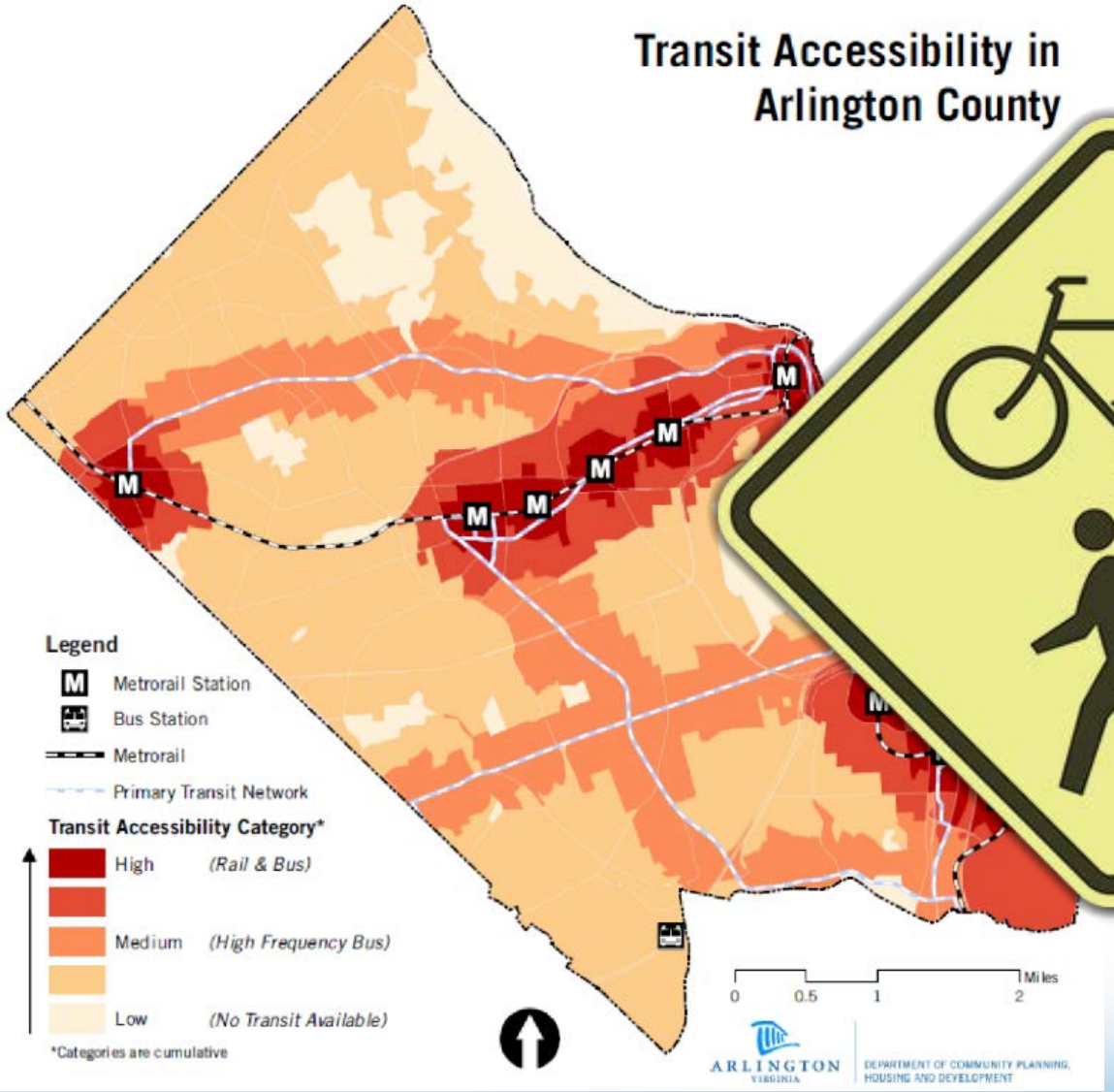
Pedestrian Safety

Assessing the Effectiveness of RRFBs

ARLINGTON
VIRGINIA

Department of Environmental Services

Arlington County Transportation at a Glance



Distance from Metro	People	Jobs
0 to 1/4 Mile	16%	59%
0 to 1/2 Mile	34%	80%

Distance from Any Transit	People	Jobs
0 to 1/4 Mile	97%	99%

ART arlington transit

metro

capital bikeshare

zipcar

CAR2GO

RAILWAY VIRGINIA EXPRESS

Why is a systemic safety program important for Arlington?

