

# US 40 Pedestrian Safety Study

SR 72 to Buckley Boulevard

April 2019



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# 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 40 Corridor

- 4.3-mile Urban Principal Arterial
- Roadway Character
  - SR 72 to Glendale Blvd/Walther Rd: 4-lane, divided
  - Glendale Blvd/Walther Rd to SR 1: 6-lane, divided
  - SR 1 to Buckley Blvd: 4-lane, divided
  - Variable shoulder widths and turn lanes at major intersections
- Traffic Control
  - 14 signalized intersections
  - 1 rail crossing (east of SR 72)
  - 1 interchange (SR 1)
  - Numerous unsignalized intersections and private driveways



# US 40 Corridor

- Posted Speed Limit
  - West of SR 1: 50 MPH
  - East of SR 1: 55 MPH
- AADT (2017 DelDOT Traffic Summary)
  - West of SR 72: 33,100
  - SR 72 to Porter Road/Salem Church Road: 36,300
  - Porter Road/Salem Church Road to SR 7: 45,900
  - East of SR 7: 26,400
- Major Pedestrian Generators
  - Multiple Shopping Centers - Fox Run, Sunset Station, Salem Center, Governors Square, Eden Square
  - Residential developments

**High Vehicular Volume  
and Speeds Mixed  
with Numerous  
Pedestrian Generators**



# Transit

Continuation of transit routes from Map A



### Transit Routes / Legend

- 2 Concord Pike (wkday/wkend)
- 4 Prices Corner/Wilmington/Edgemoor (wkday/wkend)
- 5 Maryland Avenue (wkday/wkend)
- 6 Kirkwood Highway (wkday/wkend)
- 8 8th Street and 9th Street (wkday/Sat)
- 9 Boxwood Rd/Broom St/Vandever Avenue (wkday/Sat)
- 10 Newark (Wakefield Drive)/Wilmington (wkday/Sat)
- 11 Washington Street/Marsh Road (wkday/Sat)
- 12 Baynard Boulevard/Riverfront (wkday/Sat)
- 13 Wilton/Wilmington/Tri-Stat Mall (wkday/wkend)
- 14 DHSS Campus/Wilmington/Lea Boulevard (wkday/Sat)
- 15 New Castle Avenue (wkday/wkend)
- 16 Newark Express (wkday)
- 18 Pike Creek/Prices Corner/Wilmington/Claymont (wkday)
- 20 Lancaster Pike (wkday)
- 25 Llangollen/DuPont Highway/Delaware City (wkday/Sat)
- 28 A.I. DuPont Hospital/Wilmington DMV (wkday/Sat)
- 31 Wilmington/Bellefonte/Claymont (wkday/Sat)
- 33 Wilmington/Newark (wkday/wkend)
- 34 Christiana Mall/Newark (wkday)
- 35 Concord Pike/Shiplay Road (wkday)
- 40 Glasgow/US Highway 40 (wkday/wkend)
- 42 Glasgow Express (wkday)
- 43 Middletown/Odessa (wkday)
- 44 Delaware City DMV/Christiana Mall (wkday)

**DART Routes 40, 64 operate within study corridor**

Routing is subject to change based on rerouting due to construction or other circumstances, by altering the route temporarily or permanently.  
 For assistance with trip planning, call 1.800.652.DART or use the Google Trip Planner at [DART.com](http://DART.com)



- Performed in March/April 2017 during typical weekday conditions \*
  - AM Peak (7 AM – 9 AM)
  - Midday Peak (11 AM – 1 PM)
  - PM Peak (3 PM – 6 PM)
- Data summarized on Existing Conditions figures (see Attachment A)

*\* 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 April/May 2017
- Average speeds are no more than 2 mph above the posted speed limit
- 85<sup>th</sup>-percentile speeds are up to 8 mph higher than the posted speed limit

Location	Posted Speed Limit (mph)	Eastbound US 40		Westbound US 40	
		Average Speed (mph)	85 <sup>th</sup> -Percentile Speed (mph)	Average Speed (mph)	85 <sup>th</sup> -Percentile Speed (mph)
Rickey Blvd	50	46	50	44	48
West of Salem Church Rd	50	49	54	50	54
East of Rockwood Rd	50	52	58	52	58
East of Quintilio Dr	50	52	58	48	54
West of Buckley Blvd	55	52	58	50	57

# Ped/Bike Crash Trends

(January 2005 to December 2016)



10

- 57 total ped crashes; 17 total bike crashes
- 89% of ped/bike crashes resulted in an injury or fatality
  - 10 pedestrian fatalities (approximately 1 per year)
- 65% of pedestrian/bicyclists were male
- 61% of pedestrian crashes occurred at nighttime
  - 60% of these occurred in unlit locations
- 50% of ped/bike crashes occurred from 2 PM to 8 PM
- 33% of ped crashes occurred within 200 feet of a signalized crosswalk
- Nearly 30% of pedestrian crashes occurred on a Friday
- 25% of pedestrians were 36 to 45 years old
- 12% of ped/bike crashes involved an impaired ped/bicyclist

# Crash Trends

Study Period		January 2005 to December 2016						January 2014 to December 2016	
Scenario		Pedestrian Crashes		Bicycle Crashes		Peds + Bikes		All Crashes*	
		No.	% of Total	No.	% of Total	No.	% of Total	No.	% of Total
Crash Severity	Fatal	10	18%	0	0%	10	13%	9	1%
	Injury	43	75%	13	76%	56	76%	207	19%
	PDO	4	7%	4	24%	8	11%	893	80%
Lighting Condition	Daylight	22	38%	11	65%	33	45%	736	66%
	Dark-Lit	13	23%	0	0%	13	18%	242	22%
	Dark-Unlit	21	37%	6	35%	27	36%	98	9%
	Dawn/Dusk	1	2%	0	0%	1	1%	28	2.5%
	Unknown	0	0%	0	0%	0	0%	5	0.5%
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%	1,109	100%

\* Includes pedestrian/bicycle crashes

# Crash Trends: Lighting Condition

Location (US 40 at)	All Crashes (Jan 2014 – Dec 2016)			Ped + Bike Crashes (Jan 2005 – Dec 2016)		
	Total Crashes	Nighttime Crashes		Total Crashes	Nighttime Crashes	
		No.	%		No.	%
SR 72	94	32	34%	7	3	43%
Rickey Blvd	27	9	33%	7	5	71%
Scotland Dr	80	27	34%	1	0	0%
Becks Woods Dr	24	10	42%	2	1	50%
Porter Rd/Salem Church Rd	88	23	26%	6	3	50%
Glasgow Dr	30	8	27%	1	1	100%
Brookmont Dr	57	27	47%	9	6	67%
Church Rd	101	40	40%	10	6	60%
Rockwood Rd	17	8	47%	0	0	-
Walther Rd/Glendale Blvd	71	20	28%	4	2	50%
Quintilio Dr	9	6	67%	3	3	100%
Governors Square	94	21	22%	9	5	56%
SR 7	138	42	30%	0	0	-
Eden Square	55	23	42%	0	0	-
SR 1 SB Ramps	75	16	21%	0	0	-
SR 1 NB Ramps	31	10	32%	2	1	50%
Buckley Blvd	26	13	50%	3	0	0%
Midblock Locations	92	33	36%	10	5	50%
<b>Totals</b>	<b>1,109</b>	<b>368</b>	<b>33%</b>	<b>74</b>	<b>41</b>	<b>55%</b>

% Nighttime Crashes ≥ 35%\*

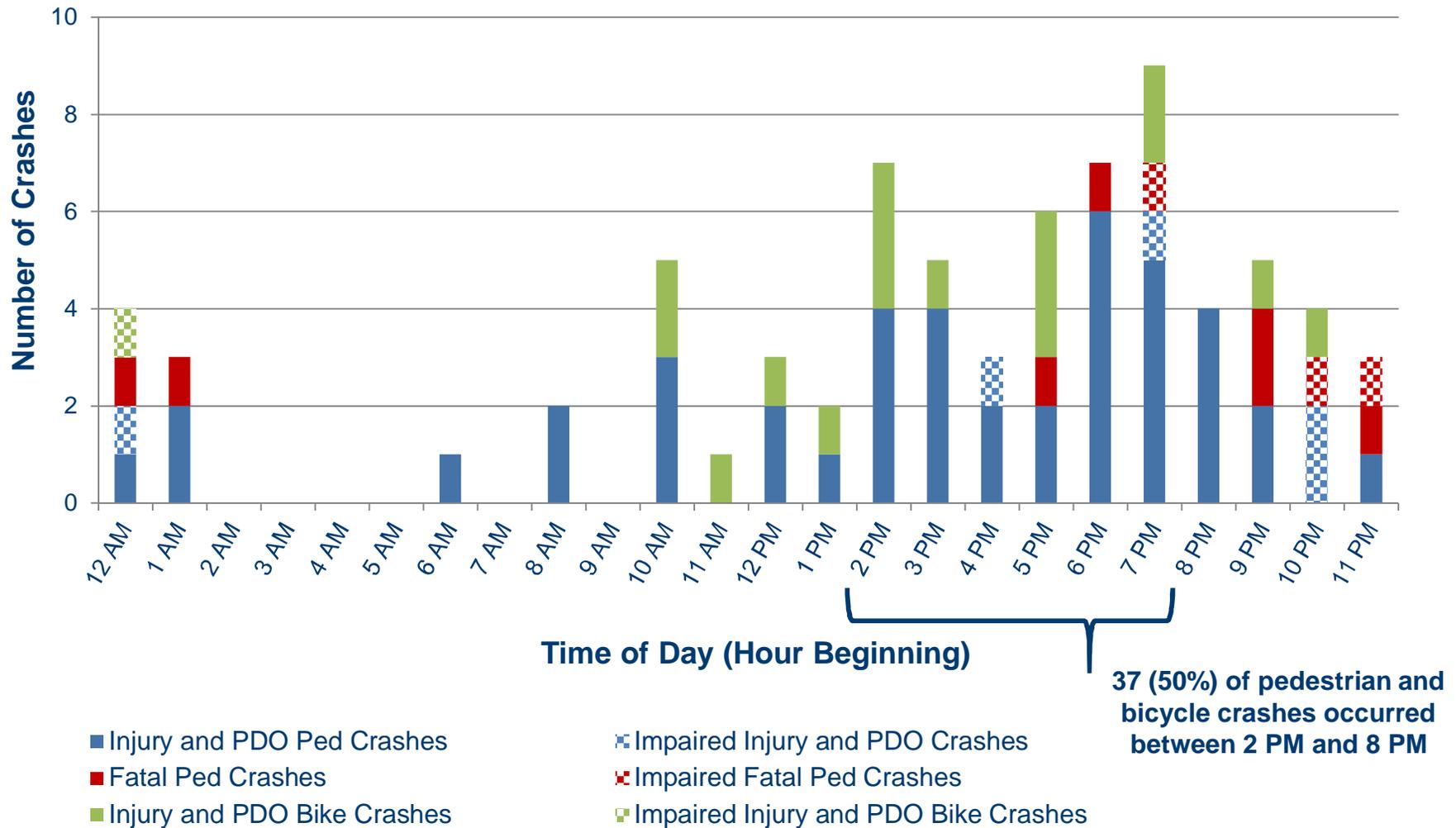
\* DelDOT's Lighting Design Guidelines (October 2012) indicates lighting may be installed where the percentage of nighttime crashes is 35 percent or greater

# Ped/Bike Crash Trends

(January 2005 to December 2016)



## US 40, SR 72 to Buckley Blvd Ped and Bike Crashes by Time of Day (January 2005 – December 2016)



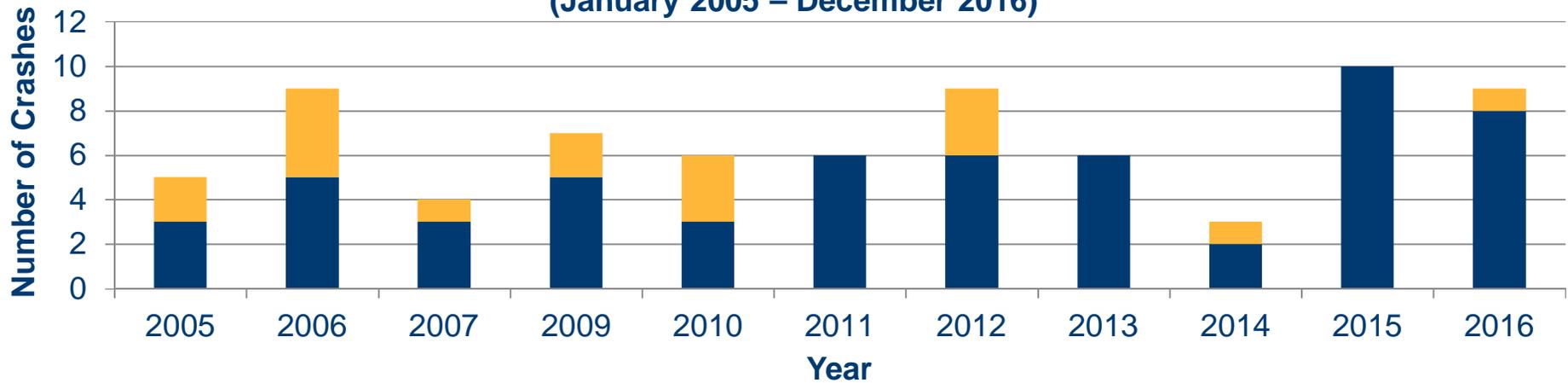
\* There were no bike crashes that resulted in a fatality during the study period.

