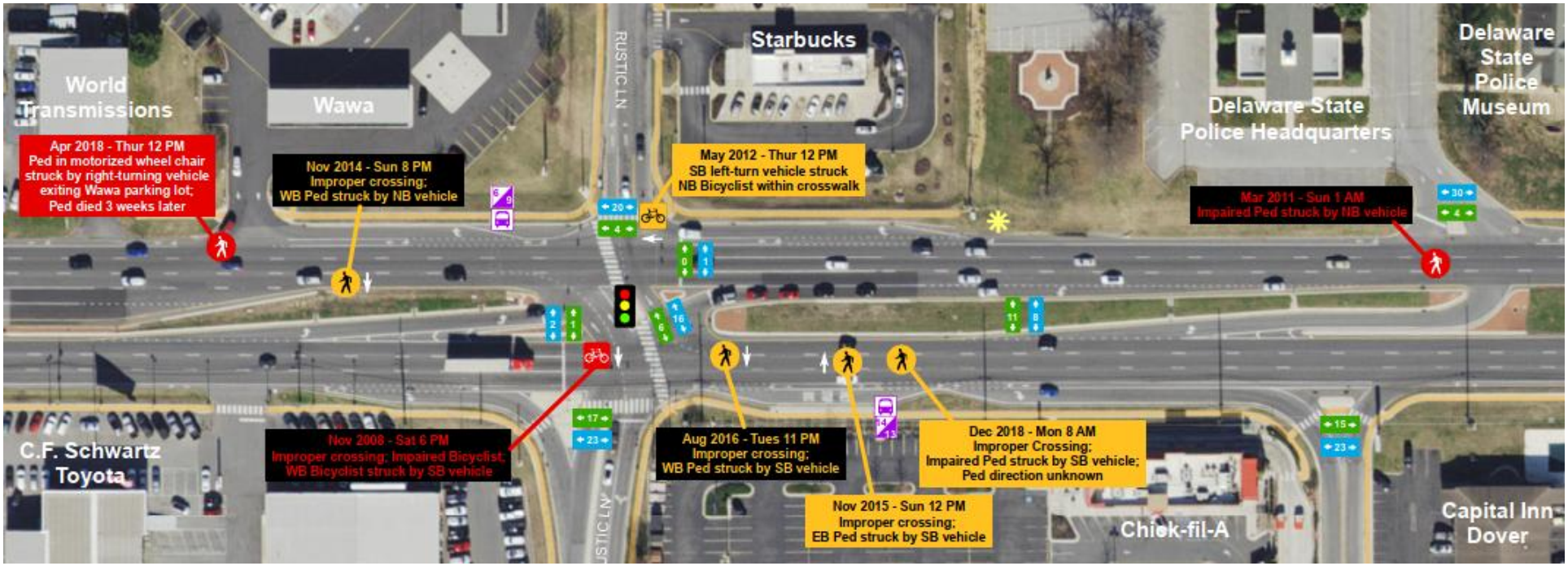
Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- Pedestrian accommodations on 2 legs and a diagonal crossing of US 13
- 2 DART stops in close proximity to the intersection
- Pedestrian generators on both sides of US 13 – Wawa and Starbucks and residences to the east, car dealership and Chick-fil-a to the west as well as bus stops near intersection

Field Meeting Suggestions:

- Consider pedestrian accommodations on all 4 legs



US 13 at Rustic Lane

Existing Conditions

Nearby Intersections with Pedestrian Accommodations:

- **US 13 at Kentwood Drive/Cedar Chase Drive – 0.4 miles north of Rustic Lane**
- **US 13 at Mall Boulevard – 0.3 miles south of Rustic Lane**

US 13 at Rustic Lane

Options Considered

- Option 1: Install pedestrian signals on north and south legs and add an exclusive pedestrian phase
  - Provides pedestrian accommodations at the desired locations
  - Reduces green time on the major approaches
  - Allows pedestrians to cross US 13 using either crosswalk at the same time
  - Delays and congestion would increase in the area
  - Would need to coordinate with nearby signals to keep queues at a minimum
  - Maintains existing through movement restrictions
- Option 2: Install pedestrian signals on north and south legs and change signal phasing to split-phased
  - Provides pedestrian accommodations at the desired locations
  - Takes green time away from the major approaches
  - Delays and congestion would increase in the area
  - Would need to coordinate with nearby signals to keep queues at a minimum
  - Allows for thru movements on Rustic Lane, once the concrete median is removed

US 13 at Rustic Lane

Options Considered

- Option 3: Install two-stage pedestrian crossing across the south leg of the intersection with main street left-turn overlap
  - Provides pedestrian accommodations at one of the desired locations
  - Takes minimal green time away from the major approaches
  - Would need to coordinate with nearby signals
  - Would need to install a “U-TURNS YIELD TO PEDESTRIANS” sign
    - NOTE: 116 northbound U-turns counted in the midday peak on 4/16/2019
- Option 4: Install pedestrian signals on north and south legs and cross pedestrians with permissive side-street left-turns
  - Provides pedestrian accommodations at the desired locations
  - Maintains concurrent side-street left-turn phasing
  - Allows for a conflict between pedestrians and left-turning vehicles
  - Takes green time away from the major approaches
  - Delays and congestion would increase in the area
  - Would need to coordinate with nearby signals to keep queues at a minimum

US 13 at Rustic Lane

Options Considered

- Option 5: Install two-stage pedestrian crossing across south leg of the intersection with no overlap phases
  - Provides pedestrian accommodations at one of the desired locations
  - WB left-turns would need to yield to pedestrians in the crosswalk
  - WB queues/delay may increase

US 13 at Rustic Lane *Synchro* Analysis

150" cycle length	AM Intersection LOS	AM Intersection Delay (sec)	PM Intersection LOS	PM Intersection Delay (sec)
Existing Conditions* (concurrent)	C	20.3	C	25.9
Proposed Option 1 (exclusive ped phase)	C	24.8	D	36.6
Proposed Option 2 (split-phased)**	C	27.7	C	32.8
Proposed Option 3 (2-stage w/ main-street left overlap)	B	19.8	C	21.5
Proposed Option 4 (1-stage w/ no overlaps)	C	24.9	C	28.1
Proposed Option 5 (2-stage w/ no overlaps)	B	19.8	C	21.5

* Existing conditions: splits cover vehicles and pedestrian movements

** Proposed Option 2: splits do not cover vehicles if pedestrians are called

US 13 at Rustic Lane

Recommendations

- Recommendations:
  - Option 4: Install pedestrian accommodations on the north and south legs of US 13 at Rustic Lane
  - Add pedestrian phases 3 and 7 across US 13
  - Maintain concurrent side-street left-turn phasing (phases 4 and 8)
  - Install “TURNING VEHICLES YIELD TO PEDESTRIANS” signs
  - Remove existing crosswalk from the southwest corner to the northeast corner
  - Extend south leg median to provide pedestrian refuge
  - Adjust northbound and southbound stop bars to accommodate new crosswalks
  - Consider reconstruction of existing NB/SB left-turn lanes to remove unnecessary channelization

US 13 at Rustic Lane

Recommended Concept (Option 4)

Conceptual design

RECOMMENDATION: Prepare design plans for DelDOT Traffic to add the fourth pedestrian crossing and remove channelization islands between the NB/SB thru lanes and NB/SB left-turn lanes. See previous slide for additional information.

LOCATION-SPECIFIC ASSESSMENTS:
US 13 AT DELAWARE STATE UNIVERSITY

US 13 at DSU

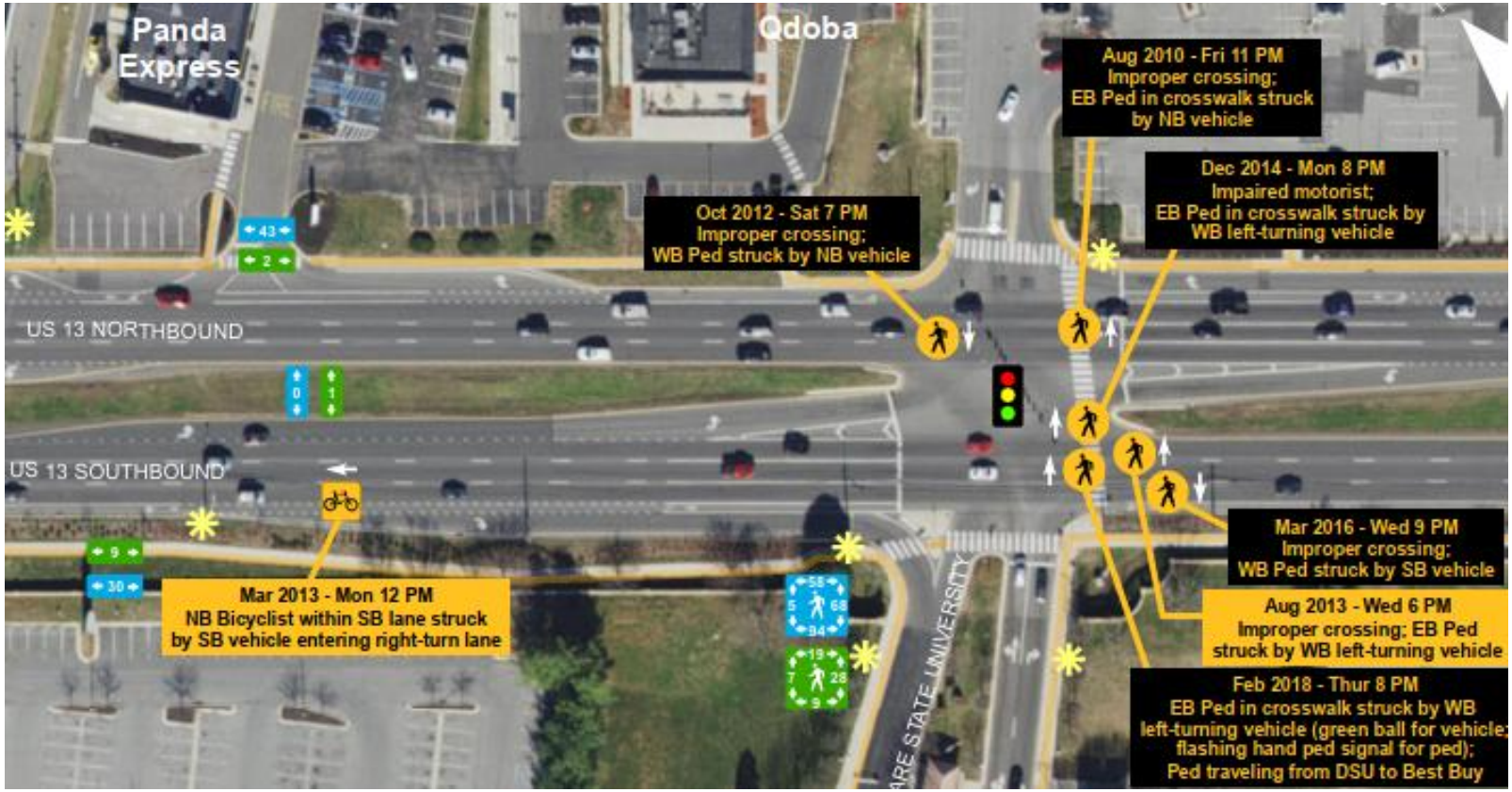
Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- Signalized crosswalks on the east, west, and north legs
- Continuous sidewalk along both sides of US 13
- Roadway lighting is present
- Split phasing recently implemented by DelDOT Traffic
- Pedestrian generators on both sides of US 13 – shopping centers to the east, DSU to the west

Field Meeting Suggestions:

- Consider crosswalk on the north leg of the intersection
- Consider median refuge area on the south leg



US 13 at DSU

Existing Conditions

Nearby Intersections with Pedestrian Accommodations:

- **US 13 at S Dover Mall – 0.15 miles north of DSU**
- **US 13 at Dover Downs – 0.25 miles south of DSU**

US 13 at DSU

Options Considered

- Option 1: Install pedestrian signal on north leg
  - Provides pedestrian accommodations at the desired locations
  - Reduces green time on major approaches
  - Delays and congestion would increase in the area
  - Would need to coordinate with nearby signals to keep queues at a minimum

- Option 2: Install pedestrian signal on north leg and extend medians on the north and south legs
  - Provides refuge for pedestrians
  - Causes vehicles to make wider left-turns from US 13
  - Would allow for two-stage ped crossings

	AM Intersection LOS	AM Intersection Delay (sec)	PM Intersection LOS	PM Intersection Delay (sec)
Existing Conditions	B	13.4	C	29.4
Proposed Conditions (Added Crosswalk)	B	14.9	C	34.2

*Cycle length is 150”

US 13 at DSU

Recommended Concept (Option 2)

Conceptual design

RECOMMENDATION: Prepare design plans for DelDOT Traffic to add the fourth pedestrian crossing, operate pedestrian crossings as two-stage, and remove channelization islands between the NB/SB thru lanes and NB/SB left-turn lanes. See previous slide for additional information.