Location-specific

Systemic

Crashes are random

Pedestrian crashes are relatively rare

Location-specific

Systemic

Crashes are far between

Short-Range Improvements

Short Range Improvements

Before

Fall 2017

Interim Tactical Improvements

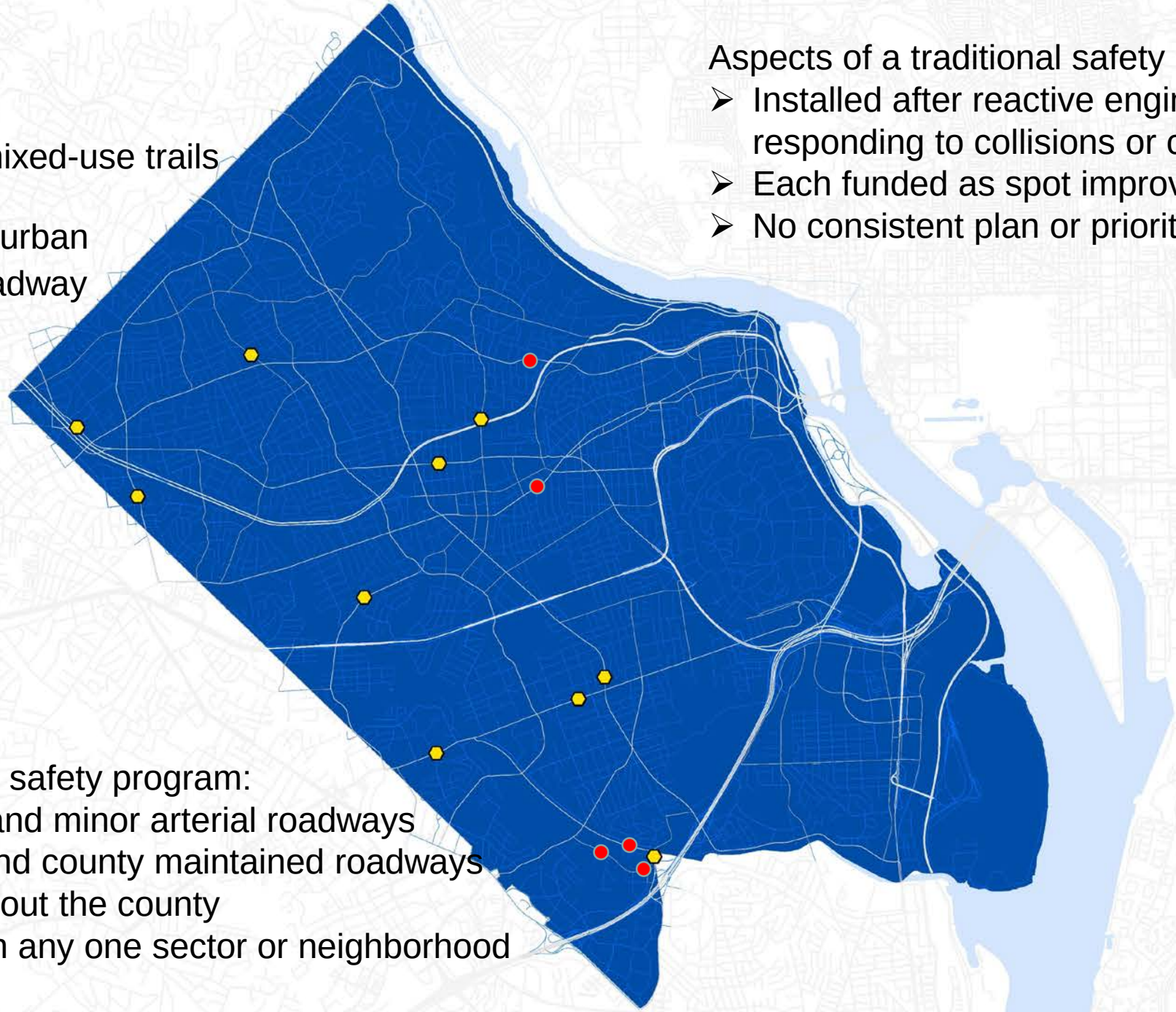
Summer 2018

Permanent Improvements

~~10~~ 15 RRFBs

100 lane-miles of mixed-use trails

1000 lane-miles of urban county-maintained roadway



Aspects of a traditional safety program:

- Installed after reactive engineering studies, responding to collisions or complaints
- Each funded as spot improvements
- No consistent plan or priority system

Aspects of a systemic safety program:

- Located on major and minor arterial roadways
- Located on state and county maintained roadways
- Distributed throughout the county
- Not concentrated in any one sector or neighborhood