# Ped/Bike Crash Trends

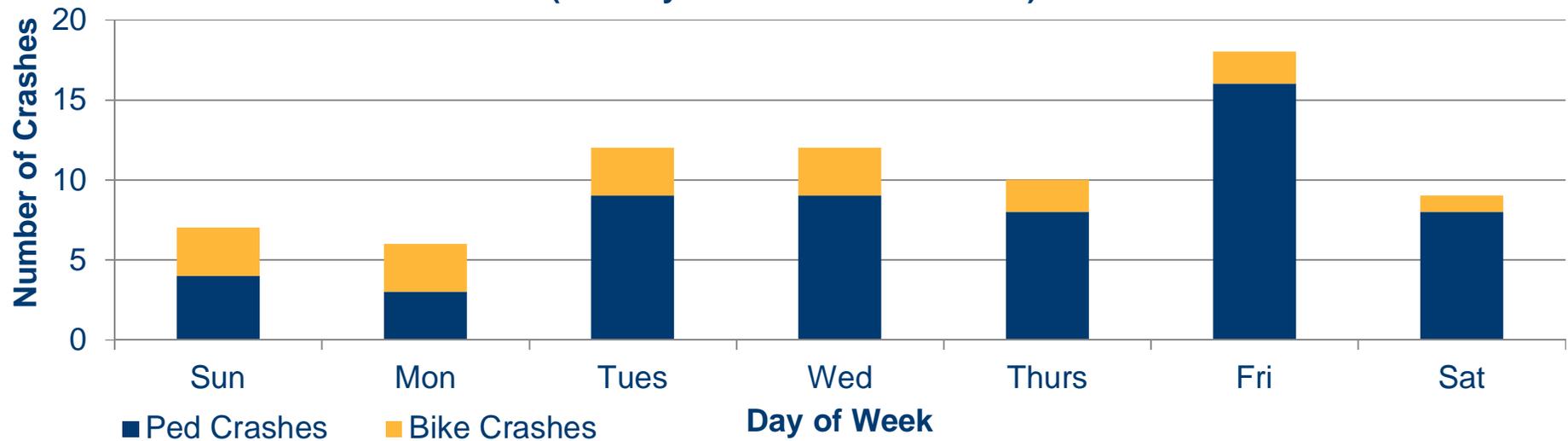
(January 2005 to December 2016)



### US 40, SR 72 to Buckley Blvd Ped and Bike Crashes by Year (January 2005 – December 2016)



### US 40, SR 72 to Buckley Blvd Ped and Bike Crashes by Day of Week (January 2005 – December 2016)

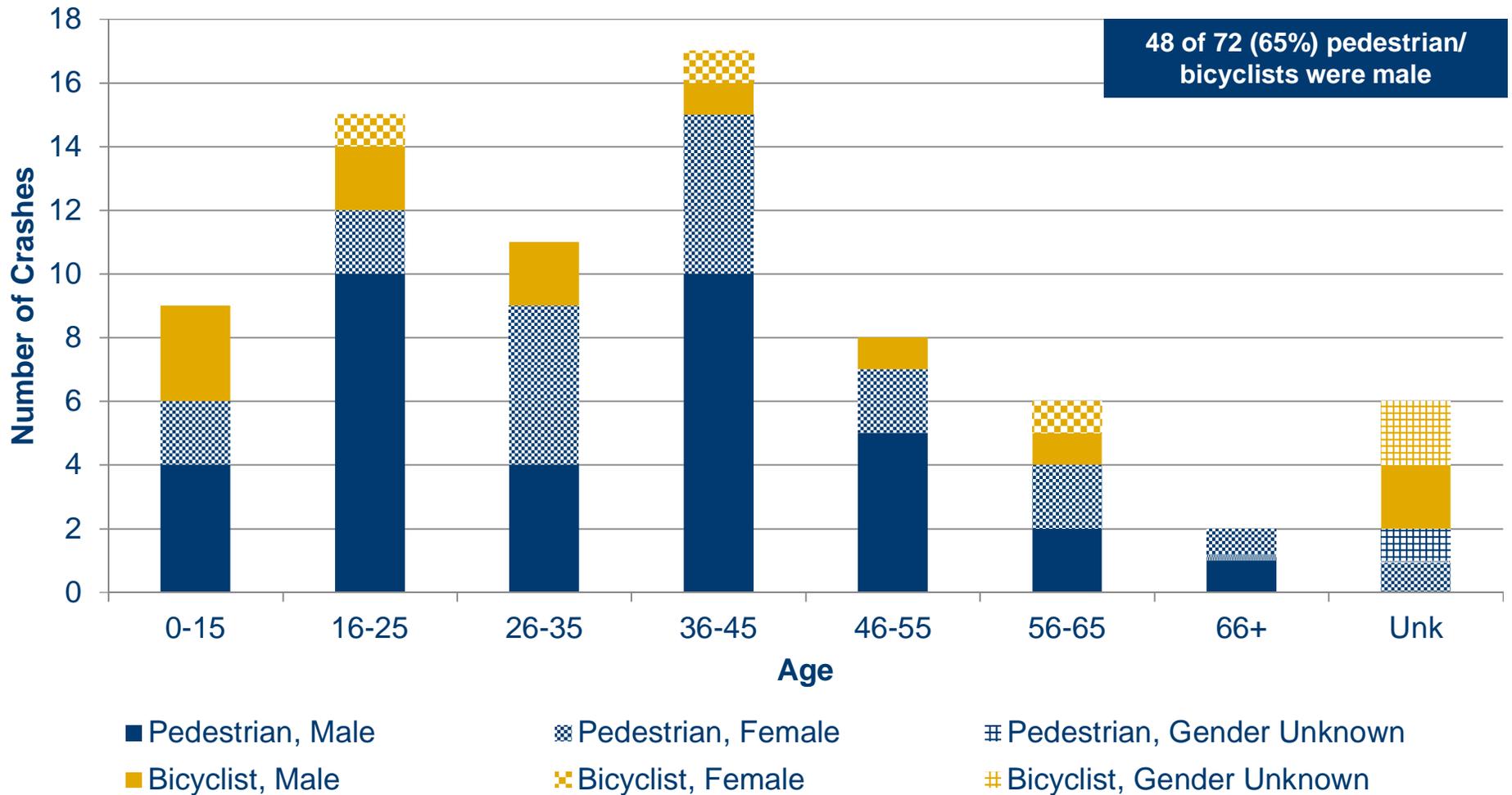


# Ped/Bike Crash Trends

(January 2005 to December 2016)



US 40, SR 72 to Buckley Blvd Ped and Bike Crashes by Age of Pedestrian/Bicyclist  
(January 2005 – December 2016)



**Note:** Two pedestrian crashes during the study period involved young children in strollers that were struck. For both of these crashes, the age of the person pushing the stroller is included in the chart.

# 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					
SR 72	Scotland Drive	0.64	14	22	14	21.9
Scotland Drive	Becks Woods Drive	0.34	1	3	1	2.9
Becks Woods Drive	Porter Rd/Salem Church Rd	0.39	10	26	4	10.3
Porter Rd/Salem Church Rd	Glasgow Drive	0.22	4	18	5	22.7
Glasgow Drive	Brookmont Drive	0.24	4	17	5	20.8
Brookmont Drive	Church Rd/Wellington Dr	0.17	1	6	9	52.9
Church Rd/Wellington Dr	Glendale Blvd/Walther Rd	0.79	7	9	11	13.9
Glendale Blvd/Walther Rd	Geissler Park/Governors Square	0.50	12	24	15	30.0
Geissler Park/Governors Square	SR 7	0.18	2	11	3	16.7
SR 7	Eden Square	0.10	0	0	0	0.0
Eden Square	SR 1 SB Ramps	0.27	2	7	0	0.0
SR 1 SB Ramps	SR 1 NB Ramps	0.17	1	6	1	5.9
SR 1 NB Ramps	Buckley Boulevard	0.28	7	25	4	14.3

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

**Note:** Two (2) reported pedestrian crashes are excluded from the table (1 crash occurred west of SR 72; 1 crash occurred east of Buckley Blvd)

# 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
-  Pedestrian  
Fatal Crash
-  Bicycle  
Fatal Crash
-  Nighttime Crash
-  Hourly Ped Volume  
(highest recorded  
hour of 3 peaks)

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

**Note: Figures included in Attachment A**

August 2017

**Existing Conditions**  
US 40  
SR 72  
to  
Buckley Boulevard

-  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
-  Pedestrian  
Fatal Crash
-  Bicycle  
Fatal Crash
-  Nighttime Crash
-  Hourly Ped Volume  
(highest recorded  
hour of 3 peaks)

Crash study period - January 2009  
through December 2016

0 100 200 Feet



Figure 13



Figure 14

# Field Meeting

- Held August 16, 2017
- Stakeholders
  - DeIDOT Traffic
  - OHS
  - DSP
  - FHWA
  - Bike Delaware
  - WILMAPCO
  - New Castle County
  - University of Delaware
- Identified potential pedestrians 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

## Route 40 Corridor 20-Year Transportation Plan



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- Adopted in June 2000
- Plan details highway, transit, and pedestrian/bicycle improvements to address growth along corridor
- Numerous projects in the Plan have been completed or are in progress
- Pedestrian and Bicycle Improvements
  - Develop continuous sidepaths on both sides of US 40 from MD state line to US 13
    - Phase I: SR 72 to SR 1 (partially implemented)
    - Phase II: SR 896 to SR 72 (partially implemented)
    - Phase III: MD state line to SR 896 & SR 1 to US 13 (partially implemented)
  - Improve pedestrian/bicycle accessibility and mobility along selected US 40 connecting roadways, including the following within US 40 Ped study's limits:
    - SR 72, US 40 to SR 71 (sidewalk) – in progress as part of T20411901
    - Salem Church Road, US 40 to I-95 (sidewalk, bike lane) – bike lane implemented to Old Baltimore Pike; sidewalk in progress
    - Porter Road, US 40 to SR 896 (bike lane) - complete
    - Walther Road, US 40 to Old Baltimore Pike (sidewalk, bike lane) – partially completed
- Annual Monitoring and Triggering Report

Additional Details Available at:

<https://www.deldot.gov/information/projects/rt40/index.shtml>

# Relevant Projects

- US 40 and Walther Road Intersection Lighting – installed Fall 2014
- Corridor Signal Retiming along US 40 implemented in 2017
  - Pedestrian signal timings upgraded to current best practices
  - Signal timings updates to be implemented again in 2019
- North XIX, 2016 PAR/P&R (T201606119)
  - SR 72 to Walther Road; SR 1 Overpass to US 13
  - ADA pedestrian facility upgrades
  - Major work completed in 2018
- Rockwood Apartments
  - Constructed 3rd EB travel lane and turn lane(s) from east of Church Rd to Walther Rd (Fall 2018)
  - New bus stop added on EB US 40 (amenities include bus pad and wide shoulder for buses to stop)
- US 40 Widening, Salem Church Rd to Walther Rd
  - Final design currently underway
  - Construction schedule unknown