LOCATION-SPECIFIC ASSESSMENTS:
US 13 AT LEPORE ROAD

US 13 at Lepore Road

Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- Partially signalized intersection controlling southbound thrus, northbound left/u-turns and eastbound right-turns
- Pedestrian crossing across west leg; no crossing of US 13
- Predominantly commercial land use on both sides of US 13
- FRA left-turn phasing recently recommended at intersection
- Pedestrian generators include residences to the east and west, but stop to the east and businesses on both sides of US 13

Field Meeting Suggestions:

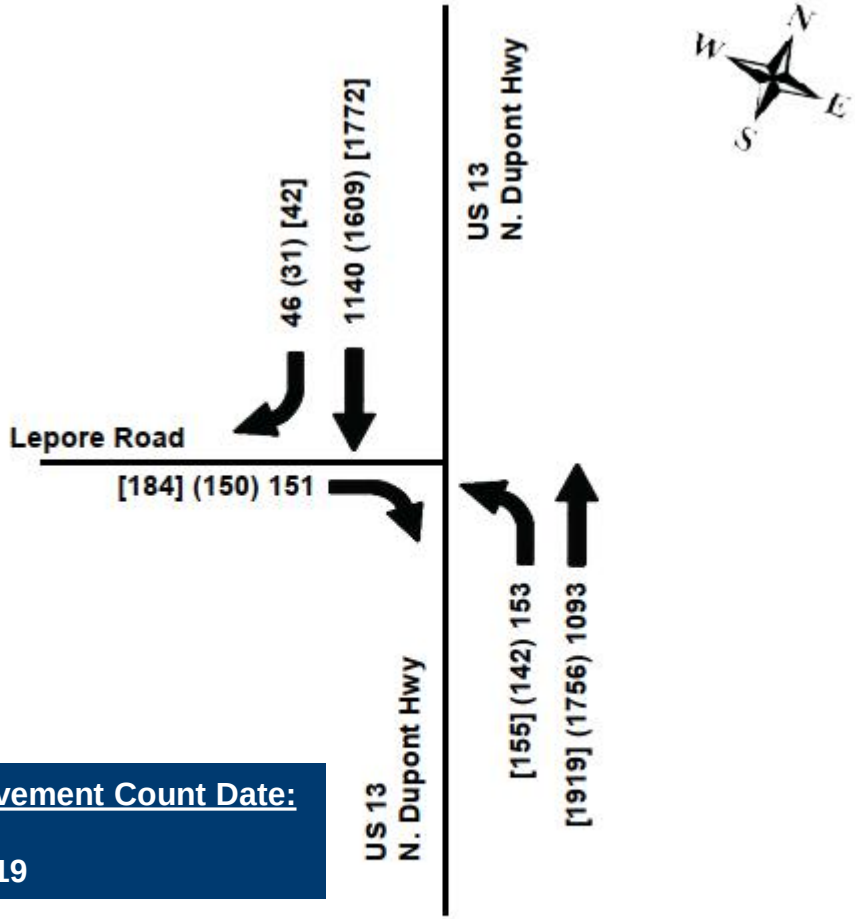
- Consider adding a signalized pedestrian crossing of US 13

Figure 10

US 13 at Lepore Road

Existing Conditions

- Nearby pedestrian accommodations
  - US 13 at Leipsic Road/N. State Street (0.23 mi north)
  - US 13 at Townsend Blvd. (0.38 mi south)
- Pedestrian/bicycle crash trends
  - 2 pedestrian crashes at intersection
  - 1 bicycle crash at intersection



Turning Movement Count Date:

April 30, 2019

00 AM Peak - 7:30 AM - 8:30 AM (2019 Peak Hour)
(00) MID Peak - 12:00 PM - 1:00 PM (2019 Peak Hour)
[00] PM Peak - 4:45 PM - 5:45 PM (2019 Peak Hour)

US 13 at Lepore Road

Options Considered

- Option 1: Signalize NB US 13 and install signalized crosswalk across US 13
  - Provides pedestrian accommodations across US 13 at the desired location
  - Reduces distances a pedestrian has to walk to use an existing signalized pedestrian crossing of US 13
  - Requires additional stop condition for NB vehicles, one that doesn't exist today
  - Minimal impact on signal progression
  - Minimal impact on delays and LOS
  - Pedestrians crossing US 13 can cross with EB right-turn and NB left-turn movements
  - Would need to coordinate with nearby signals to keep queues at a minimum

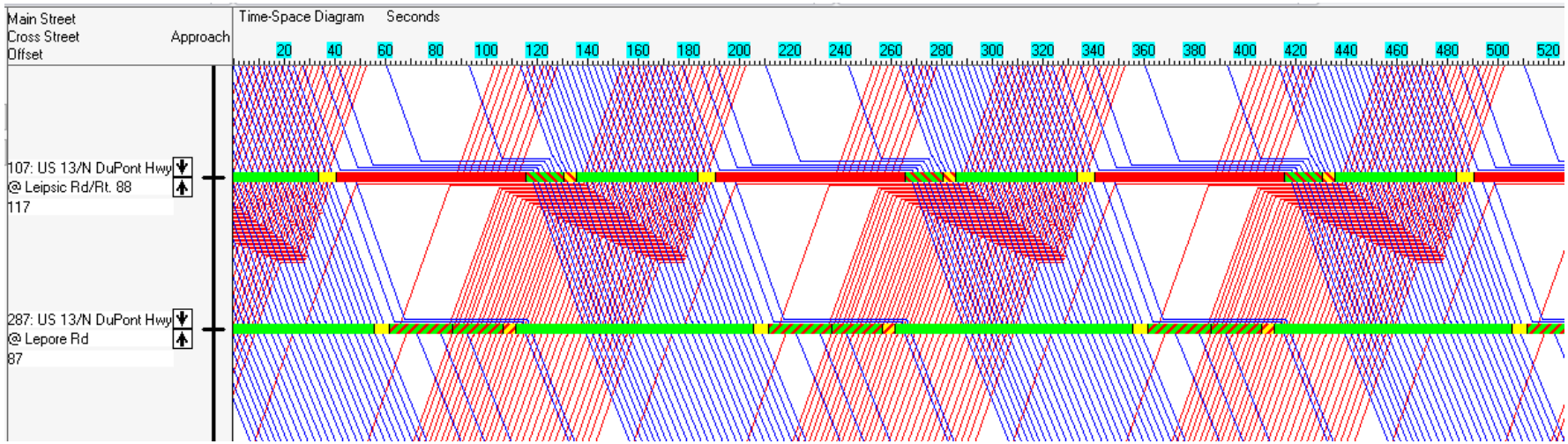
	AM Peak	Midday Peak	PM Peak
Existing	A (9.5 s/veh)	A (6.0 s/veh)	A (7.3 s/veh)
Proposed	A (8.6 s/veh)	A (9.1 s/veh)	A (7.4 s/veh)

- Recommendation: Signalize NB US 13 and install two stage signalized crosswalk across US 13. Provide ADA compliant curb ramps.
  - Crosswalk to be located on north leg and will overlap with the EB right-turn and NB left-turns
  - Includes previously proposed FRA NB left-turn phasing

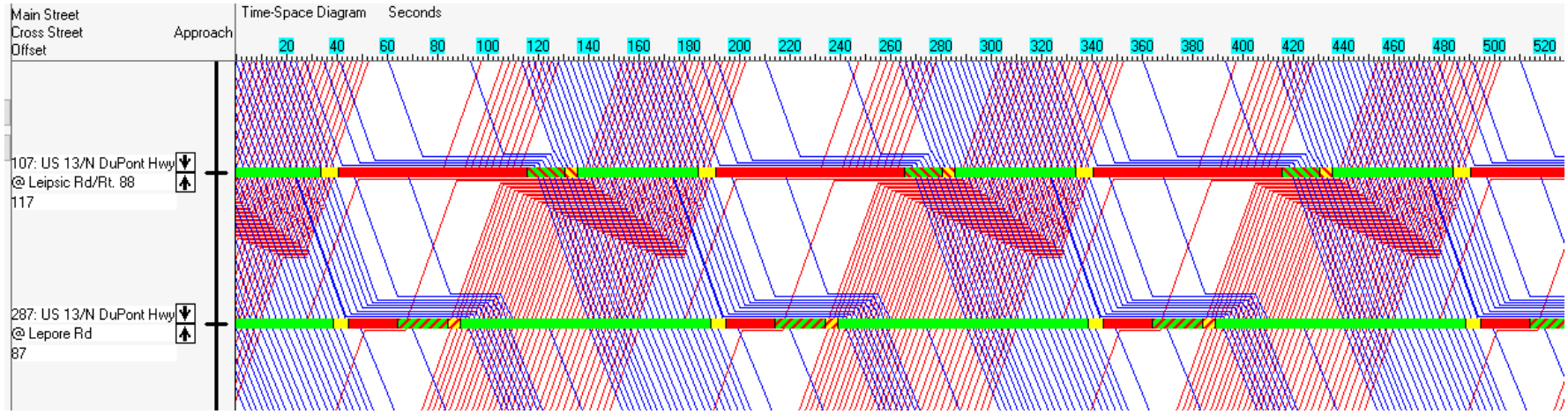
US 13 at Lepore Road

Signal Progression Impacts

Existing (PM Peak Example)



Proposed NB Signalization with FRA (PM Peak Example)



Conclusion: Minimal impact on NB signal progression, minor adjustments to offsets required

Location-Specific Assessments

US 13 at Red Lobster

(Centre at Dover Unsignalized Entrance)

US 13 at Red Lobster

Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- Median channelization allows unsignalized SB U-turns; Shopping Center entrance restricted to rights-in/rights-out
- Continuous sidewalk along both sides of US 13; no US 13 pedestrian crossing
- 4 DART stops located within Centre at Dover, including one shown near intersection with US 13
- Roadway lighting is present
- Pedestrian generators on both sides of US 13 – shopping center to the east, Days Inn + Superlodge to the west, residences and bus stops to the east

Field Meeting Suggestions:

- Evaluate signalization of intersection to provide pedestrian crossings and full or partial access
- Consider closing US 13 SB right-turn lane at Dover Center intersection to provide a bus pull-off

Crash History:

- NO reported crashes during 3-year study period from 12/12/2016 to 12/12/2019

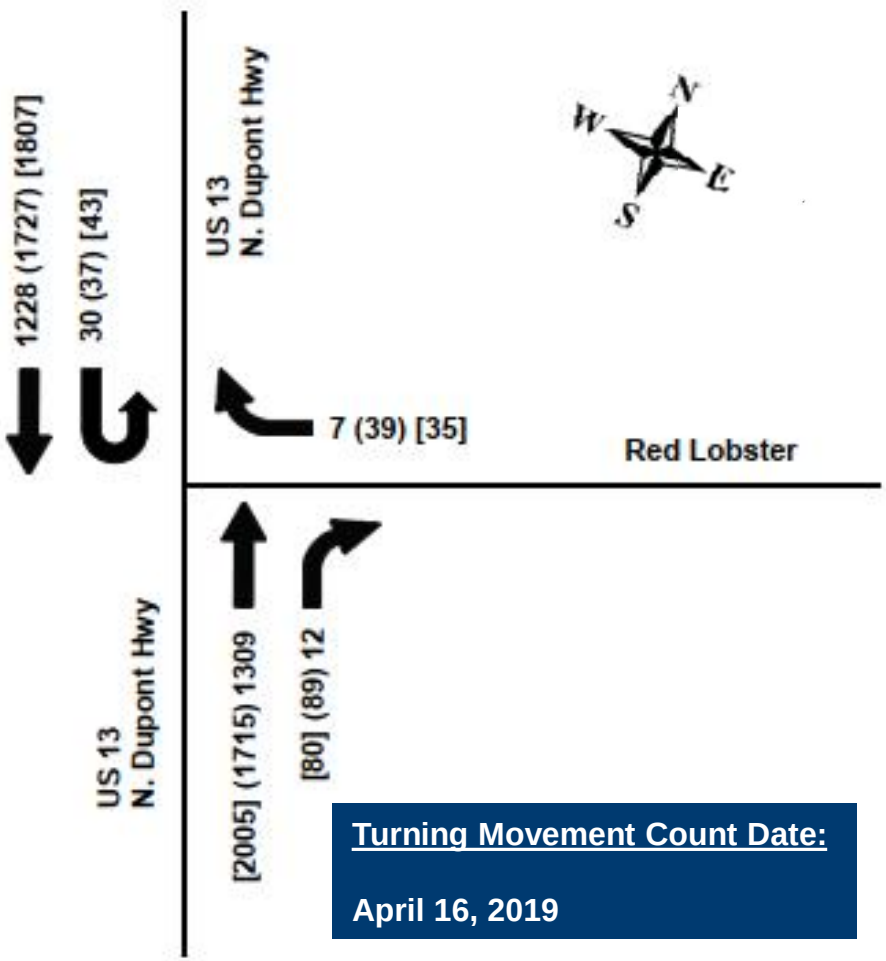
US 13 at Red Lobster

Peak Hour Traffic Volumes, Crash History and Field Observations

ZERO crashes reported at crossover from 12/12/2016 through 12/12/2019

Field Observations

- Pedestrians crossing US 13:
  - 6 in AM
  - 2 in mid-day
  - 6 in PM
- SB U-turn max queue = 2 vehicles in AM and PM
- No queuing issues observed from adjacent signals blocking crossover area
  - SB queue from White Oak Road extended to Days Inn driveway



Turning Movement Count Date:

April 16, 2019

00 AM Peak - 7:30 AM - 8:30 AM (2019 Peak Hour)
(00) MID Peak - 12:00 PM - 1:00 PM (2019 Peak Hour)
[00] PM Peak - 4:30 PM - 5:30 PM (2019 Peak Hour)

US 13 at Red Lobster

Signal Warrant Analysis Summary

- Warrant 1 (8-Hour Vehicular Volume) – NOT met
- Warrant 2 (4-Hour Vehicular Volume) – NOT met
- Warrant 3 (Peak Hour vehicular Volume) – N/A
- Warrant 4 (Pedestrian) – NOT met
- Warrant 5 (School Crossing) – N/A
- Warrant 6 (Coordinated Signal System) – N/A
- Warrant 7 (Crash Experience) - Applied to crashes from 12/12/16 to 12/12/19
  - 2011 DE MUTCD Warrant 7 Crash Criteria – NOT met
  - IA-19 Alternative Warrant 7 Crash Criteria – NOT met
- Warrant 8 (Roadway Network) – NOT met
- Warrant 9 (Intersection Near Grade Crossing) – N/A
- Pedestrian Hybrid Beacon (HAWK) Evaluation - DE MUTCD Section 4F criteria NOT met

NO WARRANTS MET

NOTE: Warrant analysis assumes US 13 NB as "major-street" and US 13 SB U-Turn as "minor-street"

US 13 at Red Lobster

NCHRP Report 562 Analysis Summary

- Worksheet 2 used for speeds > 35 MPH
  - Speed Limit = 35 MPH
  - 85th % speeds at Maple Parkway = 45 MPH
- Assumes 14 peak-hour peds/hour
  - 8 pedestrians were observed crossing at Red Lobster
  - 7 pedestrians were observed crossing between Red Lobster and White Oak Road/Kings Highway
- Worst-case scenario analyzed
  - US 13 NB crossing during PM peak hour

"RED" treatment is recommended due to excessive pedestrian delay!

Consider traffic signal or pedestrian hybrid beacon (HAWK)

WORKSHEET 2: PEAK-HOUR, EXCEEDS 35 MPH (55 KM/H)

Analyst and Site Information	
Analyst: WRA Analysis Date: December, 2019 Data Collection Date: April 16, 2019	Major Street: US 13 SB (N. DuPont Hwy) Minor Street or Location: Red Lobster Crossover Peak Hour: PM

Step 1: Select worksheet (speed reflects posted or statutory speed limit or 85th percentile speed on the major street): a) Worksheet 1 – 35 mph (55 km/h) or less b) Worksheet 2 – exceeds 35 mph (55 km/h), communities with less than 10,000, or where major transit stop exists		
Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a TCD type of treatment?		
Peak-hour pedestrian volume (ped/h), V_p 9 peak hour peds; assume 14 for analysis	*2a*	14
If *2a* ≥ 14 ped/h, then go to Step 3.		
If *2a* < 14 ped/h, then consider median refuge islands, curb extensions, traffic calming, etc. as feasible.		
Step 3: Does the crossing meet the pedestrian volume warrant for a traffic signal?		
Major road volume, total of both approaches during peak hour (veh/h), $V_{maj\text{-}s}$	*3a*	2,085
Minimum signal warrant volume for peak hour (use 3*a* for $V_{maj\text{-}s}$), SC $SC = (0.00035\ V_{maj\text{-}s}^2 - 0.80083\ V_{maj\text{-}s} + 529.197)/0.75$ OR $[(0.00035\ 3a^2 - 0.80083\ 3a + 529.197)/0.75]$	*3b*	508
If *3b* < 93, then enter 93. If *3b* ≥ 93, then enter *3b*.	*3c*	508
If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce *3c* by up to 50 percent; otherwise enter *3c*.	3*d*	508
If *2a* ≥ *3d*, then the warrant has been met and a traffic signal should be considered if not within 300 ft (91 m) of another traffic signal. Otherwise, the warrant has not been met. Go to Step 4.		
Step 4: Estimate pedestrian delay.		
Pedestrian crossing distance, curb to curb (ft), L	*4a*	50
Pedestrian walking speed (ft/s), S_p	*4b*	3.5
Pedestrian start-up time and end clearance time (s), t_s	*4c*	3.0
Critical gap required for crossing pedestrian (s), $t_c = (L/S_p) + t_s$ OR $[(4a/4b) + 4c)]$	*4d*	17
Major road volume, total both approaches or approach being crossed if median refuge island is present during peak hour (veh/h), $V_{maj\text{-}d}$	*4e*	2,085
Major road flow rate (veh/s), $v = (V_{maj\text{-}d}/0.7)/3600$ OR $[(4e/0.7)/3600]$	*4f*	0.83
Average pedestrian delay (s/person), $d_p = (e^{v\,tc} - v\,t_c - 1)/v$ OR $[\,(e^{4f \times 4d} - 4f \times 4d - 1)/4f\,]$	*4g*	1.62×10^{6}
Total pedestrian delay (h), $D_p = (d_p \times V_p)/3{,}600$ OR $[(4g \times 2a)/3600]$ (this is estimated delay for all pedestrians crossing the major roadway without a crossing treatment – assumes 0% compliance). This calculated value can be replaced with the actual total pedestrian delay measured at the site.	*4h*	6,290
Step 5: Select treatment based upon total pedestrian delay and expected motorist compliance.		
Expected motorist compliance at pedestrian crossings in region, Comp = high or low	5a	low

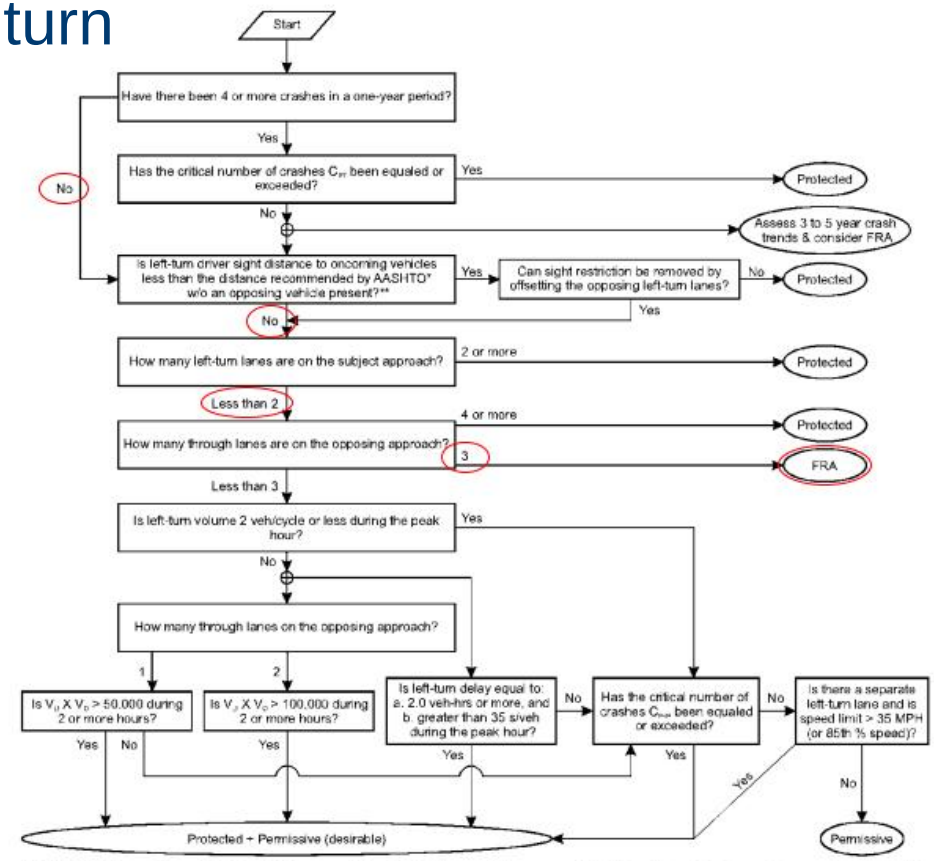
Total Pedestrian Delay, D_p (from *4h*) and Motorist Compliance, Comp (from *5a*)	**Treatment Category** (see Descriptions of Sample Treatments for examples)
$D_p \geq 21.3$ h (Comp = high or low) OR $5.3\ h \leq D_p < 21.3$ h and Comp = low	RED
$D_p < 5.3$ h (Comp = high or low) OR $5.3\ h \leq D_p < 21.3$ h and Comp = high	ACTIVE OR ENHANCED

US 13 at Red Lobster

Left-Turn Phasing Assessment

Left-Turn Phasing for SB Left/U-turn

- **<u>0 crashes</u>** 12/12/16 – 12/12/19
- > 800 ft sight distance available
  - No opposing turn lane
  - 570 ft required for Single-Unit Truck
- 1 left-turn lane
- 3 opposing through lanes
- 3.5 vehicles per cycle
  - 83 vph, 150-sec cycles in PM peak
- $V_{Lt} \times V_o$ > 100,000 in MID and PM peak hours
- **Conclusion: FRA recommended**



*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 appoach opposing the subject left-turn movement, veh/h

**If left-turn driver sight distance is temporarily obstructed by an opposing left-turning vehicle and consequently temporarily less than AASHTO recommendations, consideration should be given to the obstruction's frequency and the potential for and severity of crashes (e.g., consider opposing left turn phasing, opposing through speeds and volumes).