S Arlington Mill Dr @ Windgate

S Four Mile Run Dr @ Quincy

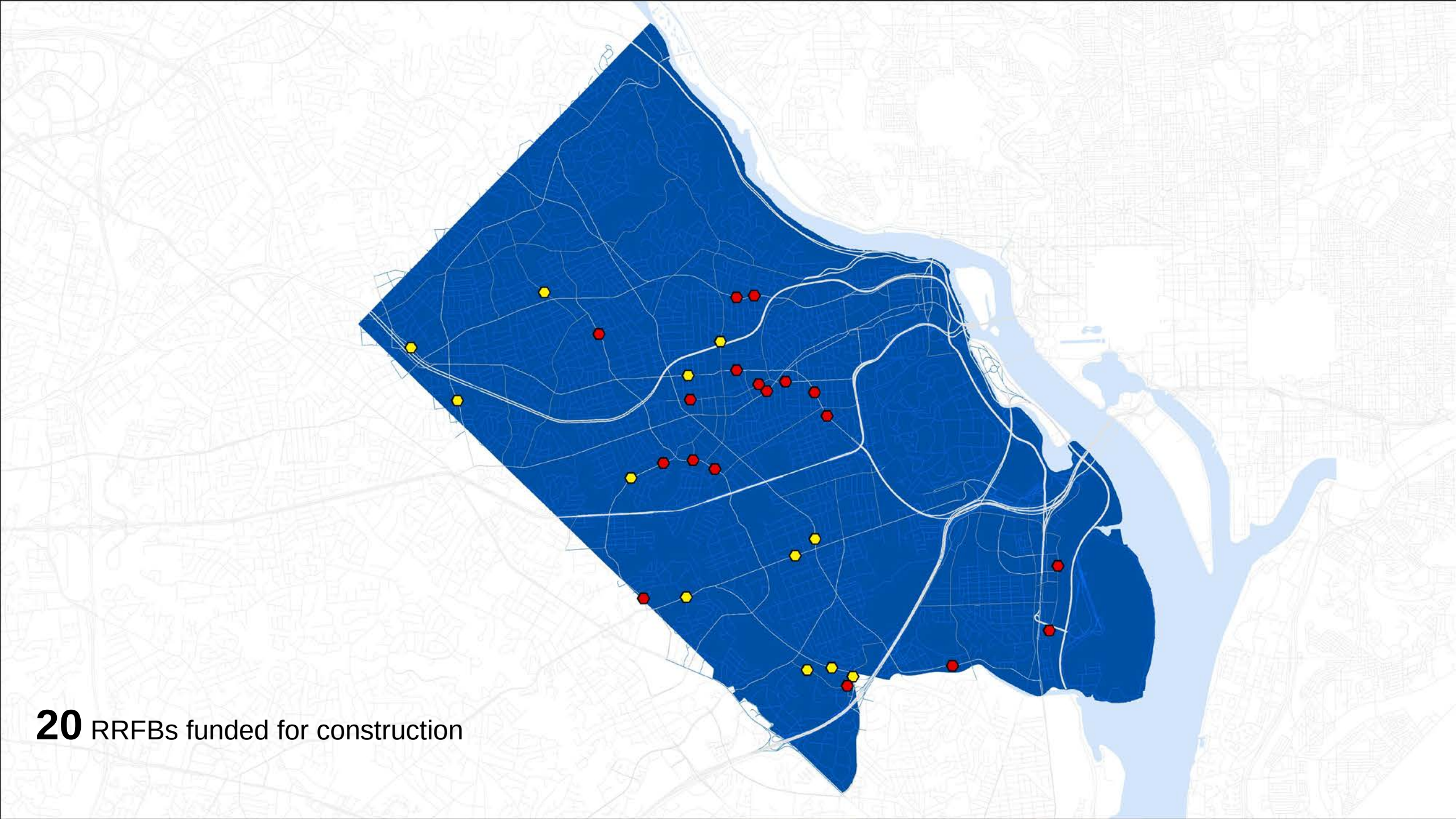
N Quincy St @ 15th St N

Lee Highway @ N Kenmore St

Columbia Pike @ s Oakland St

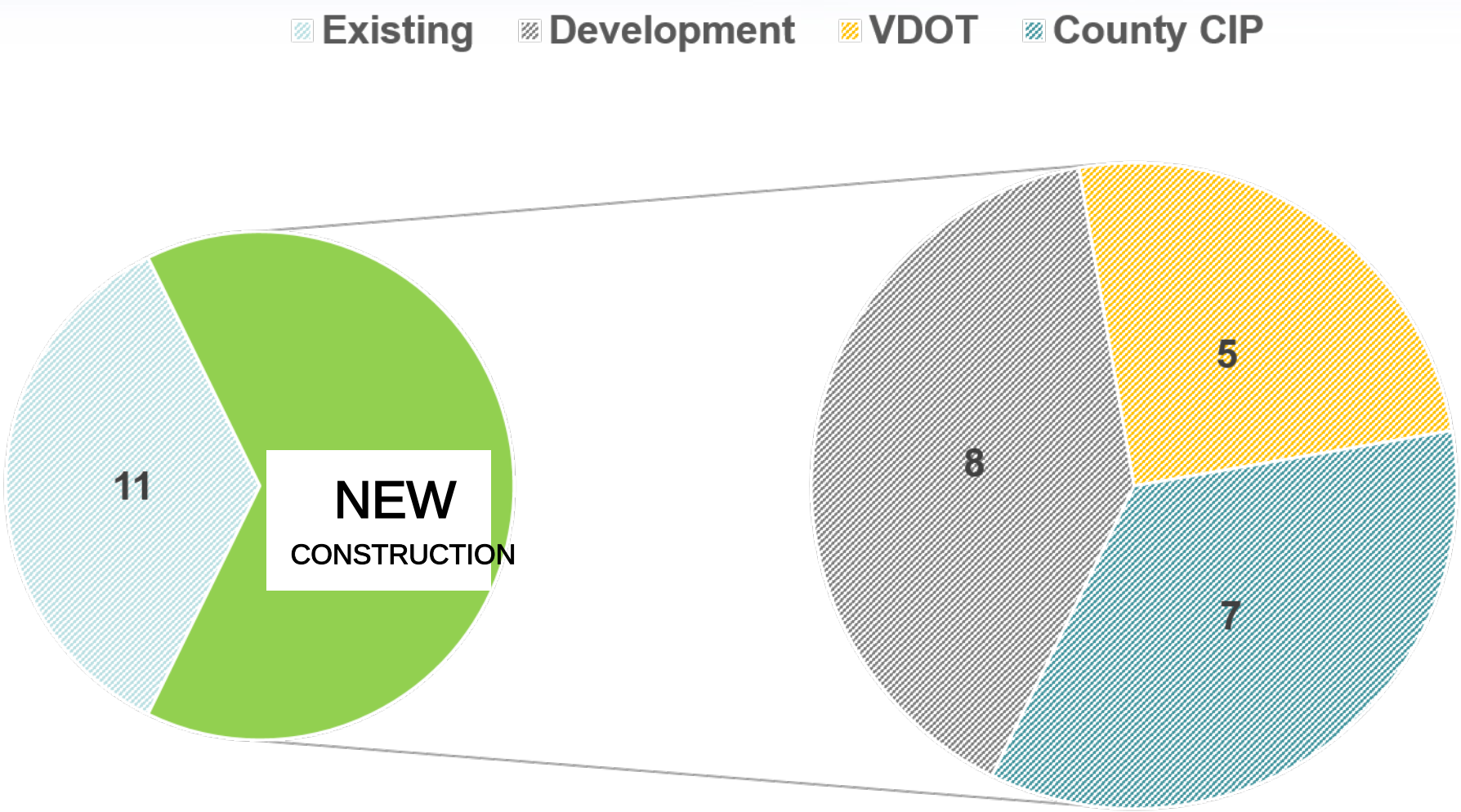