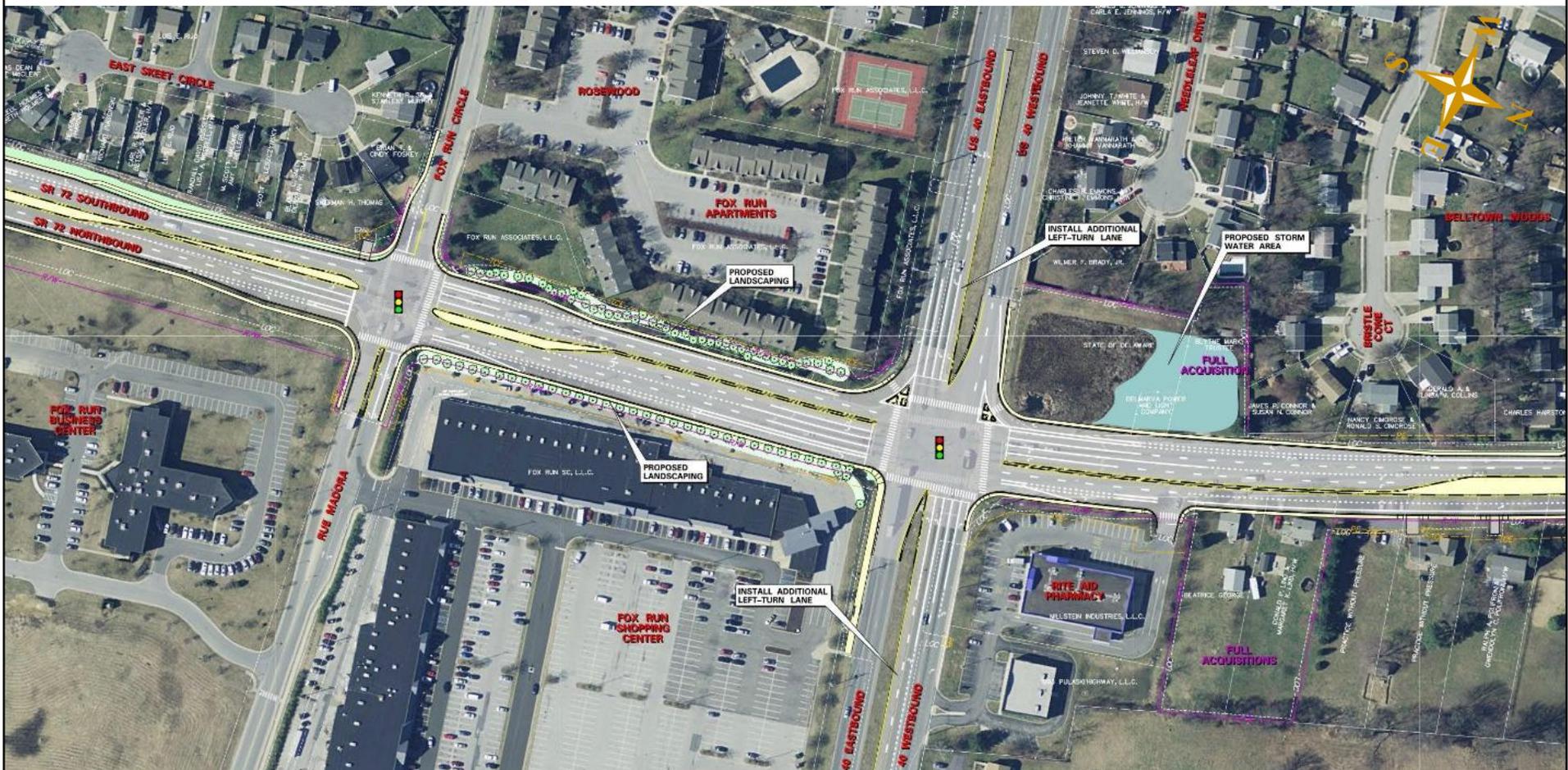
# Relevant Projects

## US 40 & SR 72 Intersection Improvements (T20411901)



- Provide additional through lanes on the SR 72 approaches to US 40
- Provide dual left-turn lanes on the US 40 approaches to SR 72
- Realign and signalize SR 72 at Del Laws Road intersection
- Improve sidewalk connectivity along SR 72

Currently in Construction



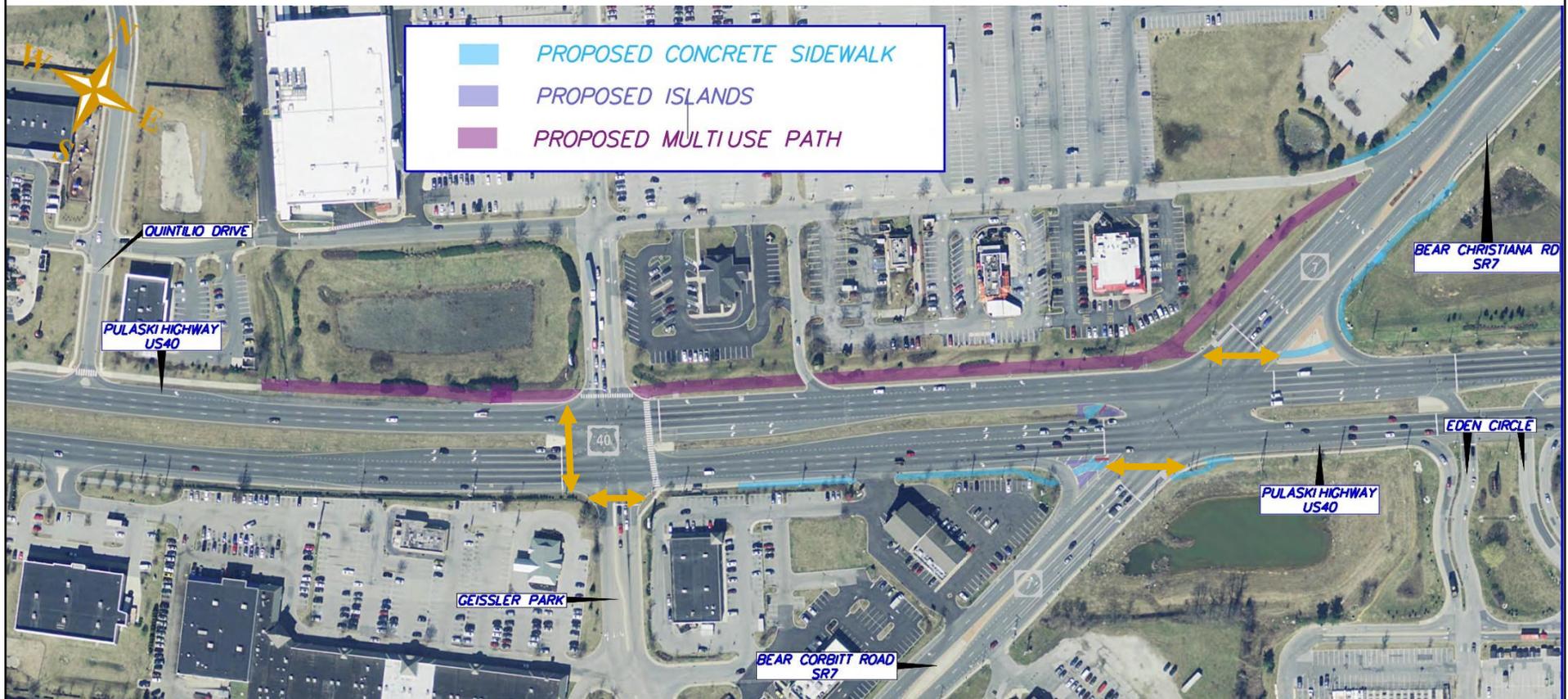
# Relevant Projects

## US 40 & SR 7 Intersection Improvements (T201200104)



- Install crosswalk on west leg of US 40 at Governors Square/Geissler Park
- Install crosswalks on north and south legs at US 40 at SR 7
- Improve pedestrian connections (sidewalk & mixed-use path)
- Signalize NB and SB SR 7 right turns at US 40
- Lighting improvements (north side near Governors Square/Geissler Park)

Construction  
Contract  
Awarded  
12/4/2018



# **CORRIDOR-WIDE ASSESSMENTS**

# Lighting Assessment

## Applicable DeIDOT Lighting Warrants



Key	DeIDOT Lighting Warrants Summary for US 40 Corridor	Statement Type
A	Interstate and controlled access highways: - junctions among mainline routes - ramp terminals with mainline route - ramp terminals with crossing roadways	Shall
B	Intersections of US Routes with US Routes (excluding Alternate (Alt.) or Business (Bus.) Routes)	Shall
C	Intersections of US Routes with DE Routes (excluding Alt. or Bus. Routes)	Shall
D	Intersections of US Routes with US Alt. and Bus. Routes	Should
E	Intersections of US Routes with DE Alt. and Bus. Routes	Should
F	Locations where crash patterns indicate that lighting may reduce crashes and where nighttime crash percentage $\geq 40\%$	Should
G	Residential development entrances where the internal streets are lighted and there are at least 75 homes	Should
H	All public transit stops	Should
I	Locations where crash patterns indicate that lighting may reduce crashes and where nighttime crash percentage $\geq 35\%$	May
J	Residential development entrances where there are at least 100 homes	May
K	Locations where a combination of favorable factors exist and Engineering Judgment indicates that lighting would be useful	May

**Statement Type**

- “Shall” requires installation
- “Should” requires consideration for installation
- “May” indicates that an installation is acceptable

**NOTE: Current lighting warrants focus on intersections**

# Lighting Assessment



Locations where a DeIDOT Lighting Guidelines Criteria is Met	Lighting Warrant(s) Met <i>(see previous slide)</i>	Reasoning Warrant is Met	Current Lighting
SR 72	C, I*, K <i>(Shall Condition)</i>	<ul style="list-style-type: none"> <li>Intersection of US and DE state route;</li> <li>34% nighttime crashes (Jan 2014 – Dec 2016);</li> <li>3 (43%) of 7 ped/bike crashes occurred at night from Jan 2005 – Dec 2016                             <ul style="list-style-type: none"> <li>Identified in prior Dark Criteria Study</li> </ul> </li> </ul>	Luminaires on all 4 corners; Additional lighting to be installed as part of T200411901
Scotland Drive	I*, K <i>(May Condition)</i>	<ul style="list-style-type: none"> <li>34% nighttime crashes (Jan 2014 – Dec 2016);</li> <li>5 (71%) of 7 ped/bike crashes occurred at night from Jan 2005 – Dec 2016                             <ul style="list-style-type: none"> <li>Identified in prior Dark Criteria Study</li> </ul> </li> </ul>	1 luminaire on NW corner
Becks Woods Drive	F, I <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>42% nighttime crashes from Jan 2014 – Dec 2016</li> </ul>	<b>No existing lighting</b>
Porter Road/Salem Church Road	K <i>(May Condition)</i>	<ul style="list-style-type: none"> <li>3 (50%) of 6 ped/bike crashes occurred at night from Jan 2005 – Dec 2016;</li> <li>Identified in prior Dark Criteria Study</li> </ul>	Luminaires on all 4 corner; Additional lighting is currently being investigated
Brookmont Drive	F, I, K <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>47% nighttime crashes (Jan 2014 – Dec 2016);</li> <li>6 (67%) of 9 ped/bike crashes occurred at night from Jan 2005 – Dec 2016                             <ul style="list-style-type: none"> <li>Identified in prior Dark Criteria Study</li> </ul> </li> </ul>	Luminaires on NW and SW corners and within east leg median
Church Road/Wellington Drive	F, I, K <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>40% nighttime crashes (Jan 2014 – Dec 2016);</li> <li>6 (60%) of 10 ped/bike crashes occurred at night from Jan 2005 – Dec 2016                             <ul style="list-style-type: none"> <li>Identified in prior Dark Criteria Study</li> </ul> </li> </ul>	Luminaires on all 4 corners and within west and east leg medians

\* From Jan. 2014 to Dec. 2016, the percentage of nighttime crashes at both SR 72 and Scotland Drive are within one (1) crash of meeting the 35% condition that indicates lighting would be acceptable to install. Both locations exhibited nighttime crash percentages greater than 35% from May 2008 to May 2011 (Dark Criteria Studies); therefore, these locations were considered as being warranted for lighting.