Source:
Adapted from FHWA's Signal Timing Manual

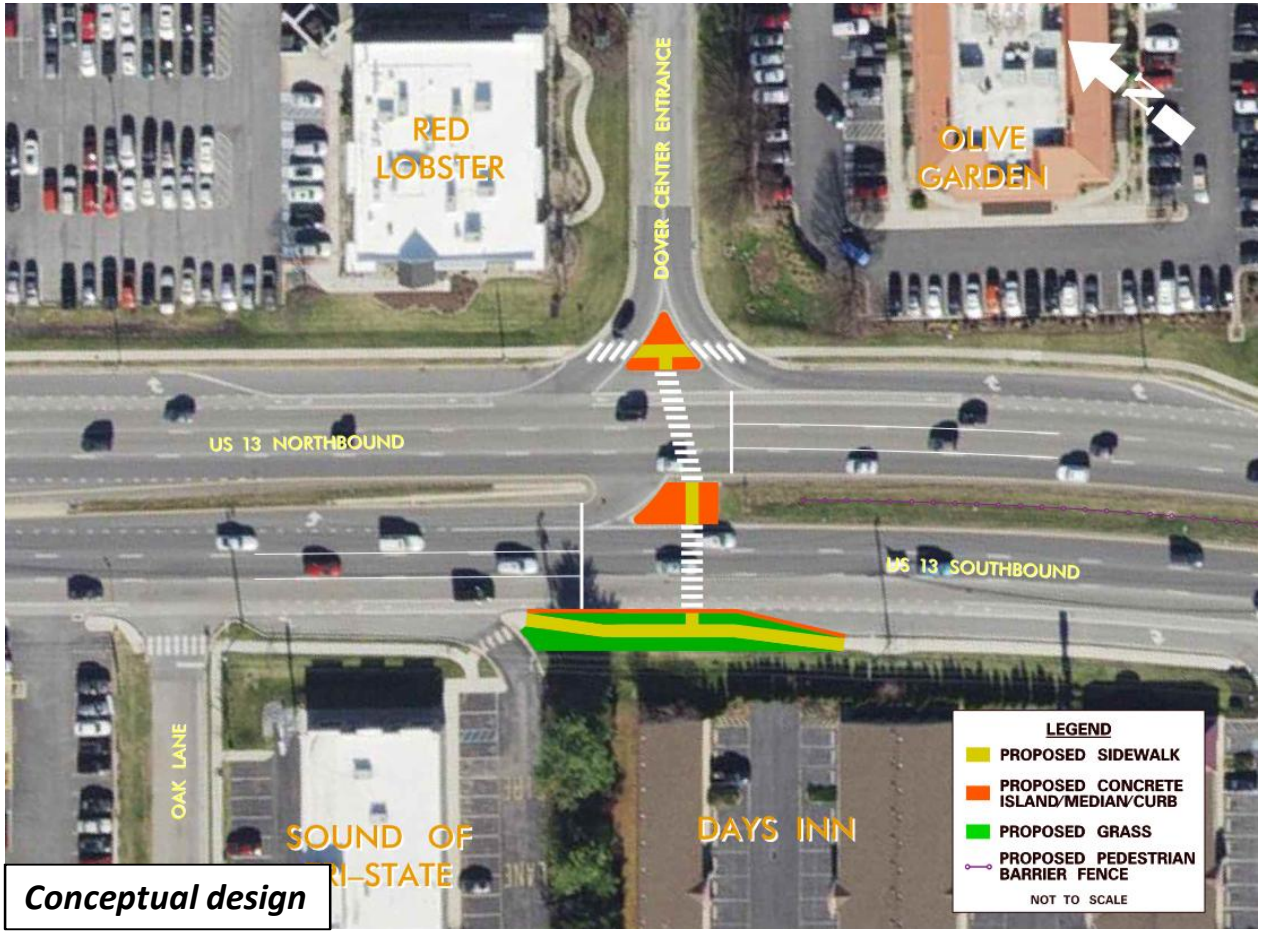
Number of Left-turn Movements on Subject Road	Period During Which Crashes are Considered (years)	Critical Left-Turn-Related Crash Count: When Considering Protected-only, C_{pr} (crashes/period)	Critical Left-Turn-Related Crash Count: When Considering Prot.+Perm., C_{ppm} (crashes/period)
One	1	6	4
One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

Figure IV-10. Guidelines for Determining Left-Turn Lane Signal Phasing Treatment

US 13 at Red Lobster

Signalization Alternatives – Option 1

- Option 1: Southbound U-Turn with Crosswalks
  - Maintains existing access / turning movements
  - US 13 SB U-Turn operates via FRA phasing
  - 2-Stage Ped Crossing: US 13 NB crossing overlaps with US 13 SB U-Turn protected phase; US 13 SB thru traffic only stops when pushbutton is activated for US 13 SB crosswalk
  - Reduces storage length for the Days Inn southbound right-turn lane

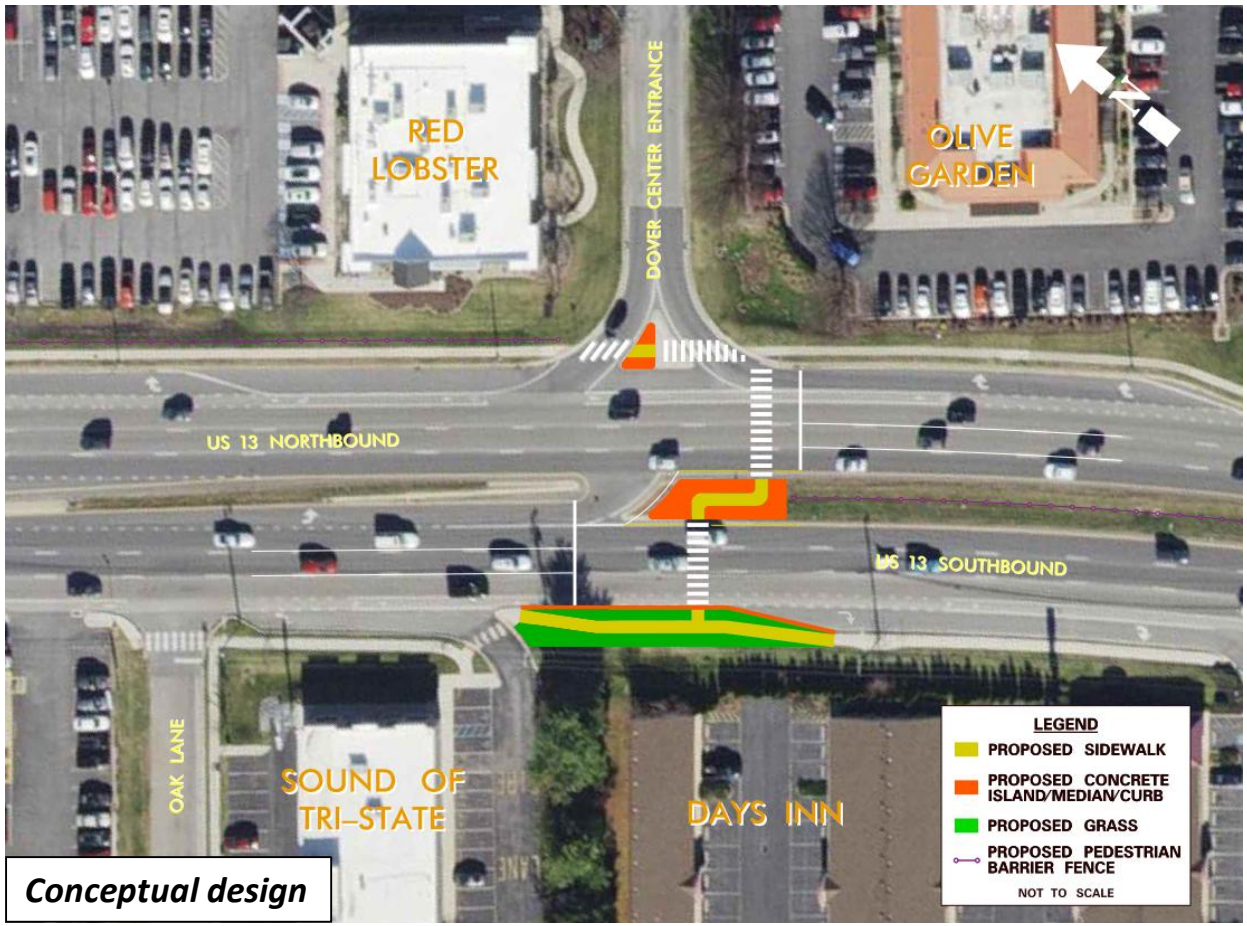


Conceptual design

US 13 at Red Lobster

Signalization Alternatives – Option 2

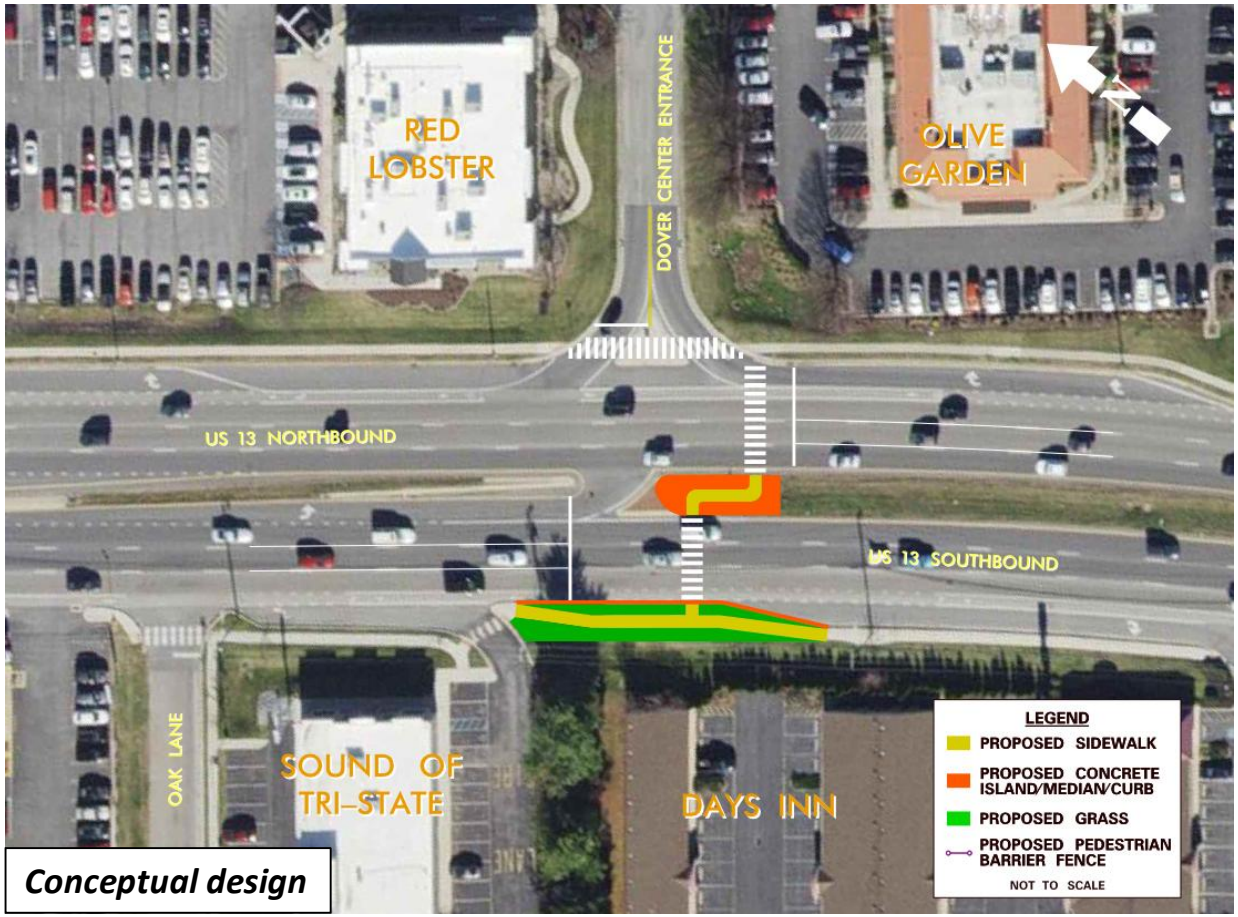
- Option 2: Southbound Lefts-In with Crosswalks
  - Allows US 13 SB U-turns and Lefts-in to Dover Center (43 existing southbound U-turns + 110 additional left-turns per hour can be accommodated within existing 150' storage length)
  - US 13 NB access remains right-in/right-out only
  - US 13 SB Left/U-Turn operates via FRA phasing
  - 2-stage ped crossing: US 13 NB crossing overlaps with US 13 SB Left/U-Turn protected phase; US 13 SB thru traffic only stops when pushbutton is activated for US 13 SB crosswalk
  - Reduces storage length for the Days Inn southbound right-turn lane