N Sycamore St @ 17th St N


N Harrison St
MIDBLOCK

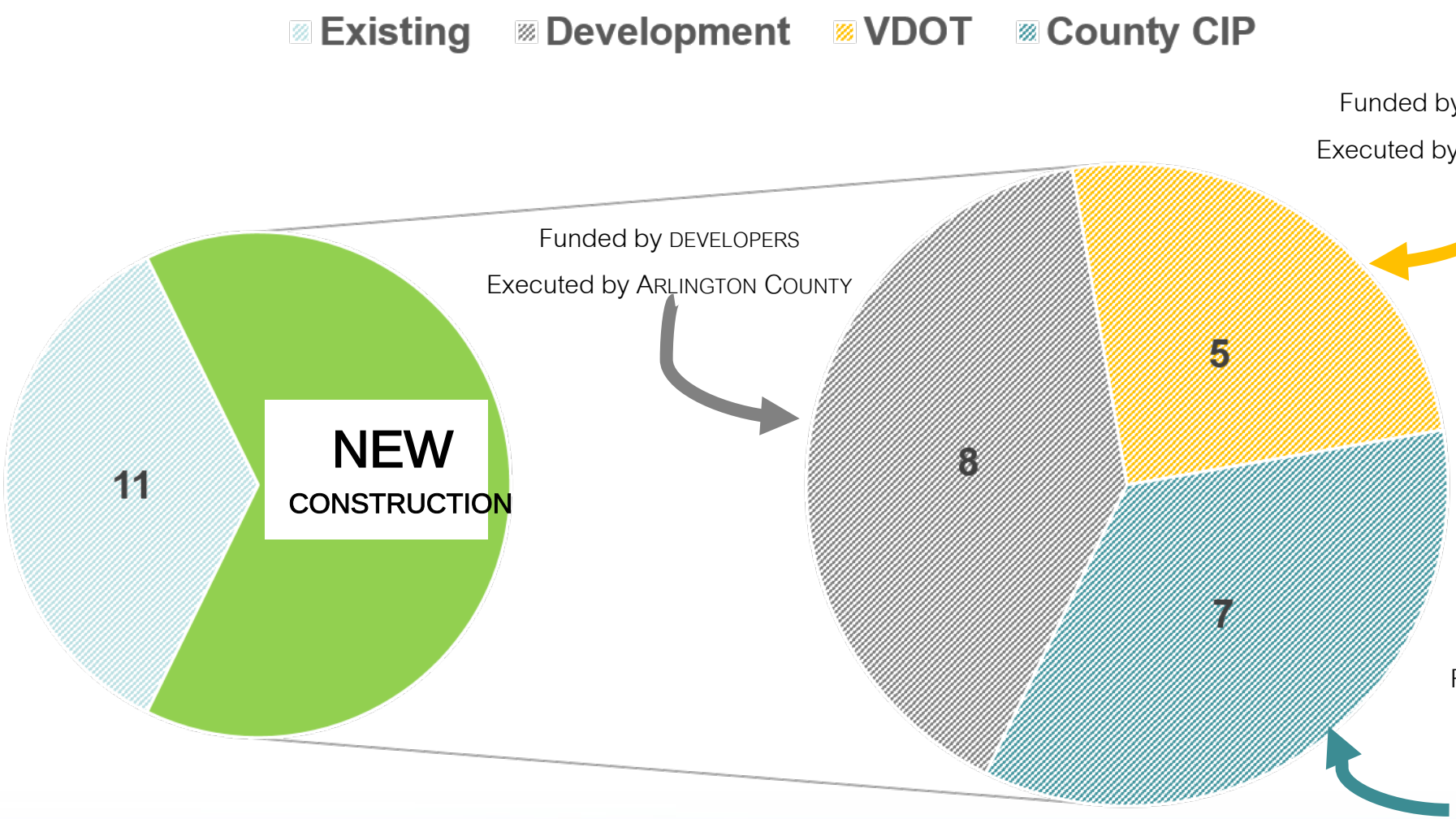


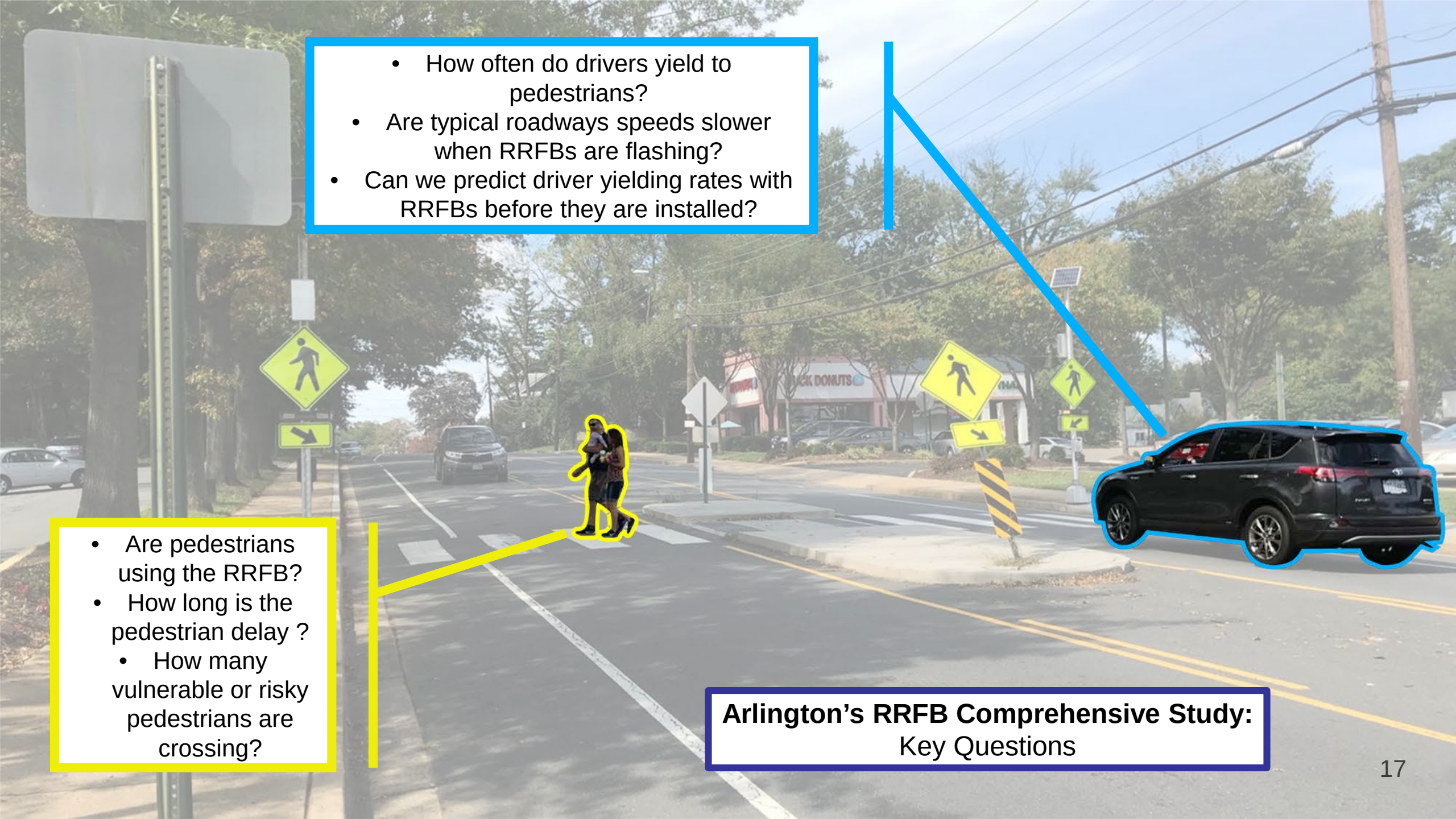
20 RRFBs funded for construction

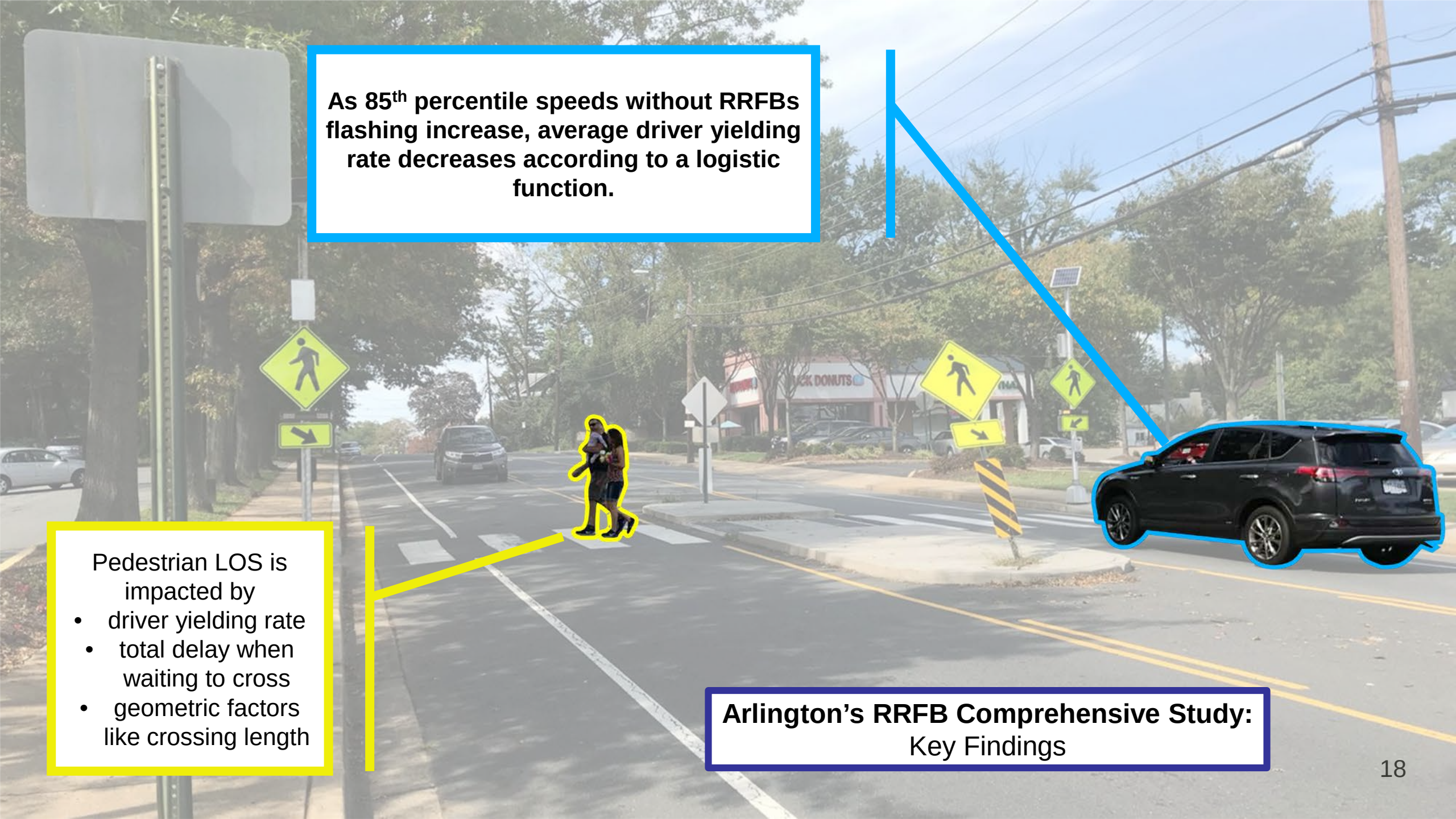
EXISTING AND PROPOSED RRFBS IN ARLINGTON COUNTY



EXISTING AND PROPOSED RRFBS IN ARLINGTON COUNTY




• How often do drivers yield to pedestrians?
• Are typical roadways speeds slower when RRFBs are flashing?
• Can we predict driver yielding rates with RRFBs before they are installed?
• Are pedestrians using the RRFB?
• How long is the pedestrian delay ?
• How many vulnerable or risky pedestrians are crossing?
Arlington's RRFB Comprehensive Study:
Key Questions