# Lighting Assessment (continued)



Locations where a DeIDOT Lighting Guidelines Criteria is Met	Lighting Warrant(s) Met <i>(see previous slide)</i>	Reasoning Warrant is Met	Current Lighting
Rockwood Road	F, I, J <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>47% nighttime crashes from Jan 2014 – Dec 2016</li> </ul>	<b>No existing lighting</b>
Walther Road/ Glendale Boulevard	K <i>(May Condition)</i>	<ul style="list-style-type: none"> <li>2 (50%) of 4 ped/bike crashes occurred at night from Jan 2005 – Dec 2016</li> <li>Identified in prior Dark Criteria Study</li> </ul>	Luminaires on NW, SW, SE corners and within both medians
Quintilio Drive	F, I, K <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>67% nighttime crashes (Jan 2014 – Dec 2016);</li> <li>3 (100%) of 3 ped/bike crashes occurred at night from Jan 2005 – Dec 2016</li> </ul>	<b>No existing lighting</b>
SR 7	C <i>(Shall Condition)</i>	<ul style="list-style-type: none"> <li>Intersection of US and DE state route</li> </ul>	Luminaires on all 4 corners
Eden Square	F, I <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>42% nighttime crashes (Jan 2014 – Dec 2016)</li> </ul>	Luminaires along both sides of US 40
SR 1 SB Ramps	A, C <i>(Shall Condition)</i>	<ul style="list-style-type: none"> <li>Interstate and controlled access highways;</li> <li>Intersection of US and DE state route</li> </ul>	Luminaires on all 4 corners
SR 1 NB Ramps	A, C <i>(Shall Condition)</i>	<ul style="list-style-type: none"> <li>Interstate and controlled access highways;</li> <li>Intersection of US and DE state route</li> </ul>	Luminaires on south side of US 40
Buckley Boulevard	F, I <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>50% nighttime crashes (Jan 2014 – Dec 2016)</li> </ul>	Luminaires on all 4 corners
All Bus Stops	H <i>(Should Condition)</i>	<ul style="list-style-type: none"> <li>All public transit stops</li> </ul>	46% of bus stops lit; <b>54% of bus stops not lit</b> <i>(see Bus Stop Amenities Assessment)</i>

# Lighting Assessment

- Lighting Safety Benefits \*
  - 81% reduction in nighttime fatal pedestrian crashes
  - 42% reduction in nighttime injury pedestrian crashes
  - 37% reduction in all nighttime injury crashes
- Lighting is warranted/appropriate at all major intersections along the study corridor based on DelDOT Lighting Warrants
- **RECOMMENDATION:** Based on pedestrian crash history and review of DelDOT lighting warrants, ***providing lighting throughout the entire study corridor is recommended.***
  - Due to pedestrian and vehicular crash history, the section along US 40 from Salem Church Road/Porter Road to SR 7 should be prioritized.
  - Existing utility poles are primarily located along the south side of US 40; therefore, full lighting coverage is not possible solely through leased lighting. Therefore, ***pursuing installation of light poles within the median (with dual luminaires) is recommended.***



**Example of Proposed Lighting**  
(US 40, west of Church Rd)

# Bus Stop Amenities Assessment

## Lighting, Bench, Shelter, Ridership Data



Direction	Location	Shelter/ Bench?	Lit?	Weekday Ridership (February 2017)			Bench Warranted? *	Shelter Warranted? *
				Boardings	Alightings	Total		
Eastbound	US 40 & SR 72 (Fox Run Shop Ctr)	Shelter	N	24	5	29	N/A	N/A
	US 40 & Rickey Blvd	None	N	23	4	27	Yes	Yes
	US 40 & Scotland Dr	Shelter	N	32	7	39	N/A	N/A
	US 40 & Op Becks Wood	None	N	5	1	6	No	No
	US 40 & Porter Rd	Shelter	Y	25	6	31	N/A	N/A
	US 40 & Op Brookmont Dr	Shelter	Y	46	9	55	N/A	N/A
	US 40 & Church Rd	None	Y	28	5	33	Yes	Yes
	US 40 & Rockwood	None	N	-	-	-	UNK	UNK
	US 40 & Glendale Blvd	Shelter	Y	5	4	9	N/A	N/A
	US 40 & Op Governors Sq Ent	Shelter	Y	7	6	13	N/A	N/A
	US 40 & Buckley Blvd	Shelter	N	4	7	11	N/A	N/A
Westbound	US 40 & Op Buckley Blvd	None	Y	5	2	7	No	No
	US 40 & Governors Sq Plaza	Shelter	Y	23	37	60	N/A	N/A
	US 40 & Governors Sq Plaza 2	Bench	N	2	6	8	N/A	N/A
	US 40 & Walther Rd	None	Y	1	4	5	No	No
	US 40 & Wilmington University Complex	None	N	2	2	4	No	No
	US 40 & Old Town Hall Ctr	None	N	0	9	9	No	No
	US 40 & Wellington Dr	None	Y	5	44	49	No	No
	US 40 & Brookmont Dr	None	Y	12	26	38	Yes	No
	US 40 & Glasgow Dr	None	Y	0	8	8	No	No
	US 40 & Salem Church Rd	None	N	6	15	21	No	No
	US 40 & Becks Woods Dr	None	N	1	9	10	No	No
	US 40 & Scotland Dr	None	N	9	29	38	No	No
	US 40 & Opposite Rickey Blvd	None	N	3	30	33	No	No
US 40 at SR 72 (Fox Run Shop Ctr)	None	N	3	7	10	No	No	

\* US 40 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:

- WB US 40 at Brookmont Drive

*(current conditions: bus pad with sidewalk connectivity; lighting)*

- Shelter criteria met at following bus stops:

- EB US 40 at Rickey Boulevard

*(current conditions: bus pad without sidewalk connectivity; no lighting)*

- EB US 40 at Church Road/Wellington Drive

*(current conditions: bus pad with sidewalk connectivity; lighting)*

- **RECOMMENDATIONS:**

- Install a bench at the WB US 40 bus stop at Brookmont Drive
- Install a bus shelter at the EB US 40 bus stop at Rickey Boulevard
- Install a bus shelter at the EB US 40 bus stop at Church Road/Wellington Drive
- Install lighting at all bus stops along corridor that currently are unlit



\* US 40 is considered to have moderate transit density

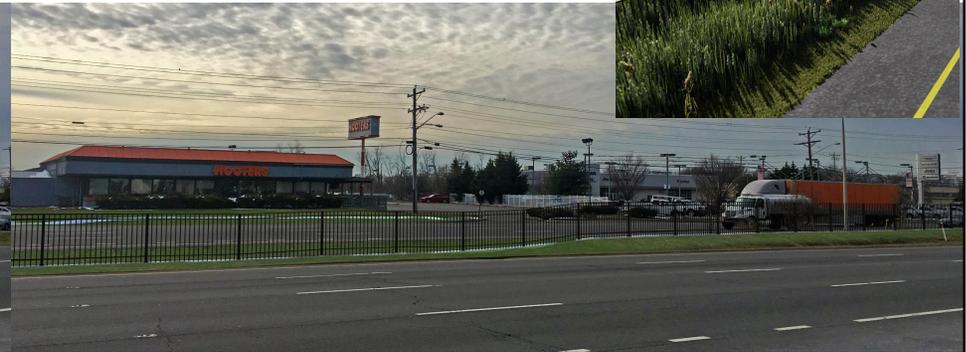
- Purpose of barrier treatments
  - Discourage pedestrians from crossing roadway in non-ideal areas such as midblock locations along a high-speed/high-volume arterial roadway where motorists do not expect pedestrians to be crossing
- Considerations for barrier treatments locations
  - Installation within 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 from US 40 to Wilmington



Before



Artist Rendering

- Post & chain fence with landscaping was recently installed along US 13 in Dover 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		
SR 72	Scotland Drive	0.64	8
Scotland Drive	Becks Woods Drive	0.34	0
Becks Woods Drive	Porter Rd/Salem Church Rd	0.39	2
Porter Rd/Salem Church Rd	Glasgow Drive	0.22	3
Glasgow Drive	Brookmont Drive	0.24	0
Brookmont Drive	Church Rd/Wellington Dr	0.17	2
Church Rd/Wellington Dr	Glendale Blvd/Walther Rd	0.79	4
Glendale Blvd/Walther Rd	Geissler Park/Governors Square	0.50	9
Geissler Park/Governors Square	SR 7	0.18	1
SR 7	Eden Square	0.10	0
Eden Square	SR 1 SB Ramps	0.27	0
SR 1 SB Ramps	SR 1 NB Ramps	0.17	0
SR 1 NB Ramps	Buckley Boulevard	0.28	2

*Priority Segment for Barrier Treatments*

\* 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

# Barrier Treatment Assessment

Glendale Blvd/Walther Rd to Governors Square/Geissler Park



34

- Segment Length: 0.5-mile
- 13 total pedestrian crashes
  - 9 pedestrian crashes that may be correctable by installation of barrier treatment
  - 3 pedestrian fatalities (Oct 2012, Sept 2015, Nov 2015)
- Frequent mid-block pedestrian crossings
- Median width within segment  $\approx$  48 ft (Glendale Blvd/Walther Rd west leg  $\approx$  38 ft; Governors Square/Geissler Park east leg  $\approx$  28 ft); No median openings
- Existing sidewalk
  - EB US 40 (south side): no sidewalk
  - WB US 40 (north side): provided through majority of segment (6 ft buffer between sidewalk & roadway)
- Adjacent land use
  - Commercial properties along both sides of roadway
  - Dense residential areas located behind commercial properties
- **Barrier options for this location: Median barrier or roadside along the north side of US 40**

# Barrier Treatment Assessment

## SR 72 to Scotland Drive



- Segment Length: 0.64-mile
- 12 total pedestrian crashes
  - 8 pedestrian crashes that may be correctable by installation of barrier treatment
  - 3 pedestrian fatalities (Nov 2009, May 2015, Aug 2015)
- Frequent mid-block pedestrian crossings
- Median width  $\approx$  40 ft (narrows to 30 ft in some locations); 3 existing median openings
- Existing sidewalk and mixed-use path
  - EB US 40 (south side): small section provided within 250 ft of SR 72
  - WB US 40 (north side): located along majority of segment; buffer is not continuous between sidewalk/path and roadway
- Adjacent Land Use: Commercial properties on both sides of roadway
- **Barrier option for this location: Median barrier**

# Barrier Treatment Assessment

Church Rd/Wellington Rd to Glendale Blvd/Walther Rd



36

- Segment Length: 0.79-mile
- 10 total pedestrian crashes
  - 4 pedestrian crashes that may be correctable by installation of barrier treatment
  - 1 pedestrian fatality (Nov 2015)
- Relatively minimal mid-block pedestrian crossings
- Median width  $\approx$  50 ft (Church Rd east leg and Walther Rd west leg  $\approx$  40 ft); One median opening at Rockwood Road
- Existing sidewalk and mixed-use path
  - EB US 40 (south side): sidewalk/path with buffer along majority of segment
  - WB US 40 (north side): path with buffer in the vicinity of Wilmington University Sports Complex
- Adjacent Land Use: mix of commercial, residential, and institutional properties
- **Barrier options for this location: Median barrier or roadside along both sides of US 40**

# Barrier Treatment Assessment

## Porter Rd/Salem Church Rd to Glasgow Dr



- Segment Length: 0.22-mile
- 3 total pedestrian crashes
  - 3 pedestrian crashes that may be correctable by installation of barrier treatment
  - 2 pedestrian fatalities (June 2007 and June 2009)
- Frequent mid-block pedestrian crossings
- Median width
  - Salem Church Rd to Glasgow Dr  $\approx$  10 ft
  - Glasgow Dr to Church Rd  $\approx$  40 ft
  - No unsignalized median openings
- Existing sidewalk and mixed-use path
  - EB US 40 (south side): provided within 150 ft of Porter Rd only
  - WB US 40 (north side): sidewalk/path provided throughout segment (with a buffer area east of Glasgow Dr)
- Adjacent Land Use: Commercial and residential
- **Barrier options for this location: Median barrier**

# Barrier Treatment Assessment

## Recommendations



- Install median barrier treatments along these identified “priority segments” of US 40:
  - Glendale Blvd/Walther Rd to Governors Square/Geissler Park
  - SR 72 to Scotland Drive – median barrier treatment should be re-evaluated following installation of the proposed signalized pedestrian crossing at Rickey Boulevard
  - Church Rd/Wellington Rd to Glendale Blvd/Walther Rd median barrier *(as part of planned US 40 Widening, Salem Church Rd to Walther Rd, Project)*
  - Porter Rd/Salem Church Rd to Glasgow Dr *(as part of planned US 40 Widening, Salem Church Rd to Walther Rd, Project)*
- Monitor crashes along other sections of US 40 (i.e., locations not identified above as “priority segments”) to consider installation of barrier treatments