US 13 at Red Lobster

Signalization Alternatives – Option 3

- Option 3: Full Access with Crosswalks
  - Allows full access to Dover Center – SB lefts-in and WB lefts-out + NB rights-in/rights-out
  - US 13 SB Left/U-turn operates under FRA phasing
  - 2-Stage Ped Crossing: US 13 NB crossing overlaps with WB phase; US 13 SB crossing overlaps with SB Left/U-turn phase (while SB thru traffic has red)
  - Reduces storage length for the Days Inn southbound right-turn lane

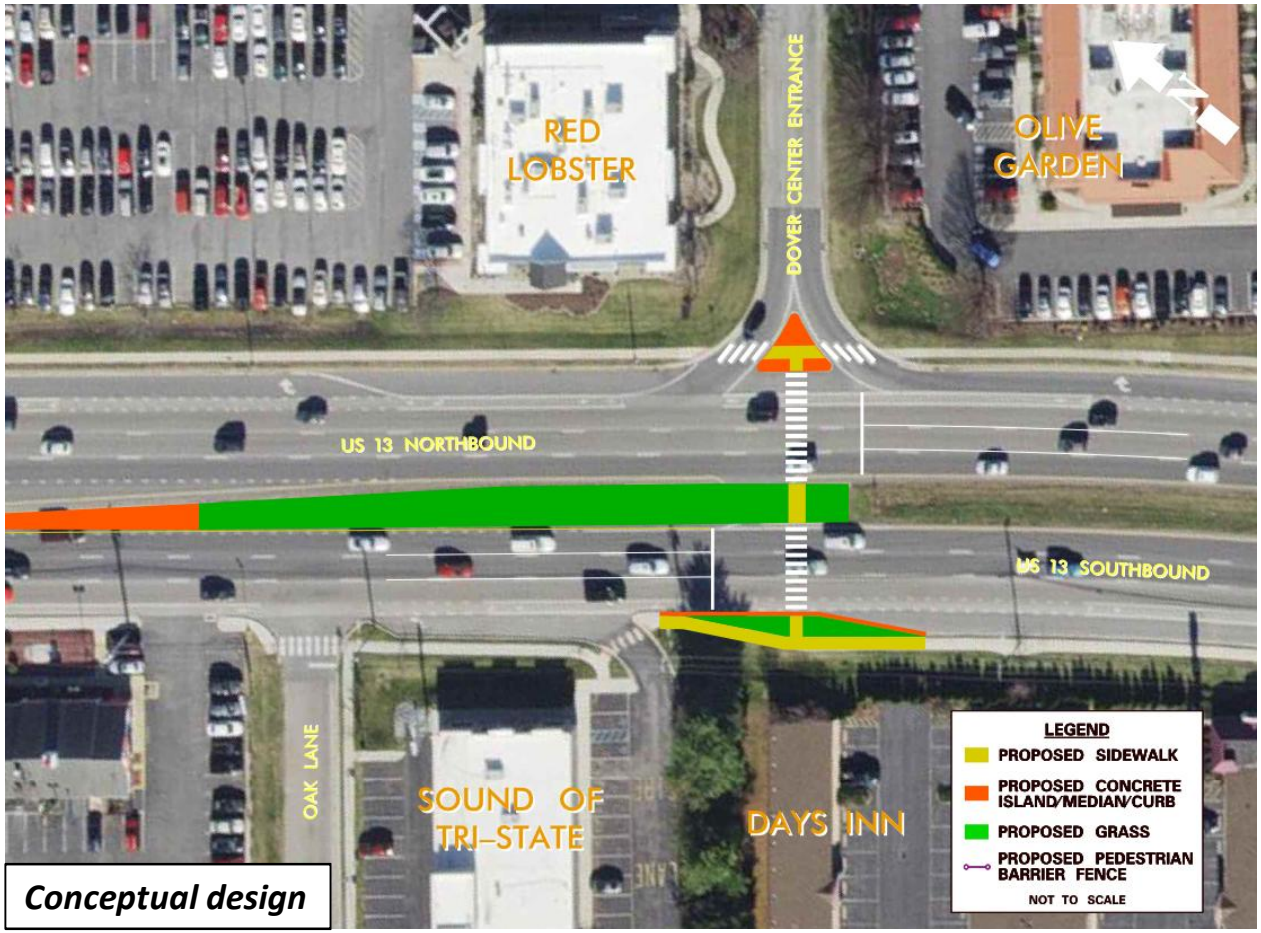


Conceptual design

US 13 at Red Lobster

Signalization Alternatives – Option 4

- Option 4: Crossover Closure + Pedestrian Hybrid Beacon (HAWK)
  - Existing crossover and US 13 SB U-turn is closed; SB U-turns diverted to White Oak Road
  - 2-stage pedestrian crossing activated by pedestrian pushbutton
  - Standard HAWK phasing: dark → flashing yellow → solid yellow → solid red → flashing red
  - Reduces storage length for the Days Inn southbound right-turn lane



US 13 at Red Lobster

Capacity Analyses Summary

Cycle Length = 150 seconds				
Scenario	**Movement**	***Synchro* Movement Delay (sec) & LOS**	***SimTraffic* 95th Percentile Queue (ft)**	**Intersection Delay (sec) & LOS**
Existing	SB U-Turn	16.5 (C)	69	-
	SB Left *	**62.2 (E)**	**257'**	**D (42.7)**
Option 1: SB U-Turn Signal	SB U-Turn	4.4 (A)	65	2.8 (A)
	NB Thru	2.5 (A)	247	
	SB Thru	2.9 (A)	135	
Option 2: SB Left/U-Turn Signal	SB Left	13.7 (B)	65	6.6 (A)
	NB Thru	9.1 (A)	230	
	SB Thru	3.5 (A)	153	
Option 3: Full Access Signal	SB Left	32.3 (C)	120	7.6 (A)
	NB Thru	2.9 (A)	416	
	SB Thru	9.4 (A)	262	
	WB Left/Right	57.1 (E)	109	
Option 4: HAWK	NB Thru	2.9 (A)	285	3.1 (A)
	SB Thru	3.1 (A)	188	
	SB Left *	**88.4 (F)**	**353'**	**D (40.7)**

* **RED TEXT** indicates LOS and 95th-percentile queues for SBL movement at US 13 and White Oak Road/Kings Highway NE intersection. Option 4 redirects US 13 southbound U-turns from the Red Lobster Crossover to the White Oak Road/Kings Highway NE intersection.

US 13 at Red Lobster

Signalization Recommendations

- Recommendation: Pursue Option 1 – Maintain Existing U-Turn Only Configuration with Signalized Crosswalks
  - Existing vehicular traffic volumes do not warrant a signal at this location. Maintaining existing access with FRA phasing for SB U-turn will minimize disruption along US 13 corridor.
  - Consider phasing adjustments at existing Centre Drive signalized intersection if future shopping center vacancies are filled and traffic volumes increase (i.e., FRA phasing for US 13 left-turns, removal of channelizing island to permit WB lefts from shopping center, etc.).
  - Option 4 (crossover closure + HAWK + redirecting SB U-turns to White Oak Road intersection) is not recommended due to anticipated LOS and queueing issues for SB left-turn movement at White Oak Road with additional u-turning traffic.

- Bus Pull-Off Concept
  - Recommend DART/DelDOT coordinate with Dover Center shopping center owner to discuss removal of the redundant NB right-turn at the existing Centre Drive signalized intersection (with Option 1, the NB right turn at Red Lobster remains a free movement with zero delay)
  - Geometric modifications would be required at the intersection of US 13/Centre Drive

Location-Specific Assessments

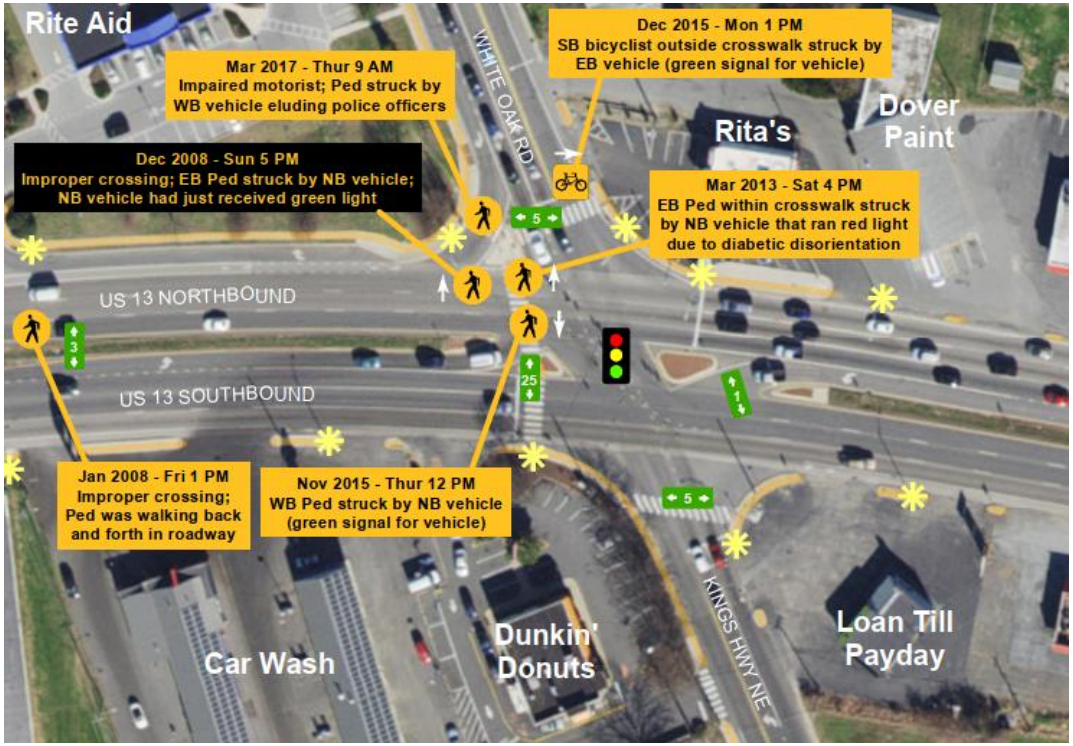
US 13 at White Oak Road / Kings Highway NE

US 13 at White Oak Rd/Kings Hwy NE

Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- Crosswalks on north, east and west legs
  - East and west leg crosswalks are uncomfortable for pedestrians due to large turning radii and offset from US 13
  - Accessible pedestrian signals
- Flashing Red Arrow phasing for US 13 NB and SB left-turns; split phasing for side streets
- No DART bus stops in vicinity of intersection
- Intersection roadway lighting is present
- SW and SE corners lack ADA-compliant PAR due to light poles and signal poles



Field Meeting Suggestions:

- **Consider geometric improvements – intersection seems confusing in general for vehicles and peds**
- **Provide crosswalks on all 4 legs**
- **Intersection is listed in MPO long-range plan (no specific concerns or improvement alternatives provided)**
- **Lidl grocery store being developed at SW corner; includes 10' shared-use path along US 13 frontage**

US 13 at White Oak Rd/Kings Hwy NE

Geometric Improvements Assessment

North Leg Crosswalk:

- **Two stage crossing with median refuge area is feasible; requires:**
  - Removal of SBL triangular channelizing island
  - Extension of median nose
  - Shifting SB stop line and crosswalk ~10 feet north
  - Restricts SBL movement to WB-40 design vehicle (currently serves WB-62)

South Leg Crosswalk:

- **Two stage crossing with median refuge area is feasible; requires:**
  - Removal of NBL triangular channelizing island
  - Extension of median nose
  - Shifting NB thru stop line ~50 feet south and NBL stop line ~10 feet south