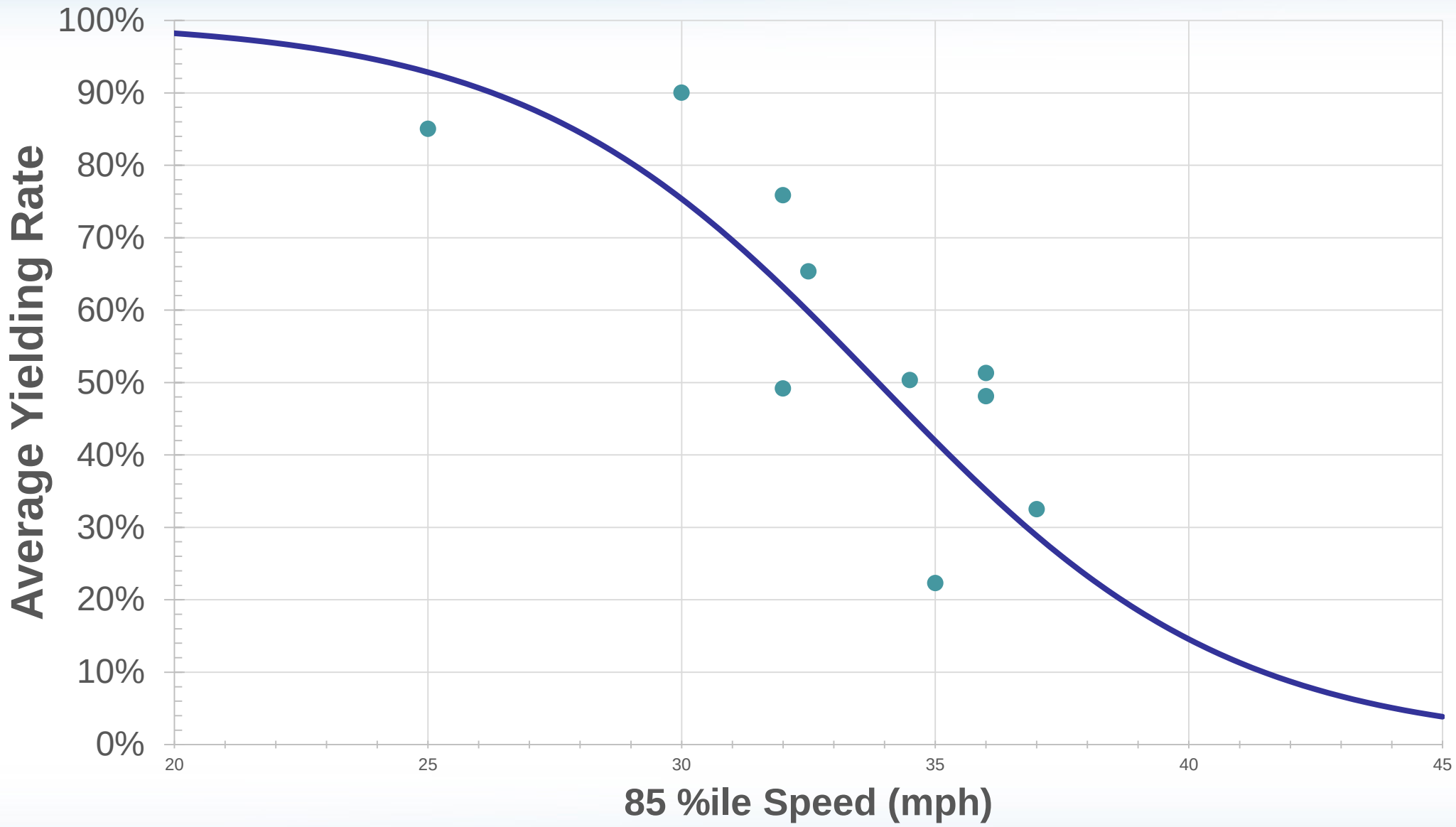


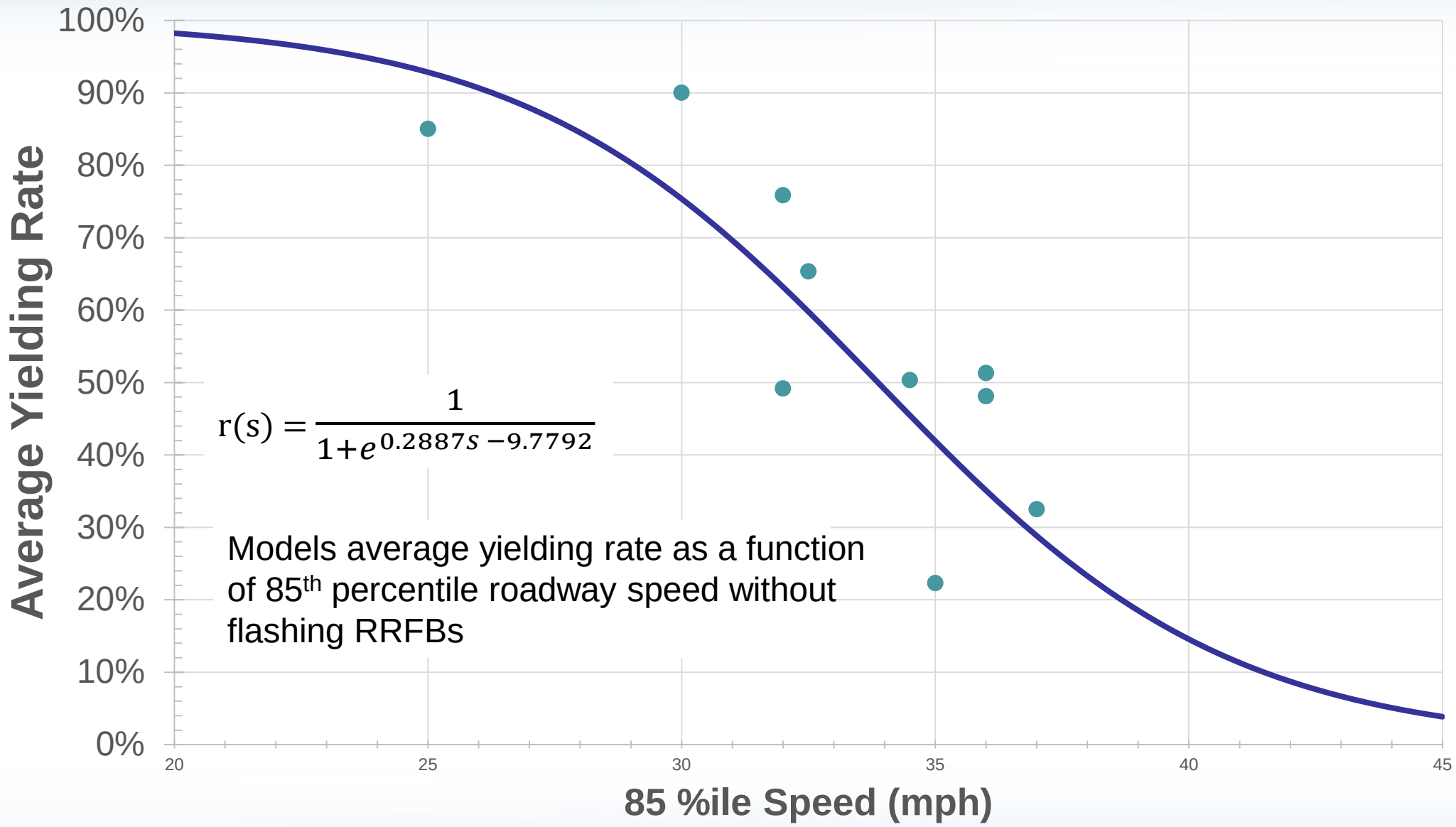
As 85th percentile speeds without RRFBs flashing increase, average driver yielding rate decreases according to a logistic function.

Pedestrian LOS is impacted by

- driver yielding rate
- total delay when waiting to cross
- geometric factors like crossing length