# **LOCATION-SPECIFIC ASSESSMENTS:** ***US 40 AT RICKEY BOULEVARD***

# US 40 at Rickey Boulevard

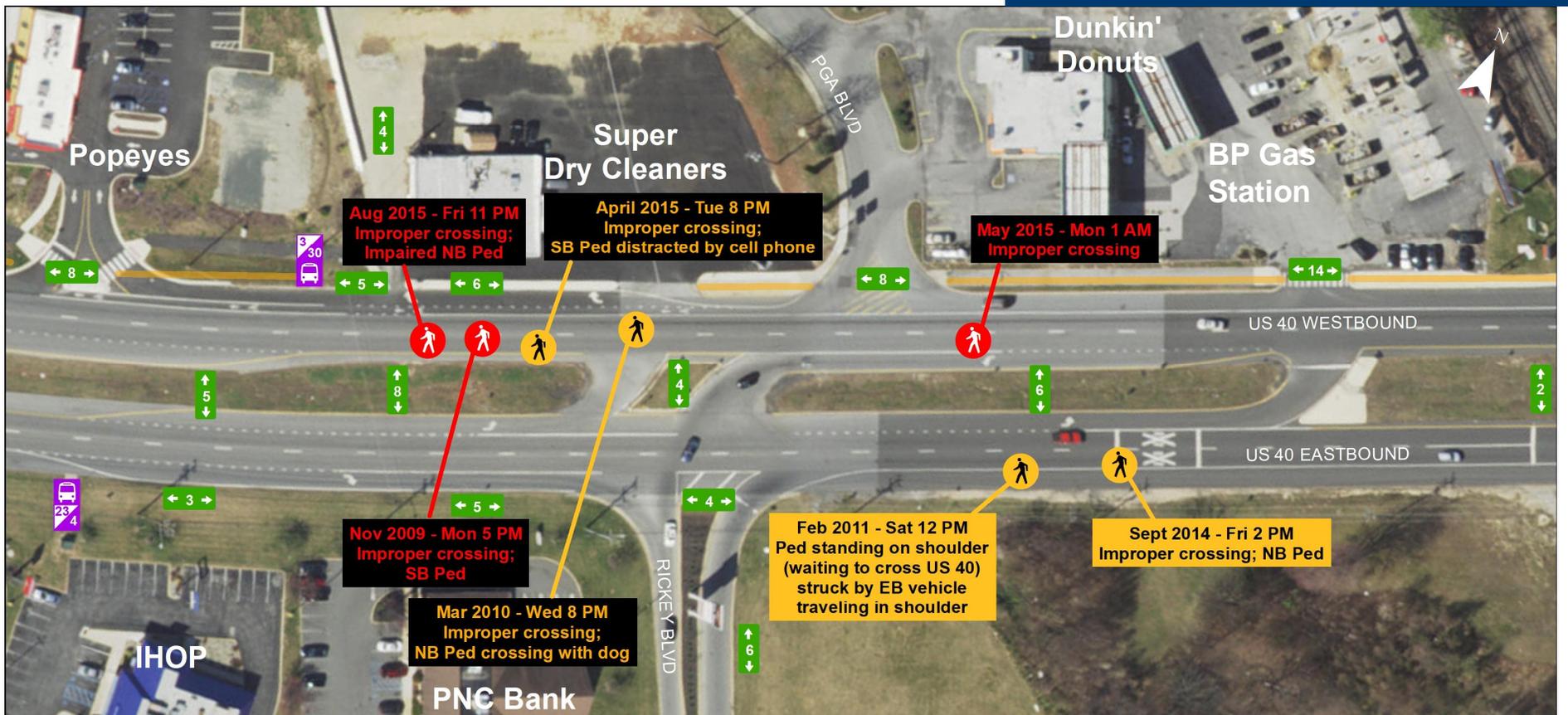
## Existing Conditions & Field Meeting Suggestions

### Existing Conditions:

- Median channelization prohibits side street left and thru movements
- Located 1,700 feet east of SR 72 and 650 feet west of Norfolk Southern R/R crossing
- Bus stops located on EB and WB US 40 on west leg

### Field Meeting Suggestions:

- Investigate signal warrants and/or HAWK to provide signalized ped crossing
- Consider relocating EB bus stop to a signalized location or within shopping center



# US 40 at Rickey Boulevard

## Crash History Summary (2014 – 2018)

### US 40 at Fox Hunt Dr: 14 crashes

- 7 rear end crashes (50%)
  - 4 WB (related to SR 72)
  - 2 NB
  - 1 EB
- 4 NB right-turn/EB angle crashes (29%)
- 3 run-off the road crashes (21%)

### US 40 at Rickey Blvd: 48 crashes

- 26 rear end crashes (54%)
  - 15 NB right-turn
  - 6 in WB queue for SR 72
  - 3 in EB queue stopped for rail signal
  - 2 WB left-turn
- 15 angle crashes (31%)
  - 7 WB left/U-turn / EB thru
  - 3 EB/NB right-turn
  - 2 SB/WB
  - 2 WB U-turn/NB right-turn
  - 1 EB U-turn/WB
- 4 pedestrian crashes (8%) – 2 fatal
  - 3 in WB direction
  - 1 in EB direction
  - All occurred between Sept 2014 and Aug 2015
- 3 sideswipe crashes (6%)

### US 40 at BP Gas Station: 11 crashes

- 7 rear end crashes (63%)
  - 4 EB (1 involved left-turn vehicles)
  - 3 WB
- 2 angle crashes (18%)
  - 1 EB left-turn/WB
  - 1 SB right-turn/WB
- 1 WB sideswipe crash (9%)
- 1 deer-related crash (9%)



# US 40 at Rickey Boulevard

## Signalization Assessment – Peak Hour Traffic Volumes

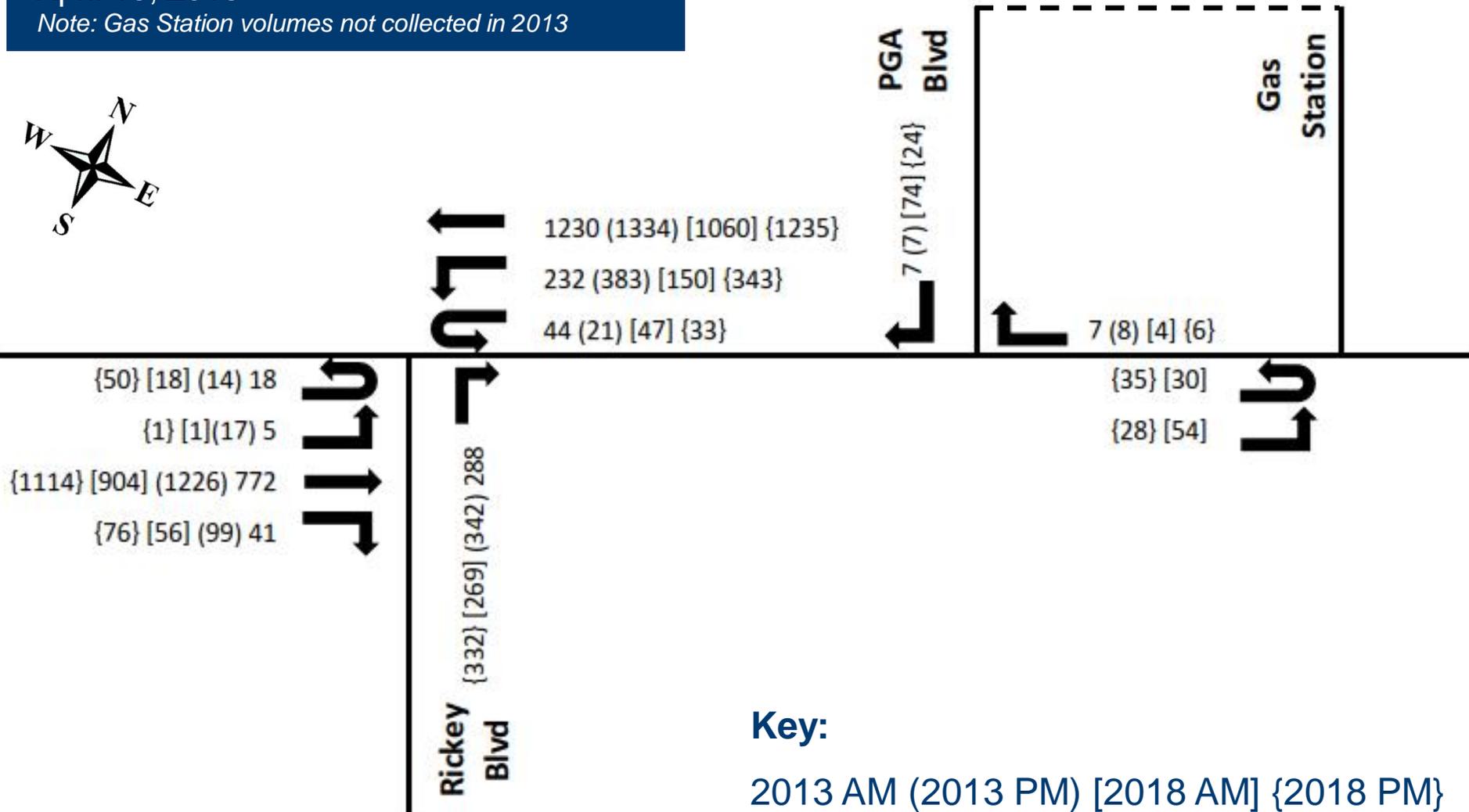


### Turning Movement Count Dates:

October 1 & 2, 2013

April 19, 2018

*Note: Gas Station volumes not collected in 2013*



# US 40 at Rickey Boulevard

## Field Observations



43

- Pedestrians Crossing US 40: 1 in AM, 2 in PM
  - All crossed between EB and WB crossovers at Rickey Blvd
- WB Left-Turn Queues
  - AM: maximum of 5 vehicles
  - PM: maximum of 12 vehicles; available turn lane filled ( $\approx$  300 feet)
- NB Right-Turn Queues
  - AM: maximum of 3 vehicles
  - PM: maximum of 11 vehicles and extended to internal shopping center intersection
- EB left-turn/U-turn Queues at Rickey Blvd and BP Gas Station
  - AM: maximum of 2 vehicles
  - PM: maximum of 5 vehicles
- Vehicles frequently exit PGA Blvd and perform short weave across WB US 40 lanes to access WB left-turn lane at Rickey Blvd

**Queuing Observations  
Performed Tuesday 12/11/18  
8:30-9:15 AM; 4:00-5:15 PM**

# US 40 at Rickey Boulevard

## Signal Warrant Analysis Summary



- Warrant 1 (8-Hour Vehicular Volume) – Conditions A & B are **MET** for both major street vs. minor street and EB Thru vs. WB lefts
- Warrant 2 (4-Hour Vehicular Volume) – **MET** for both major street vs. minor street and EB Thru vs. WB lefts
- Warrant 3 (Peak Hour vehicular Volume) – N/A
- Warrant 4 (Pedestrian) – not met
- Warrant 5 (School Crossing) – not met
- Warrant 6 (Coordinated Signal System) – not met
- Warrant 7 (Crash Experience) - Applied to crashes from 1/1/14 to 12/6/18
  - 2011 DE MUTCD Warrant 7 Crash Criteria – **MET**
    - 9 crashes susceptible to correction by traffic signal from 5/28/2014 to 5/27/2015 (criteria is 5)
  - IA-19 Alternative Warrant 7 Crash Criteria\* - **MET**
    - 9 angle and pedestrian crashes (all severities) within 1-year period from 5/28/14 to 5/27/15 (criteria is 9)
- Warrant 8 (Roadway Network) – not met
- Warrant 9 (Intersection Near Grade Crossing) – not met
- Pedestrian Hybrid Beacon (HAWK) Evaluation - DE MUTCD Section 4F criteria NOT met

**NOTE: Same warrants are met for vehicular traffic volumes from both Oct 2013 and April 2018**

\* Assumptions for applying the IA-19 Alternative 7 Crash Criteria:

- Area Type: Rural Area (due to US 40 posted speed limit exceeding 40 mph)
- Major Street: 2 or more through lanes
- Minor Street: 1 lane