East Leg Crosswalk:

- Tighten SE corner radius to provide 5' minimum wide PAR in front of existing light poles and signal pole
- Realign crosswalk closer to US 13 to mitigate pedestrian sight distance concerns
- Restricts NBR movement to WB-40 design vehicle (currently serves WB-62)
- Maintain existing WB channelized right turn and island (minor island reconstruction required to accommodate realigned crosswalk)

West Leg Crosswalk:

- Tighten SW corner radius to provide 5' minimum wide PAR in front of existing signal pole
- Tighten the NW corner radius, to provide a wider PAR and realign crosswalk closer to US 13 to mitigate pedestrian sight distance concerns.
- Restricts SBR movement to WB-40 design vehicle (currently serves WB-62)

Vehicle Turning Path Summary

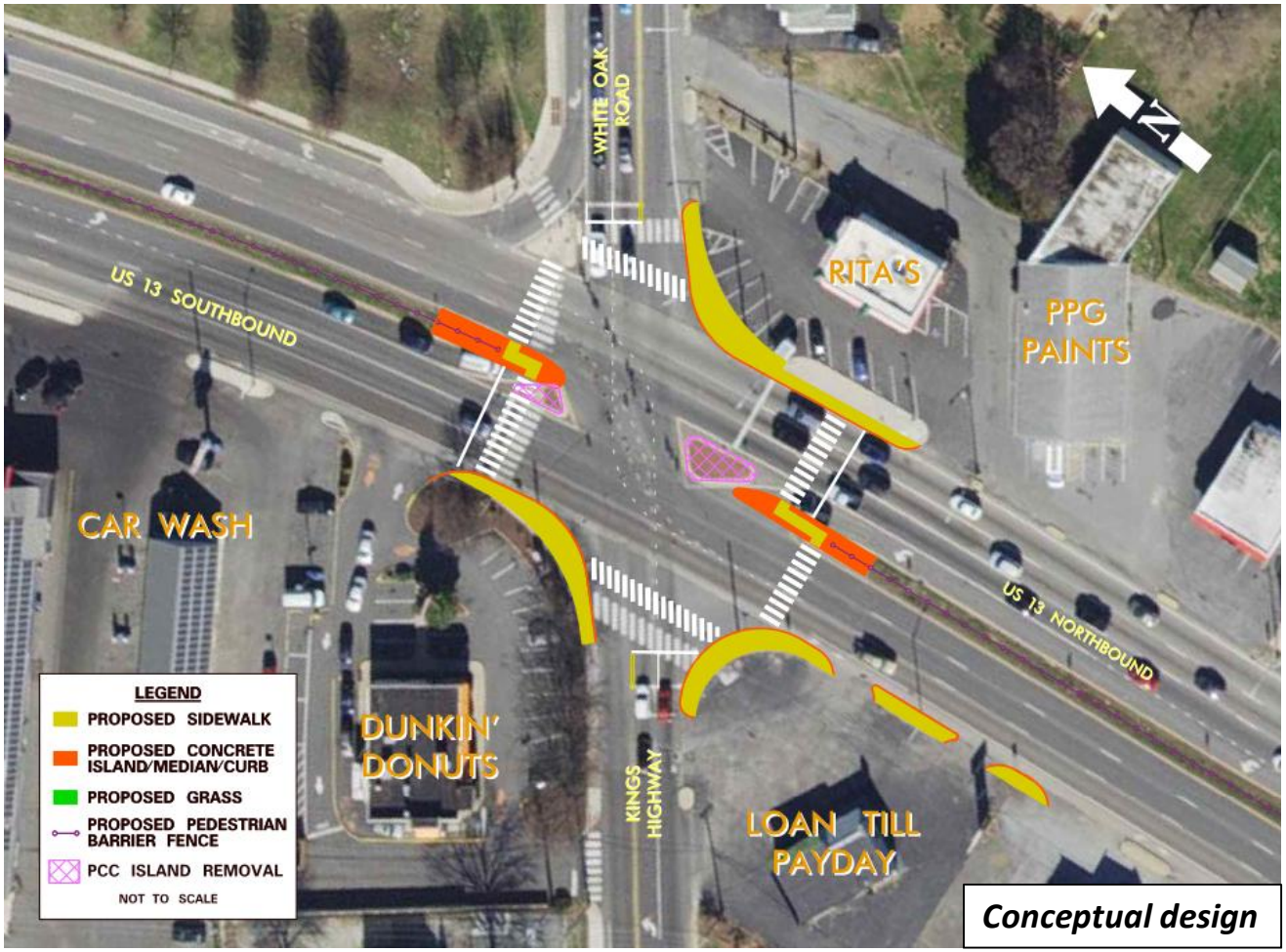
Movement	Existing Conditions	Proposed Conditions
NB Left	WB-62	WB-62
NB Right	WB-62	**WB-40**
SB Left	WB-62	**WB-40**
SB Right	WB-62	**WB-40**
EB Left	WB-62	WB-62*
EB Right	WB-62**	WB-62**
WB Left	WB-62	WB-62
WB Right	WB-40	WB-40

* WB-62 can only make turn to US 13 NB middle receiving lane

** WB-62 can only make turn to US 13 SB left-most receiving lane

US 13 at White Oak Rd/Kings Hwy NE

Concept and Recommendations



Conceptual design

Recommendations:

- Install 2-stage pedestrian crossings on north and south leg; requires removal of channelizing islands and extension of median noses
- Tighten radii on NW, SW and SE corners to provide 5' minimum PAR and realign crosswalks closer to US 13 for improved pedestrian sight distance

LOCATION-SPECIFIC ASSESSMENTS

US 13 AT BAY ROAD/MLK BOULEVARD

US 13 at Bay Road/MLK Blvd

Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- No existing pedestrian accommodations
- Observed uncontrolled pedestrian crossings
- Target located on the east side
- Wawa & Royal Farms located on the west side
- Bay Road northbound and US 13 southbound are free-flowing movements

Field Meeting Suggestions:

- Consider pedestrian accommodations

US 13 at Bay Road/MLK Blvd

Existing Conditions

Nearby Intersections with Pedestrian Accommodations:

- US 13 at Loockerman Street – 0.22 mile north
- Bay Road at MLK Boulevard/S. Little Creek Road – 0.14 mile southeast
- US 13 at MLK Boulevard – 0.08 mile south

US 13 at Bay Road/MLK Blvd

Options Considered

- Option 1: Install HAWK Signals
  - Provides pedestrian accommodations at the desired location
  - Requires existing free-flowing NB and SB traffic to be stopped when active
  - Speeds and turning vehicles are a concern for safety
  - Delays and congestion would increase in the area
  - Would need to coordinate with nearby signals to keep queues at a minimum
- Option 2: Improve pedestrian accommodations at nearby signals
  - Adds a fourth pedestrian crossing (south leg) at the US 13 and Loockerman Street signal
  - Adds a fourth pedestrian crossing (north leg) at the Bay Road and S. Little Creek Road signal
  - Adds a fourth pedestrian crossing (south leg) at the US 13 and MLK Blvd. signal.
  - Improves pedestrian accommodations along NB and SB US 13, especially adjacent to the NB frontage road between Bay Road and Loockerman Street
  - Requires pedestrians to take a longer route
  - Requires barriers to be installed in the median at the intersection of US 13 at Bay Road to prevent uncontrolled crossings
  - Keeps disruptions to vehicle delays and congestion at a minimum

US 13 at Bay Road/MLK Blvd

Concept and Recommendations – Option 2

Conceptual design

Recommendations:

- Install pedestrian accommodations on the south leg of US 13 at Loockerman Street
- Improve pedestrian accommodations along northbound US 13 and northbound Bay Road between Loockerman St and MLK Blvd
- Install pedestrian accommodations on the north leg of Bay Road at S. Little Creek Road
- Install fencing along the median and southbound US 13 to prevent improper pedestrian crossing at US 13 at Bay Road/MLK Blvd
- Install two-stage pedestrian accommodations on the south leg of US 13 at MLK Blvd.

LOCATION-SPECIFIC ASSESSMENTS

US 13 AT ROOSEVELT AVENUE

US 13 at Roosevelt Avenue

Existing Conditions & Field Meeting Suggestions

Existing Conditions:

- No existing pedestrian accommodations
- Shopping Center (Carroll's Plaza) draws pedestrians to the southwest corner
- Residences on both sides, Dover YMCA, pharmacy, medical offices and bus stops to the west

Field Meeting Suggestions:

- Consider crosswalks on all four legs of the intersection
- Consider median refuge area on east and west legs

US 13 at Roosevelt Avenue

Options Considered

- Option 1: Crosswalks on all four legs of the intersection
  - Provides full pedestrian accommodations at the signal
  - Requires stop bars to be pulled back and curb work to be completed to improve the medians
  - The SB right-turn channelization would need to be removed
  - The two driveways on the northwest corner require pedestrian accommodations to be in a less than desired area
  - Would increase vehicular delays at the intersection
- Option 2: Crosswalks on two legs of the intersection
  - Provides pedestrian accommodations on the east and south legs of the intersection
  - Would require pedestrians to modify their current movements (currently crossing north and west legs)
  - Would allow for a two-stage ped crossing on the south leg to keep vehicular delays at a minimum to no impact
  - Removes potential conflict with the SB right-turn and the two driveways on the northwest corner

US 13 at Roosevelt Avenue

Capacity Analyses Summary

Cycle Length = 150 seconds		
Scenario	**Peak Hour**	**Intersection Delay (sec) & LOS**
Existing	AM	10.1 sec (B)
	Mid	10.7 sec (B)
	PM	12.4 sec (B)
Option 1: Full Ped Accommodations	AM	11.2 sec (B)*
	Mid	11.8 sec (B)*
	PM	13.3 sec (B)*
Option 2: East and South Ped Accommodations	AM	10.1 sec (B)
	Mid	10.7 sec (B)
	PM	12.4 sec (B)

***Existing pedestrian count used, delays would likely increase as demand increases**

US 13 at Roosevelt Avenue

Concept – Option 2

Conceptual design

RECOMMENDATION: Install pedestrian accommodations, including median and island work, on the east and south legs of the intersection and install bus stops north and south of the intersection ***(currently in design)***