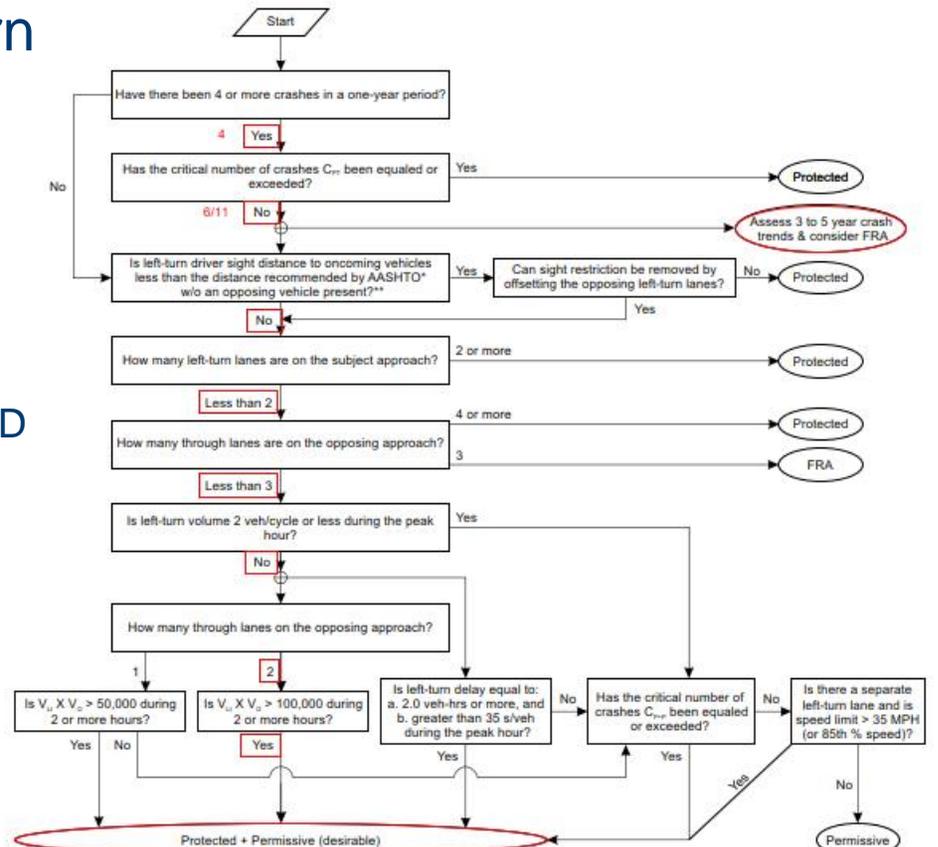
# US 40 at Rickey Boulevard

## Left-Turn Phasing Assessment



### Left-Turn Phasing for WB Left/U-turn

- 4 crashes 8/31/15-8/30/16
- 6 crashes 2014-16
  - $C_{PT} = 11$
- > 750 ft sight distance available
  - When EB left/U-turn vehicles are present, SD reduced to 360 ft
  - 580 ft required for Single-Unit Truck
- 1 left-turn lane
- 2 opposing through lanes
- 19 vehicles per cycle
  - 383 vph, 180-sec cycles in PM peak
- $V_{Lt} \times V_o > 100,000$  in AM and PM peak hours
- **Conclusion: Protected + Permissive recommended, FRA can be considered**



\*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

\*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, $C_{cr}$ (crashes/period)	When Considering Prot.+Perm., $C_{cr}$ (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

Guidelines for determining left-turn lane signal phasing treatment

# US 40 at Rickey Boulevard

## Half Signal Option Considerations

- **WB Lefts:** WB left-turn sight distance (SD) decreases to 360 ft when EB left-turn vehicle(s) is present
  - Required SD for SU truck = 580 ft
  - Low EB left/U-turn volumes reduces frequency of blocked WB left-turn sight distance
- **EB Lefts:** EB left-turn sight distance obstructed with WB left/U-turn queues
  - Occurs frequently due to heavy WB left-turn/U-turn volumes
  - Downstream EB crossover located only 400 ft from Rickey Blvd provides similar access to commercial properties
- Due to sight distance, Option 1 (Half Signal) includes closing the EB left-turn/U-turn crossover at Rickey Blvd
- Providing protected/permissive phasing for WB left-turn/U-turn movement will allow portion of these vehicles to turn during a signalized protected phase (which is a safety benefit compared to existing unsignalized conditions)



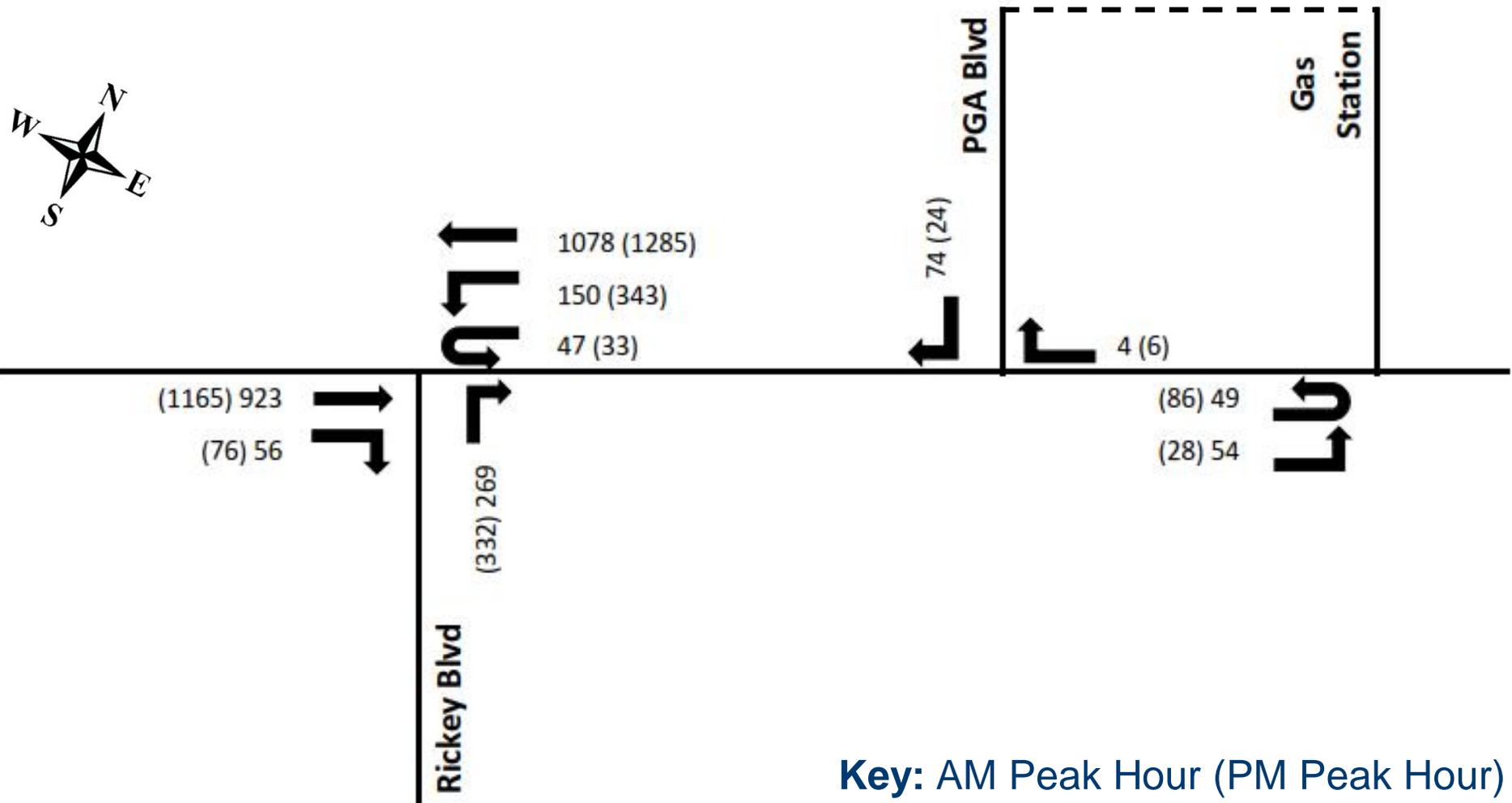
**WB Left-Turn/U-Turn Sight Distance at Rickey Blvd**

# US 40 at Rickey Boulevard

## Half Signal Option Traffic Volumes



Redistributed 2018 Volumes with EB Left-Turn Lane Closure



# US 40 at Rickey Boulevard

## Options Considered



- Option 1: Half Signal
  - EB US 40 Left – Crossover closed; vehicles detoured to nearby median opening at BP Gas Station
  - WB US 40 Left – Protected/permissive (FRA)
  - NB Rickey Blvd – channelized yield control rights; prohibited lefts (same as existing)
  - Pedestrian phase across US 40 operates concurrent with WB protected left-turn phase (WB thru stops only with pedestrian actuation)
- Option 2: Signalize US 40 Lefts/U-Turns
  - EB and WB US 40 Lefts – Protected/permissive (FRA)
  - NB Rickey Blvd – channelized yield control rights; prohibited lefts (same as existing)
  - Pedestrian phase across US 40 operates concurrent with EB and WB protected left-turn phases
- Option 3: Full Signalization
  - EB and WB US 40 Lefts – Protected/permissive (FRA)
  - NB Rickey Blvd – channelized yield control rights; signalized lefts
  - Pedestrian phase across US 40 operates concurrent with Rickey Blvd approach

# US 40 at Rickey Boulevard

## Capacity Analysis



- Evaluated operations at US 40 at Rickey Blvd and EB left-turn/U-turn crossover at BP Station
- PM Peak (4:45 – 5:45 PM) determined to be the critical hour
- US 40 coordinated system currently operates with 180 second length
  - CMS-based signal timings
  - US 40 at Rickey Blvd evaluated at both full cycle (180 sec) and half cycle (90 sec)
  - With half cycle, WB left-turn phase maxes out at 25-second
- Flashing Red Arrow operations
  - Solid green left-turn arrow (protected phase)
  - 15-second solid red phase
  - Flashing Red Arrow for remainder of opposing through phase
- Conservatively assumed 10 pedestrian calls per hour
- Queue length and delay results averaged from 5 SimTraffic runs

# US 40 at Rickey Boulevard

## Capacity Analyses Summary: PM Peak Hour



Cycle Length = 180 seconds					
Scenario	Location	Movement	Movement Delay (sec) & LOS	95th Percentile Queue (ft)	Intersection Delay (sec) & LOS
Existing	Rickey Blvd	WB Left	33.5 (D)	276	10.3 (B)
		EB Left	22.3 (C)	32	
	BP Gas Station Crossover	EB Left	30.3 (D)	91	-
Option 1: Half Signal	Rickey Blvd	WB Left	35.2 (D)	301	13.3 (B)
		WB Thru	7.6 (A)	357	
		EB Thru	14.5 (B)	77	
	BP Gas Station Crossover	EB Left	44.2 (E)	144	-
Option 2: Signalize US 40 Lefts/U-Turns	Rickey Blvd	WB Left	34.2 (C)	295	13.4 (B)
		WB Thru	7.3 (A)	357	
		EB Left	24.7 (C)	39	
		EB Thru	14.8 (B)	79	
	BP Gas Station Crossover	EB Left	33.5 (D)	93	-
Option 3: Signalize US 40 Lefts/U-Turns AND NB Rickey Blvd	Rickey Blvd	WB Left	27.6 (C)	252	19.9 (B)
		WB Thru	7.5 (A)	268	
		EB Left	31.3 (C)	167	
		EB Thru	32.1 (C)	474	
		NB Left	59.6 (E)	107	
	BP Gas Station Crossover	EB Left	27.2 (D)	56	-

# US 40 at Rickey Boulevard

## Capacity Analyses Summary: PM Peak Hour



Cycle Length = 90 seconds					
Scenario	Location	Movement	Movement Delay (sec) & LOS	95th Percentile Queue (ft)	Intersection Delay (sec) & LOS
Existing	Rickey Blvd	WB Left	33.5 (D)	276	10.3 (B)
		EB Left	22.3 (C)	32	
	BP Gas Station Crossover	EB Left	30.3 (D)	91	-
Option 1: Half Signal	Rickey Blvd	WB Left	21.6 (C)	243	14.9 (B)
		WB Thru	5.7 (A)	247	
		EB Thru	26.0 (C)	315	
	BP Gas Station Crossover	EB Left	35.6 (E)	132	-
Option 2: Signalize US 40 Lefts/U-Turns	Rickey Blvd	WB Left	19.8 (B)	217	14.9 (B)
		WB Thru	6.6 (A)	267	
		EB Left	27.8 (C)	35	
		EB Thru	25.1 (C)	307	
	BP Gas Station Crossover	EB Left	32.5 (D)	90	-
Option 3: Signalize US 40 Lefts/U-Turns AND NB Rickey Blvd	Rickey Blvd	WB Left	N/A	N/A	N/A
		WB Thru	N/A	N/A	
		EB Left	N/A	N/A	
		EB Thru	N/A	N/A	
		NB Left	N/A	N/A	
	BP Gas Station Crossover	EB Left	N/A	N/A	-

Note: Option 3 not practical with 90-second cycle length

# US 40 at Rickey Boulevard

## Signalization Assessment Summary



- Installation of a signalized crosswalk across US 40 is warranted based on pedestrian crash history, presence of EB bus stop, and the long distance to adjacent crosswalks
- Signal warrants 1, 2, and 7 are MET
- Similar traffic operations are expected for both full and half signal conditions
- Operating the US 40 at Rickey Blvd signal as a half cycle (i.e., 90 sec during the PM peak hour) reduces queues and the potential for westbound queues extending to the nearby RR tracks

# US 40 at Rickey Boulevard

## Signalization Recommendations



- Short-Term Recommendations – Pursue Option 2
  - Provide FRA left-turn phase for WB/EB US 40
  - Provide pedestrian phase across US 40 (operates concurrent with EB and WB protected left-turn phase)
  - Install mountable curb between WB left-turn lane and WB through lane to prevent SB PGA Blvd traffic from weaving across WB traffic
- Long-Term Recommendations
  - Following completion of US 40 at SR 72 capital project, perform comprehensive study along US 40 from SR 72 to Scotland Drive to consider the feasibility of accommodating all movements at a US 40 and Rickey Boulevard signal in conjunction with access management at adjacent median openings (*study should include Rue Madora and consider realignment of Rickey Boulevard across from PGA Boulevard to form a four-legged intersection*)

# US 40 at Rickey Boulevard

Concept



54



# US 40 at Rickey Boulevard

## Eastbound Bus Stop Relocation Assessment



# US 40 at Rickey Boulevard

## Eastbound Bus Stop Relocation Assessment



- Option 1 – Eliminate stop “B”
  - Existing bus stop spacing is appropriate based on DTC’s preferred bus stop spacing of 1,000 ft for local bus service with moderate transit density
- Option 2 – Consolidate bus stops A, B, and C to a new stop located at a central location within Fox Run Shopping Center
  - Increased delays possible for DART Route 40
- Option 3 – Maintain existing bus stops AND improve connectivity to stop “B”
  - Least impactful to current operations
- **RECOMMENDATION:** In conjunction with US 40 at Rickey Boulevard signalization, provide sidewalk connection to EB US 40 bus stop.

# **LOCATION-SPECIFIC ASSESSMENTS:** ***US 40 AT BROOKMONT DRIVE***

# US 40 at Brookmont Drive

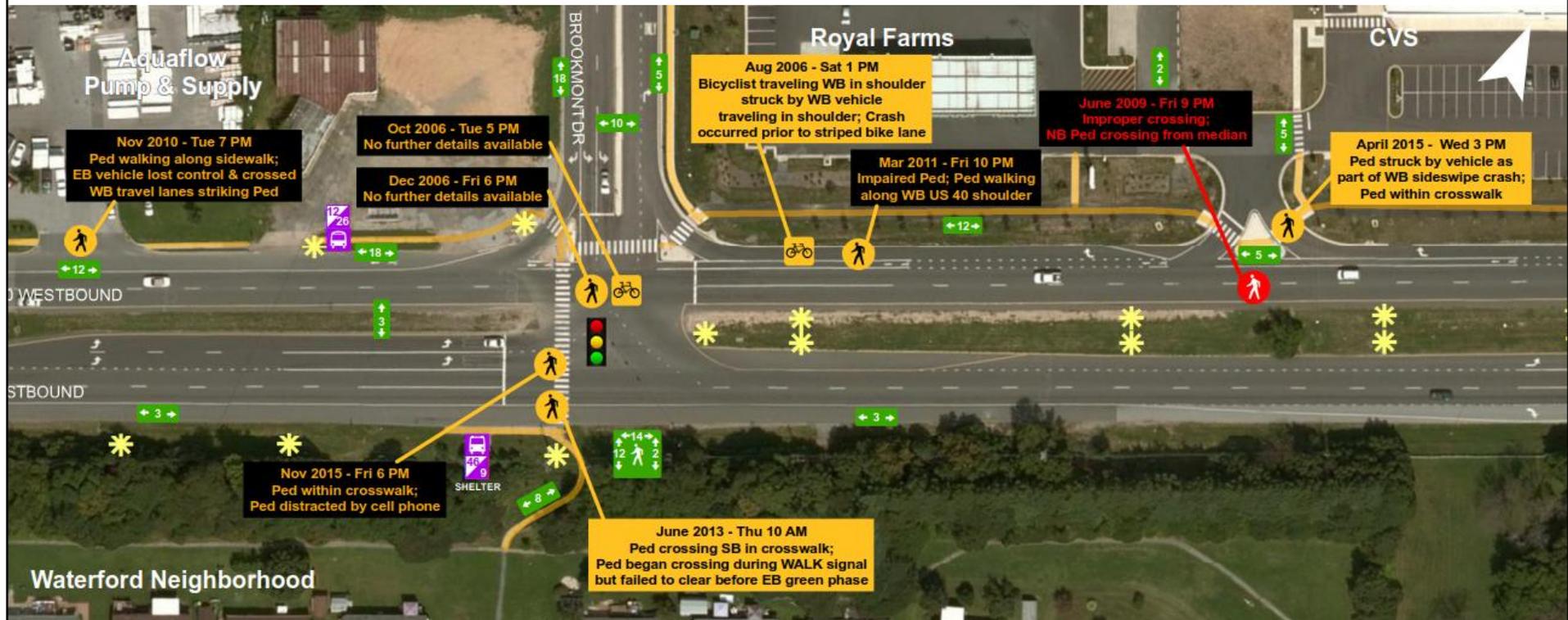
## Existing Conditions & Field Meeting Suggestions

### Existing Conditions:

- Protected-only EB left-turn phasing
- Crosswalks on west and north legs
- Bus stops located on EB and WB US 40 on west leg
  - Bus stops also on both sides of Brookmont Dr on north leg (not shown)

### Field Meeting Suggestions:

- Improve sidewalk connectivity on north leg
- Consider median refuge area on west leg



# US 40 at Brookmont Drive

## North Leg Sidewalk Assessment



- Existing Sidewalk on Brookmont Drive
  - East side - along Royal Farms frontage (~475 feet)
  - West side - no sidewalk
- Both EB and WB US 40 bus stops are located on west leg of intersection, near signalized crosswalk
  - Bus stops also located on both sides of Brookmont Dr ~375 feet north of US 40
- Pedestrian counts indicate higher demand on west side than east side of Brookmont Drive (18 vs. 5 during highest observed hour)
- Adjacent Land Use
  - Brookmont Farms Park (~1,000 feet north of US 40)
  - Wellington Woods neighborhood (north of US 40)
  - Waterford neighborhood (south of US 40) – sidewalk connectivity provided to US 40
- **RECOMMENDATION:** Install continuous sidewalk along the east and/or west side of Brookmont Dr between US 40 and Kemper Drive

# US 40 at Brookmont Drive

## West Leg Pedestrian Refuge Assessment



- Refuge area is feasible; requires:
  - Restriping EB dual left-turning tracks
  - Prohibiting EB U-turning trucks
    - Diverted to Church Rd/Wellington Dr located 850 feet to the east
    - Nov 2014 Count (7-9 AM; 4-6 PM) indicates only 10 (<3%) of EB left-turn vehicles are heavy vehicles
- No capacity impacts anticipated
- **RECOMMENDATION:** Extend west leg median nose to provide pedestrian refuge area and install a pedestrian push button stub pole

Vehicle Turning Path Impact Summary		
Movement	Existing Conditions	Proposed Conditions
EB U-Turn	Passenger Car	Passenger Car
EB Left – Inside Lane	SU-40	SU-40
EB Left – Outside Lane	WB-40	WB-40
SB Left – Inside Lane	SU-40	SU-40
SB Left – Outside Lane	WB-67	WB-67
EB U-Turn at Church Rd/Wellington Dr (Nearest Diversion for EB U-Turn trucks from Brookmont Dr)	SU-30; WB-40	SU-30; WB-40

# US 40 at Brookmont Drive

## Concept



Extend median nose to provide median refuge and pedestrian push button

Install continuous sidewalk along the east and/or west side of Brookmont Dr between US 40 and Kemper Drive

LEGEND	
	REMOVE EXISTING STRIPING
	PROPOSED SIGN POST
	INSTALL CONCRETE / GRASS MEDIAN
	PASSENGER CAR (AASHTO 2011)
	SU-40 (AASHTO 2011)
	WB-40 (AASHTO 2011)
	WB-67 (AASHTO 2011)

**US 40 PEDESTRIAN SAFETY STUDY  
US 40 (PULASKI HIGHWAY) AT BROOKMONT DRIVE  
PROPOSED IMPROVEMENTS**

SCALE  
0' 30' 60'

NEW  
CASTLE  
COUNTY

DECEMBER  
2018



Whitman, Requardt & Associates, LLP  
801 South Caroline Street  
Baltimore, MD 21201

**LOCATION-SPECIFIC ASSESSMENTS:**  
***US 40 AT CHURCH ROAD/  
WELLINGTON DRIVE***

# US 40 at Church Rd/Wellington Dr

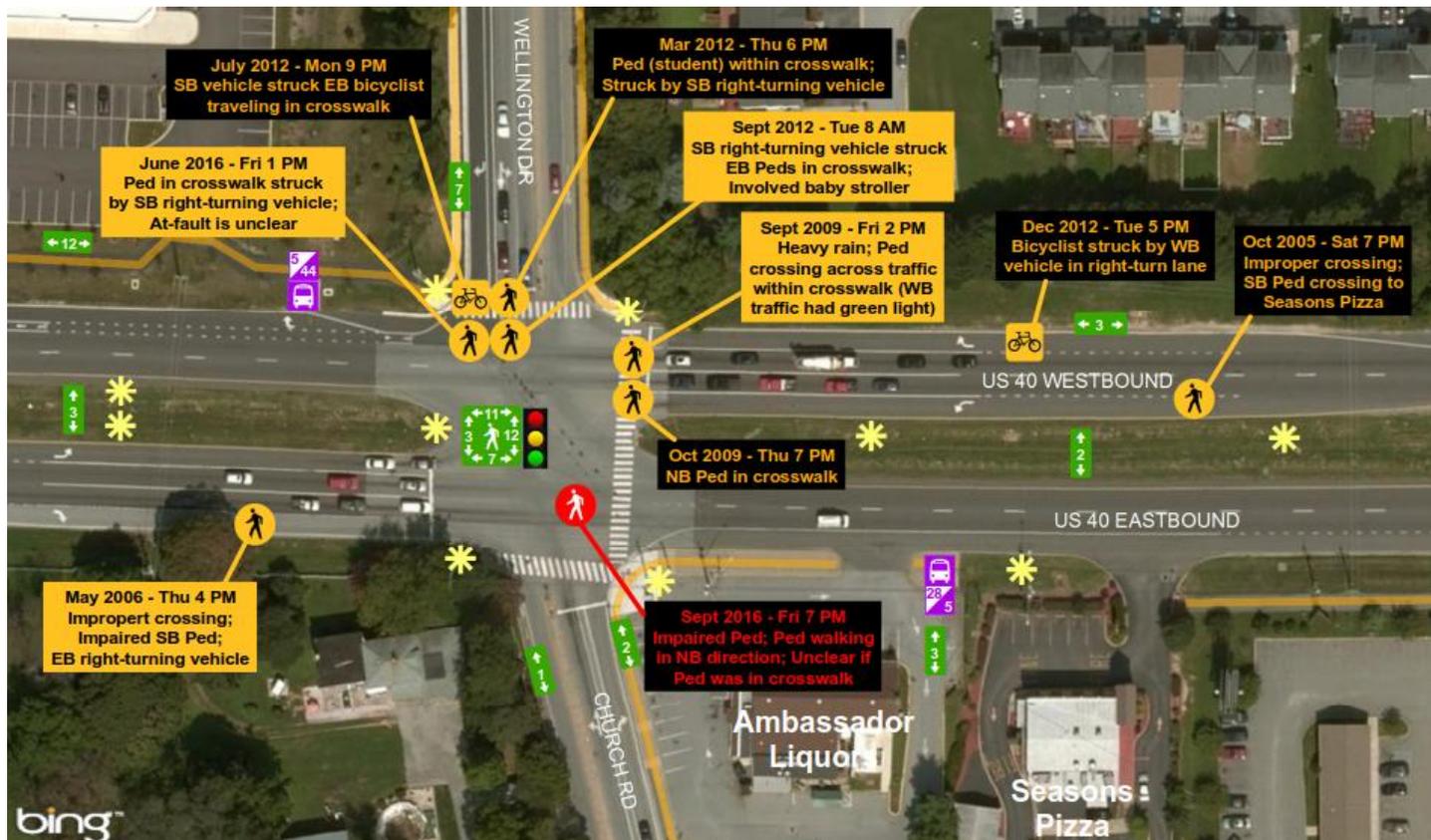
## Existing Conditions & Field Meeting Suggestions