LOCATION-SPECIFIC ASSESSMENTS

US 13 AT SOUTH STATE STREET

US 13 at South State Street

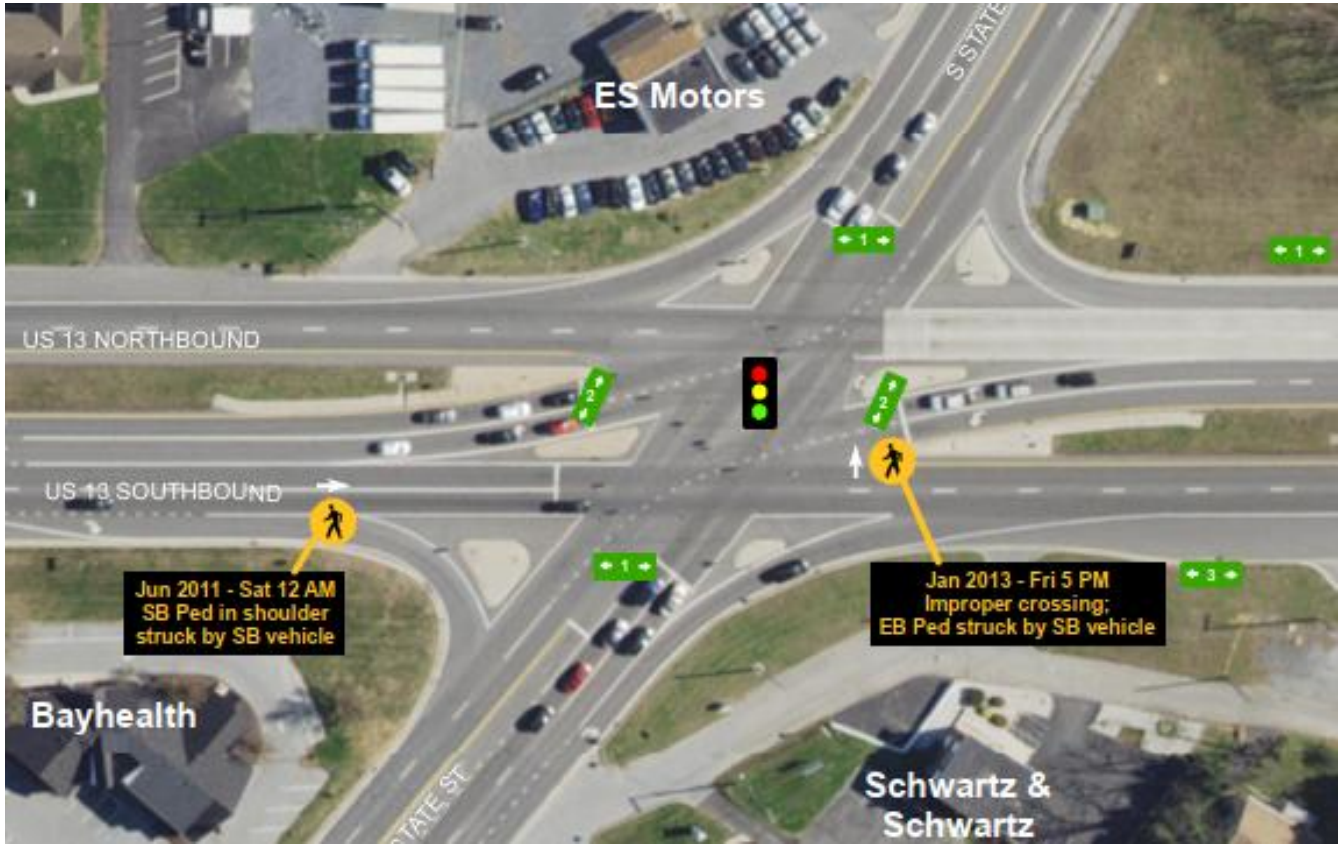
Existing Conditions & Recommendations

Existing Conditions:

- **Pedestrian generators include Dover YMCA, pharmacy and shopping center to the west, bus stops along State Street, medical offices and residences**

Field Meeting Suggestions:

- **Consider crosswalks on all four legs of the intersection**



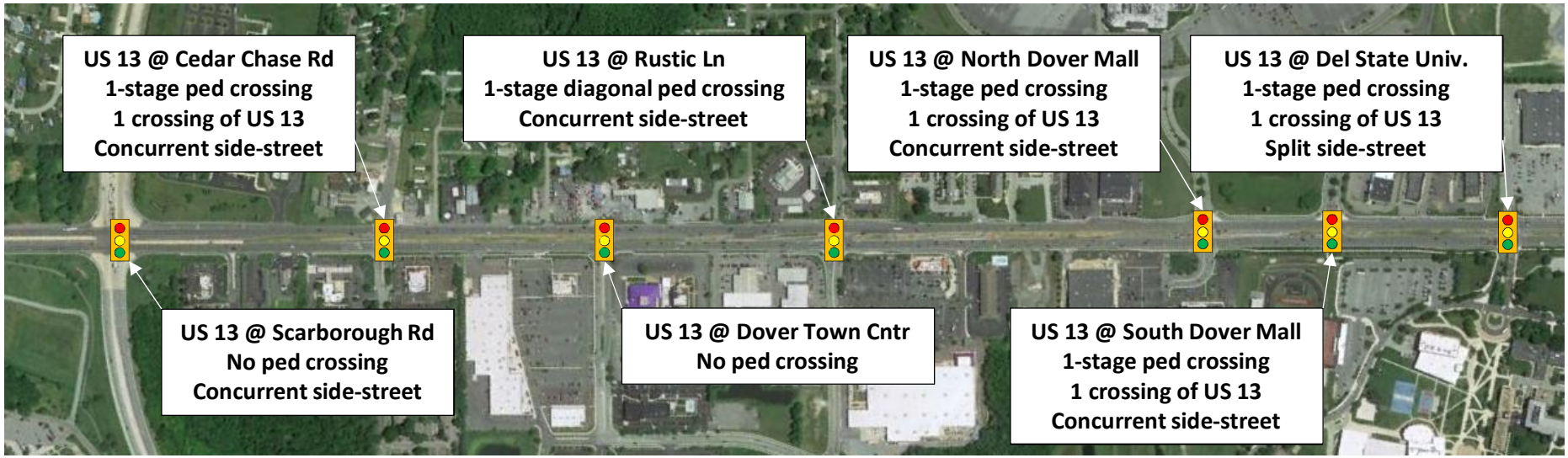
RECOMMENDATION: Develop Traffic-only project to add pedestrian crossings on all four legs, remove offset left-turn lanes and remove unnecessary channelization islands. If impacts are too extensive, the project will become a capital project.