### Existing Conditions:

- Protected-only EB & WB left-turn phasing
- Crosswalks on east, north, south legs
- Far-side EB and WB bus stops

### Field Meeting Suggestions:

- Consider median refuge area on east leg



# US 40 at Church Rd/Wellington Dr

## East Leg Pedestrian Refuge Assessment



- Refuge area is feasible; requires:

- Restriping SB dual left-turning tracks

- No capacity impacts anticipated

- **RECOMMENDATION:** Extend east leg median nose to provide pedestrian refuge area and install a pedestrian push button stub pole

Vehicle Turning Path Impact Summary		
Movement	Existing Conditions	Proposed Conditions
WB U-Turn	SU-30	SU-30
WB Left	WB-67	WB-67
SB Left – Inside Lane	SU-40	SU-40
SB Left – Outside Lane	WB-67	WB-67

# US 40 at Church Rd/Wellington Dr

## Concept



LEGEND	
	REMOVE EXISTING STRIPING
	PROPOSED SIGN POST
	INSTALL CONCRETE / GRASS MEDIAN
	SU-30 (AASHTO 2011)
	SU-40 (AASHTO 2011)
	WB-40 (AASHTO 2011)
	WB-67 (AASHTO 2011)

**US 40 PEDESTRIAN SAFETY STUDY  
US 40 (PULASKI HIGHWAY) AT CHURCH RD/WELLINGTON DR  
PROPOSED IMPROVEMENTS**



NEW  
CASTLE  
COUNTY

DECEMBER  
2018



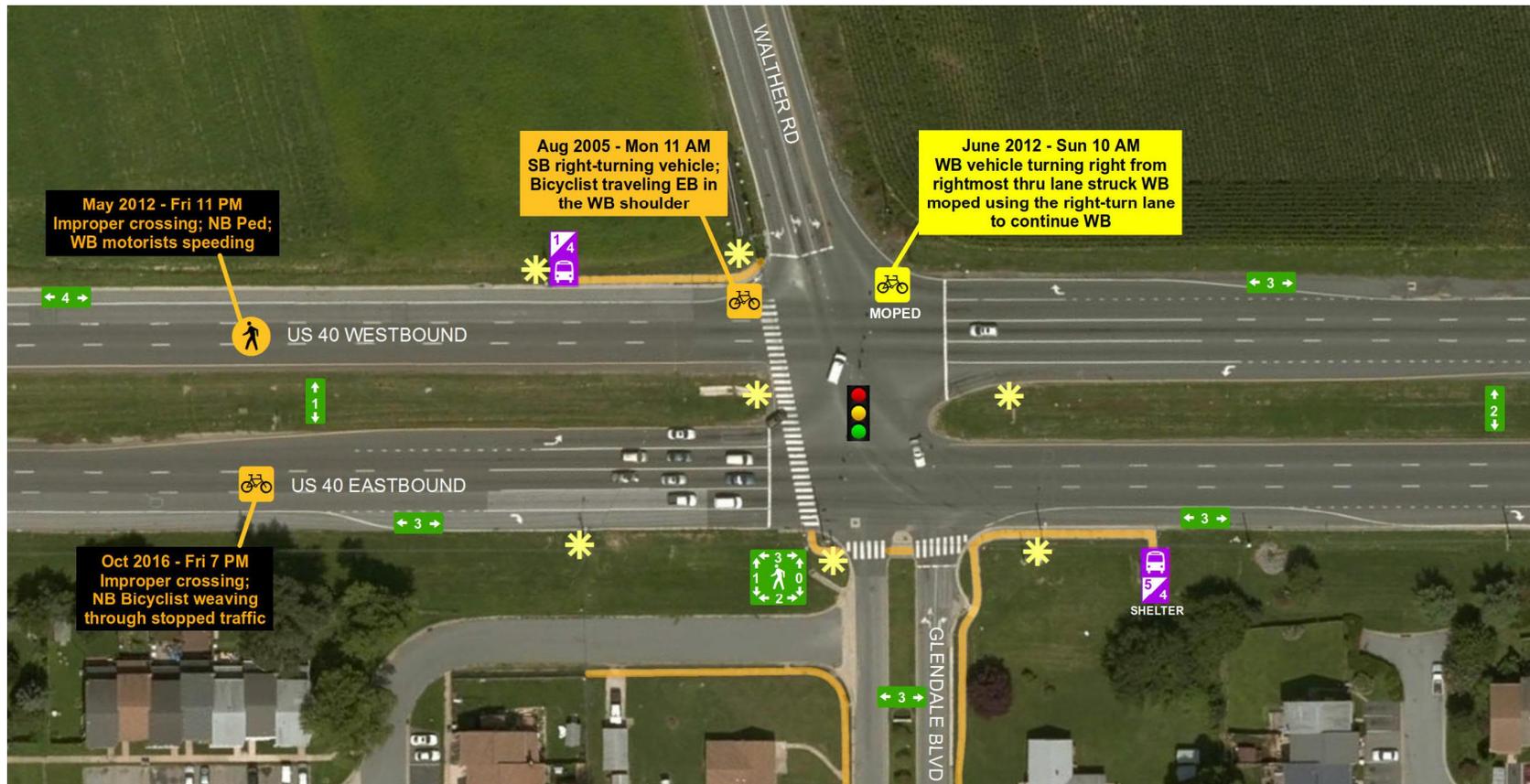
**LOCATION-SPECIFIC ASSESSMENTS:**  
***US 40 AT GLENDALE BOULEVARD/  
WALTHER ROAD***

# US 40 at Glendale Blvd/Walther Rd

## Existing Conditions



- Protected-only EB and WB left-turn phasing
- Crosswalks on west and south legs
- Far-side EB and WB bus stops



- Citizen Request (December 2017):
  - Received from citizen involved in an Oct 2017 pedestrian crash
  - Requested improvements:
    - Refresh faded crosswalk markings –
      - *New crosswalk markings were installed in 2018 as part of P&R project*
    - Signing to alert a driver that a pedestrian may be trying to cross the roadway
- **RECOMMENDATION:** Monitor crashes to consider future signing enhancements

# **LOCATION-SPECIFIC ASSESSMENTS:** ***US 40 AT QUINTILIO DRIVE***

# US 40 at Quintilio Drive

## Existing Conditions & Field Meeting Suggestions

### Existing Conditions:

- Right-in / right-out
- Pedestrian generators on both sides
- Far-side WB bus stop

### Field Meeting Suggestions:

- Consider elimination WB bus stop due to low ridership
- Access management strategies to reduce conflict points along south side



# US 40 at Quintilio Drive

## WB Bus Stop Removal Assessment

- Pedestrians are typically willing to walk 5 to 10 min or 0.25 to 0.50 mile (1,320 to 2,640 feet) to a transit stop \*
- DTC's preferred bus stop spacing is approximately 1,000 ft for local bus service with moderate transit density
  - Nearest WB bus stop to east (at Governors Square): 840 feet
  - Nearest WB bus stop to west (at Walther Road): 1,820 feet



\* Per FHWA's Pedestrian Safety Guide for Transit Agencies (FHWA-SA-07-017)

# US 40 at Quintilio Drive

## WB Bus Stop Removal Assessment



- Pedestrian Crash History: 5 pedestrian crashes within approximately 750 feet that involved “improper crossings”
- Land Use:
  - Commercial land uses adjacent to US 40 (both sides)
  - Residential properties “behind” commercial (both sides)
- Sidewalk Connectivity to Adjacent Bus Stops:
  - Walther Road – Not provided
  - Governors Square – To be completed as part of T201200104 (US 40 & SR 7 Intersection Improvements Project)
    - Sidewalk system within Governors Square does not connect existing bus stops
- **RECOMMENDATIONS:**
  - Maintain existing WB bus stop at Quintilio Drive
  - Post signing (i.e., USE CROSSWALK) to discourage mid-block crossings

# SUMMARY OF RECOMMENDATIONS

# Improvement Matrix (1 of 3)



Location	Timeframe	Recommendation	Responsible Party
Corridor Wide	Long-Term	Continue to pursue pedestrian and bicycle improvements outlined in Route 40 20-Year Implementation Plan	DelDOT
	Mid-term	As identified in the Route 40 20-Year Implementation Plan, continue pursuing continuous sidepaths on both sides of US 40. The following locations for sidepaths are recommended for prioritization from this study: <ul style="list-style-type: none"> <li>• South side of US 40 from east of SR 72 to Rickey Boulevard</li> <li>• South side of US 40 from west of SR 72 to the SR 72 intersection</li> </ul>	DelDOT
	Mid-Term	Pursue lighting the entire study corridor using light poles within the US 40 median with dual luminaires. Due to pedestrian and vehicular crash history, Salem Church Road/Porter Road to SR 7 should be prioritized.	DelDOT Traffic
	Mid-Term	Install lighting at all bus stops along corridor that currently are unlit	DelDOT/DTC
	Mid-Term / Long-Term	Install median barrier treatments along these identified “priority segments” of US 40: <ul style="list-style-type: none"> <li>• Glendale Blvd/Walther Rd to Governors Square/Geissler Park</li> <li>• SR 72 to Scotland Drive – median barrier treatment should be re-evaluated following installation of the proposed signalized pedestrian crossing at Rickey Boulevard</li> <li>• Church Rd/Wellington Rd to Glendale Blvd/Walther Rd median barrier (<i>as part of planned US 40 Widening, Salem Church Rd to Walther Rd, Project</i>)</li> <li>• Porter Rd/Salem Church Rd to Glasgow Dr (<i>as part of planned US 40 Widening, Salem Church Rd to Walther Rd, Project</i>)</li> </ul>	DelDOT Traffic
	Mid-Term / Long-Term	Monitor crashes along other sections of US 40 (i.e., locations not identified above as “priority segments”) to consider installation of barrier treatments	DelDOT Traffic

# Improvement Matrix (2 of 3)



Location	Timeframe	Recommendation	Responsible Party
US 40 at Rickey Boulevard	Short-Term	Install a bus stop shelter at the EB US 40 bus stop at Rickey Blvd	DTC
	Short-Term	Install new traffic signal at US 40 at Rickey Boulevard as follows: <ul style="list-style-type: none"> <li>• US 40 lefts/U-turns to operate with FRA</li> <li>• Signalized pedestrian crossing of US 40 to operate concurrently with EB/WB US 40 lefts/U-turns</li> <li>• Provide sidewalk connection to eastbound US 40 bus stop</li> <li>• Install mountable curb between WB left-turn and WB through lanes to prevent SB PGA Boulevard traffic from weaving across WB traffic</li> </ul>	DelDOT Traffic
	Long-Term	Following completion of US 40 at SR 72 capital project, perform comprehensive study along US 40 from SR 72 to Scotland Drive to consider the feasibility of accommodating all movements at a US 40 and Rickey Boulevard signal in conjunction with access management at adjacent median openings ( <i>study should include Rue Madora and consider realignment of Rickey Boulevard across from PGA Boulevard to form a four-legged intersection</i> )	DelDOT Traffic
US 40 at Brookmont Drive	Mid-Term	Install a bench at the westbound US 40 bus stop at Brookmont Drive	DTC
	Mid-Term	Install continuous sidewalk along the east and/or west side of Brookmont Drive between US 40 and Kemper Drive	DelDOT
	Mid-Term	Extend west leg median nose to provide pedestrian refuge area and a pedestrian push button stub pole at US 40 at Brookmont Drive	DelDOT Traffic

# Improvement Matrix (3 of 3)



Location	Timeframe	Recommendation	Responsible Party
US 40 at Church Road/ Wellington Drive	Mid-Term	Install a bus stop shelter at the eastbound US 40 bus stop at Church Road/Wellington Drive	DTC
	Mid-Term	Extend east leg median nose to provide pedestrian refuge area and a pedestrian push button stub pole at US 40 at Church Road/Wellington Drive	DeIDOT Traffic
US 40 at Glendale Boulevard/ Walther Road	Mid-Term	Monitor crashes at US 40 at Glendale Blvd/Walther Road to consider future signing enhancements	DeIDOT Traffic
US 40 at Quintilio Drive	Short-Term	Post signing (i.e., USE CROSSWALK) to discourage mid-block pedestrian crossings at westbound US 40 bus stop at Quintilio Drive	DeIDOT Traffic