Summary of Recommendations

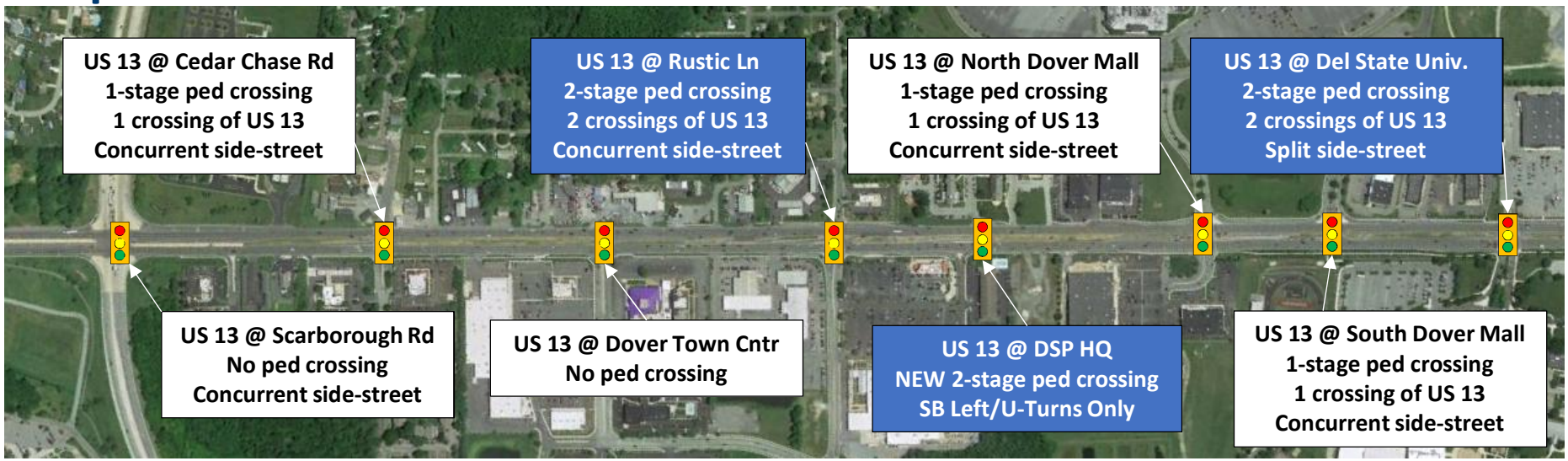
US 13 Corridor

Proposed Signalized Pedestrian Crossing Changes

Existing



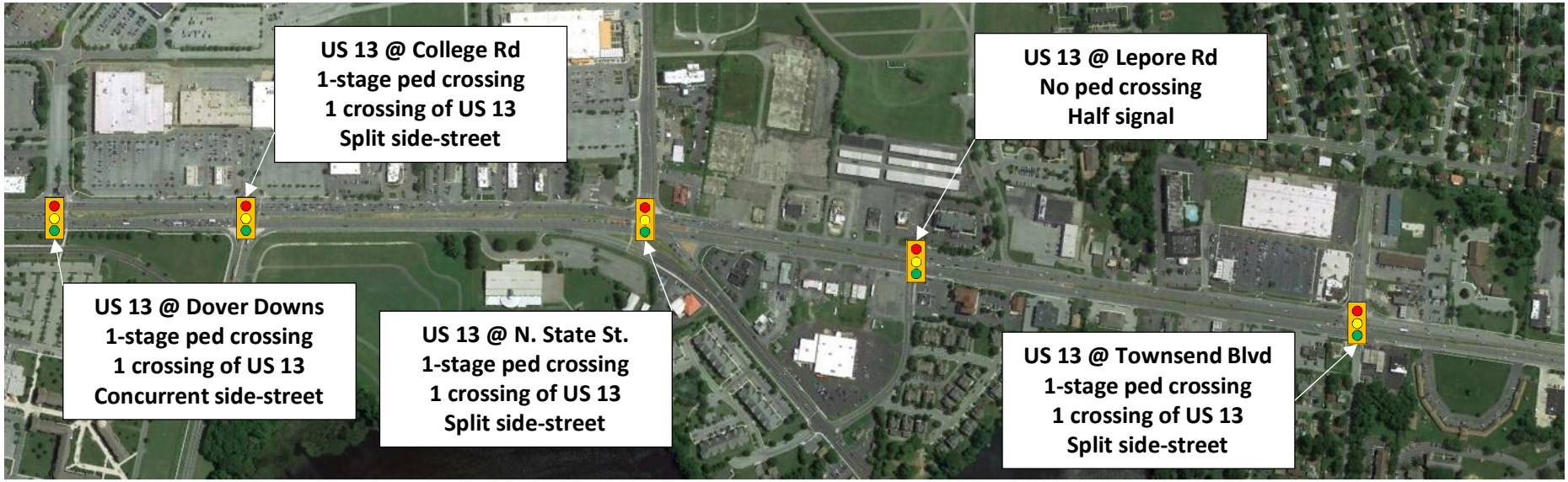
Proposed



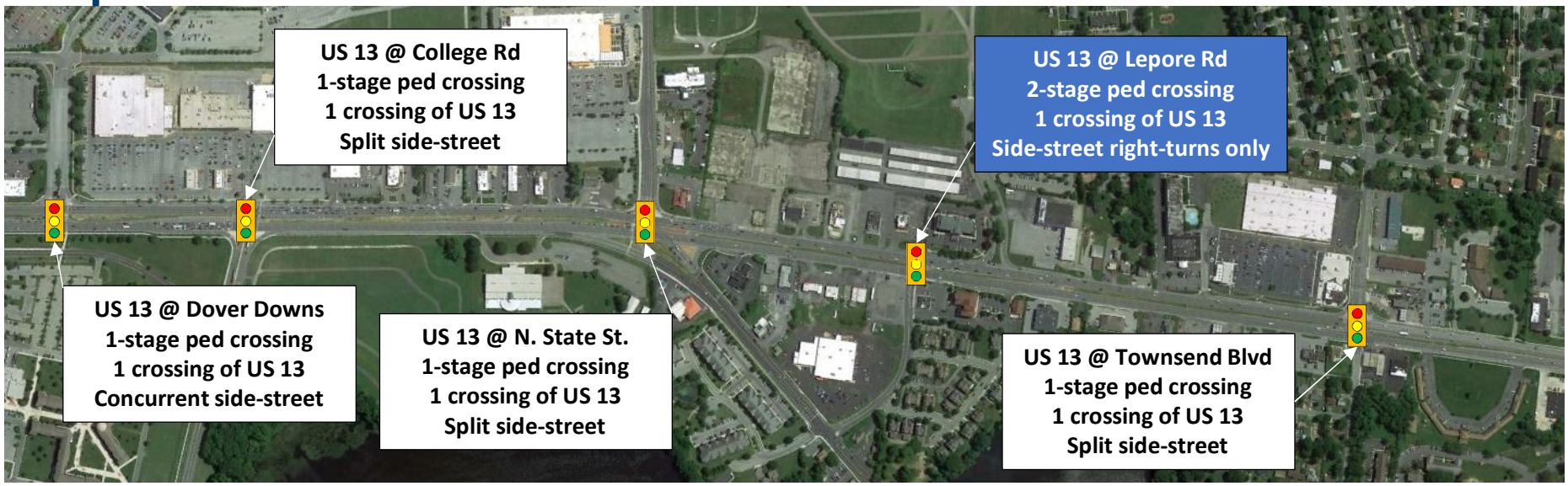
US 13 Corridor

Proposed Signalized Pedestrian Crossing Changes

Existing



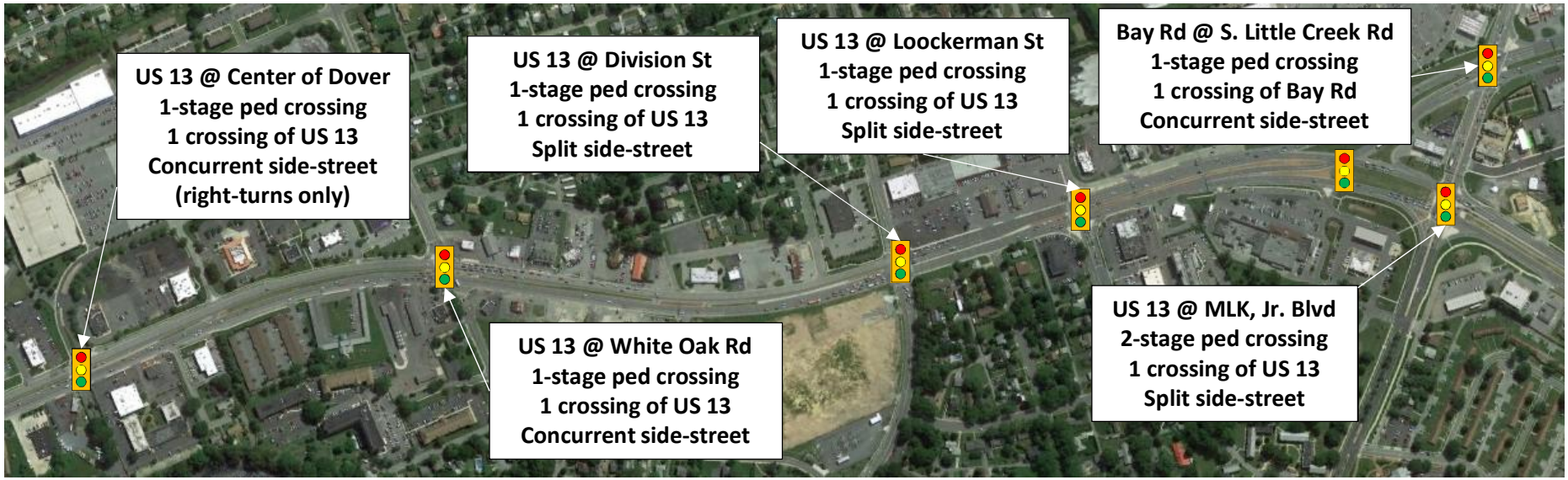
Proposed



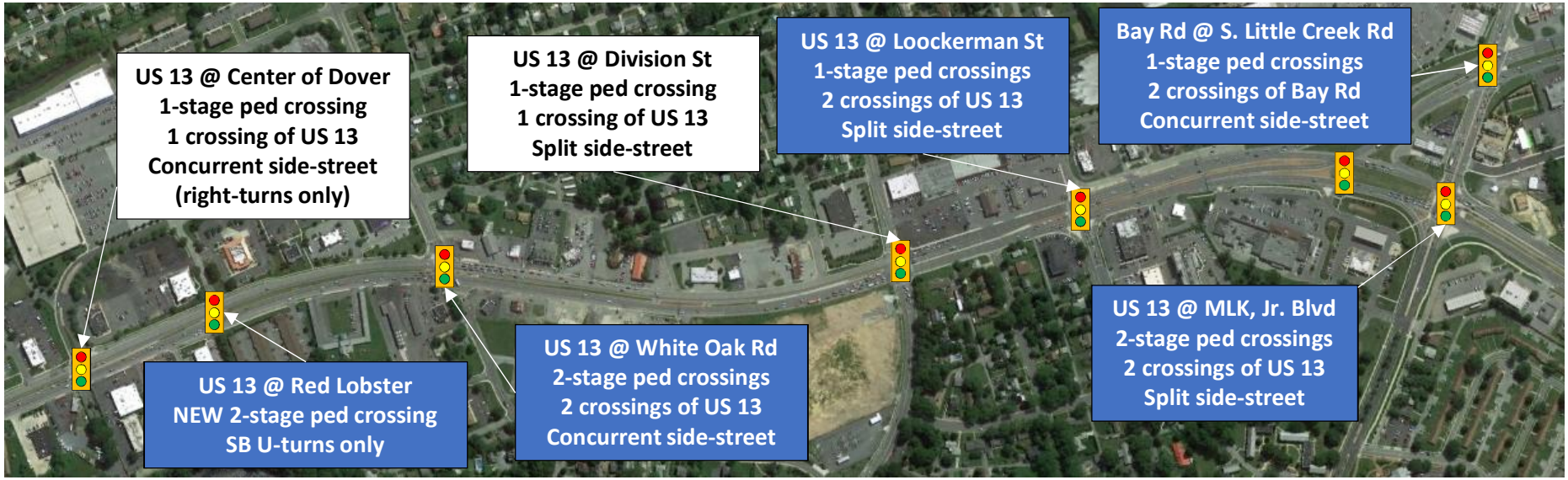
US 13 Corridor

Signalized Pedestrian Crossings

Existing



Proposed



US 13 Corridor

Signalized Pedestrian Crossings

Existing

Proposed

Improvement Matrix (1 of 4)

Location	Timeframe	Recommendation	Responsible Party
Corridor Wide	Short-Term	Install 40 mph speed limit sign on US 13 between Rustic Lane and N. State Street, lowering the posted speed limit from 45 mph to 40 mph	DelDOT Traffic
	Short-Term	Install Turning Vehicle Yield to Pedestrian signs at appropriate signalized intersections along US 13	DelDOT Traffic
	Mid-Term	Through capital, PAR, Pave & Rehab, Traffic and developer projects, add additional signalized pedestrian crossings of US 13 at existing intersections where signalized pedestrian crossings do not exist or where a second crossing of US 13 does not exist.	DelDOT
	Mid-Term/ Long-Term	Through capital, PAR, Pave & Rehab, Traffic and developer projects, continue to close gaps in sidewalks/sidepaths along the US 13 corridor	DelDOT
	Long-Term	Begin high-level conceptual layout of a road re-configuration to identify any geometric design concerns and upon completion of other pedestrian safety improvements, re-evaluate pedestrian crashes to determine if a road re-configuration would provide additional pedestrian safety benefits	DelDOT
	Mid-Term	As part of future Pave & Rehab projects, implement lane width reductions throughout the corridor to effectively reduce vehicular speeds	DelDOT Traffic
	Mid-Term/ Long-Term	Coordinate with DTC to improve access to transit along US 13, including improvements to existing stops, providing new stops with appropriate bus pull offs and providing pedestrian infrastructure where none exists today to support future transit service	DelDOT/DTC
	Mid-Term	Install lighting at all bus stops along corridor that currently are unlit	DelDOT/DTC
	Mid-Term	Install median barrier treatments along these identified “priority segments” of US 13: • Rustic Lane to North Dover Mall Entrance • College Road to Leipsic Road/N. State Street • Centre Drive to White Oak Road • Loockerman Street to MLK Boulevard (see US 13 at Bay Road recommendations)	DelDOT Traffic

Improvement Matrix (2 of 4)

Location	Timeframe	Recommendation	Responsible Party
Corridor Wide	Mid-Term / Long-Term	Monitor crashes along other sections of US 13 (i.e., locations not identified above as “priority segments”) to consider installation of barrier treatments	DelDOT Traffic
US 13 at Rustic Lane	Short-Term	Install pedestrian accommodations on the north and south legs and remove diagonal pedestrian crossing of US 13, including: • Installation of two-stage pedestrian crossings • Maintain concurrent side-street left-turn phasing • Extend the south leg median to provide pedestrian refuge • Adjust northbound and southbound stop bars to accommodate new crosswalks • Realign NB/SB left-turn lanes to remove offset lefts and provide adequate median refuge islands	DelDOT Traffic
	Short-Term	Install a bench at the SB US 13 bus stop at Rustic Lane	DTC
US 13 between Rustic Lane and North Dover Mall	Mid-Term	Install a signalized pedestrian crossing of US 13 at the existing median opening at DSP Headquarters. Signalization should include FRA phasing for the SB LT/UT and consider a two-stage crossing	DelDOT Traffic
	Long-Term	Install median barrier between signalized pedestrian crossings from Rustic Lane to North Dover Mall	DelDOT Traffic
US 13 at DSU/Best Buy	Short-Term	Install pedestrian accommodations on the north and south legs of the intersection. Consider two-stage crossings with median nose extensions for median refuge areas by removing offset left-turns.	DelDOT Traffic
	Short-Term	Install a bench at the NB US 13 bus stop at Best Buy/Michaels	DTC
US 13 between College Road and N. State Street/Leipsic Road	Mid-Term	As part of a median barrier project (see Corridor Wide recommendations), close the existing unsignalized median opening between College Road and N. State Street/Leipsic Road	DelDOT Traffic

Improvement Matrix (3 of 4)

Location	Timeframe	Recommendation	Responsible Party
US 13 at Lepore Road	Short-Term	Reconstruct traffic signal to signalize northbound US 13 and install a signalized pedestrian crossing across US 13 at the intersection. Provide ADA compliant curb ramps as part of the project. Complete improvements in conjunction with previously recommended FRA left-turn phasing	DelDOT Traffic
US 13 between Centre Drive and White Oak Road	Short-Term	Install new traffic signal at the existing unsignalized Centre at Dover entrance as follows: • Maintain the existing SB U-turn only configuration • Install a two-stage signalized pedestrian crossing on the south side of the intersection, crossing US 13 • Utilize FRA phasing for the SB U-turn movement	DelDOT Traffic
	Mid-Term	Implement signal phasing adjustments at the existing Centre Drive signalized intersection if future shopping center vacancies are filled and traffic volumes increase. Improvements should include: • FRA phasing for US 13 left-turns • Removal of channelizing island to permit WB lefts from the shopping center	DelDOT Traffic
	Long-Term	Coordinate with Dover Center shopping center owner to discuss removal of the redundant NB right-turn at the existing Centre Drive signalized intersection and construct a bus pull-off in this area.	DelDOT Traffic / DTC
US 13 at White Oak Road / Kings Highway NE	Short-Term	Install Turning Vehicles Yield to Pedestrian (R10-15) signs on NB and SB US 13 at the intersection with White Oak Rd/Kings Hwy NE	DelDOT Traffic
	Mid-Term	Install two-stage pedestrian crossings on the north and south legs of the intersection. Improvements should include: • Remove channelizing islands in median adjacent to left-turn lanes • Extend median noses to provide a pedestrian refuge area • Tighten radii on the NW, SW and SE corners to provide a 5-ft minimum PAR and realign crosswalks closer to US 13 for improved pedestrian sight distance	DelDOT Traffic

Improvement Matrix (4 of 4)

Location	Timeframe	Recommendation	Responsible Party
US 13 between Loockerman Street and MLK Blvd	Mid-Term	Install pedestrian accommodations on the south leg of US 13 at the intersection with Loockerman Street	DelDOT Traffic
	Mid-Term	Install an improved ADA compliant PAR along the Frontage Road adjacent to US 13 NB between Loockerman Street and Bay Road	DelDOT PAR
	Mid-Term	Install pedestrian accommodations on the north leg of Bay Road at the intersection with S. Little Creek Road	DelDOT Traffic
	Mid-Term	Install pedestrian median barrier/fencing along the median of US 13 and adjacent to the sidewalk on southbound US 13	DelDOT Traffic
US 13 at Roosevelt Avenue	Short-Term	Install pedestrian accommodations, including median and island work, on the east and south legs of the intersection and install bus stops north and south of the intersection.	DelDOT Traffic
US 13 at S. State Street	Mid-Term	Develop Traffic-only project to add pedestrian crossings on all four legs, remove offset left-turn lanes and remove unnecessary channelization islands. If impacts are too extensive, the project will become a capital project.	DelDOT Traffic