Arlington's RRFB Comprehensive Study:
Key Findings


Average Yielding Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
25
30
35
40
45
85 %ile Speed (mph)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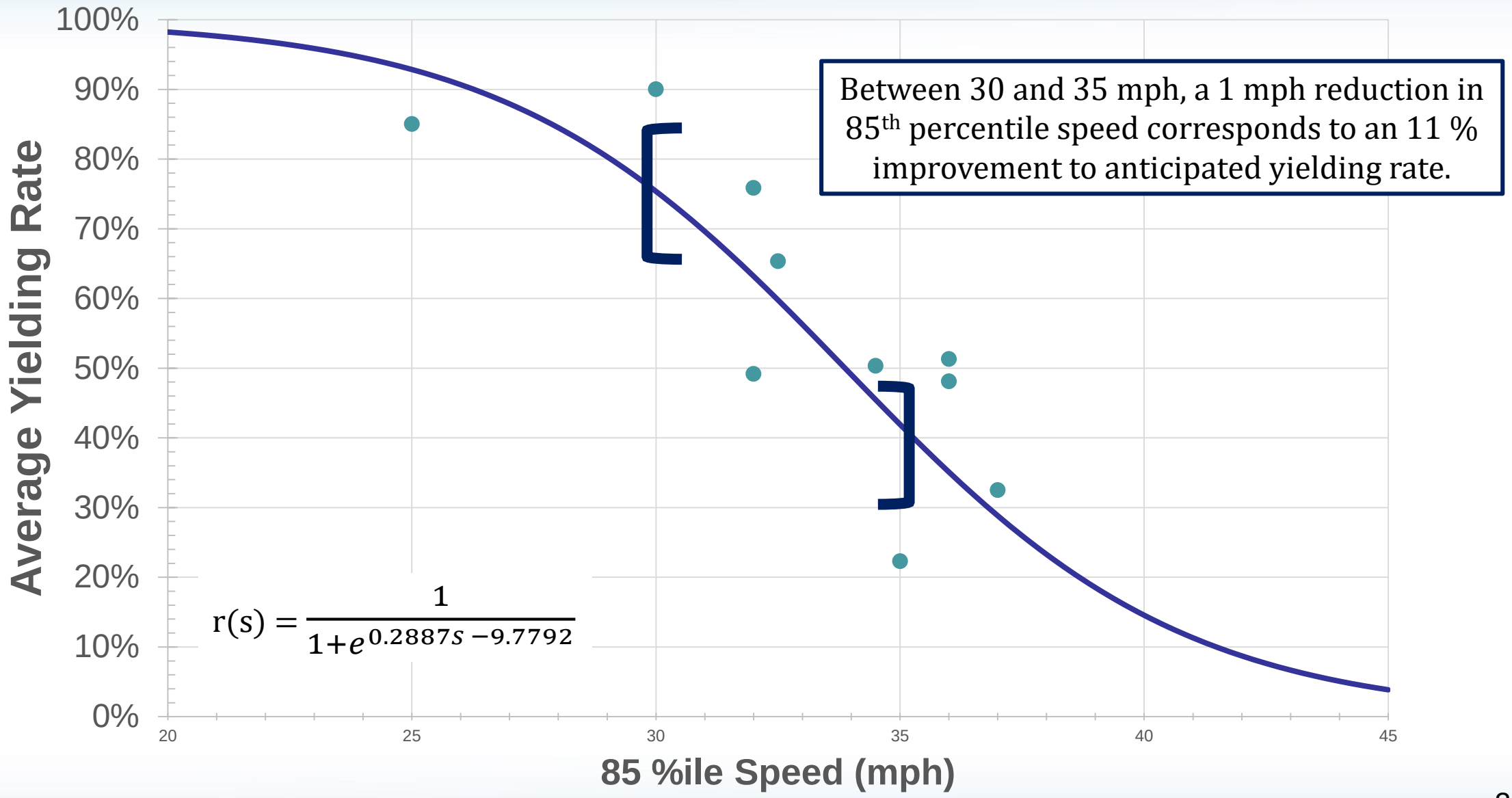
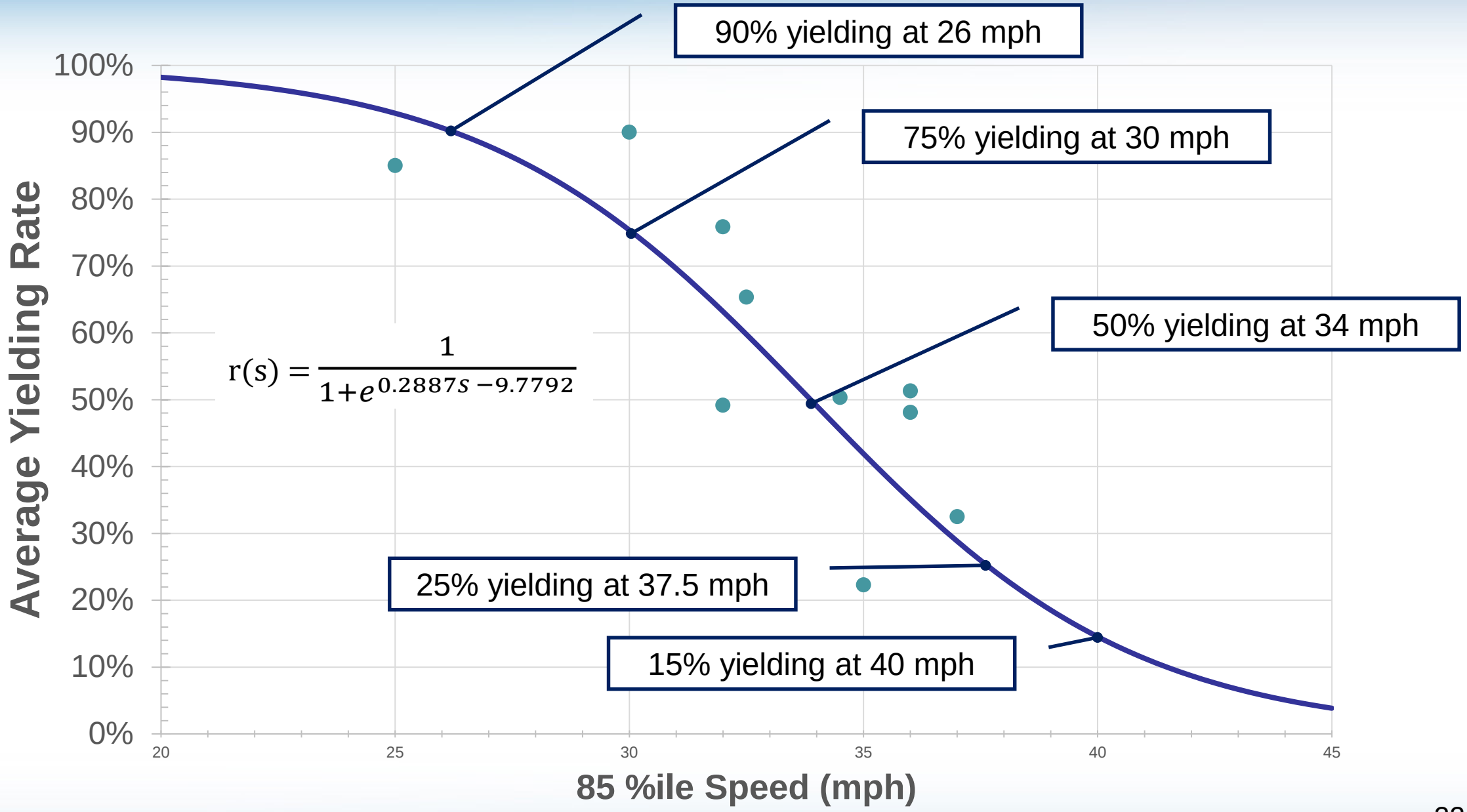
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
25
30
35
40
45
85 %ile Speed (mph)
$r(s) = \frac{1}{1+e^{0.2887s-9.7792}}$
Models average yielding rate as a function of 85th percentile roadway speed without flashing RRFBs


Average Yielding Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
25
30
35
40
45
85 %ile Speed (mph)
Between 30 and 35 mph, a 1 mph reduction in 85th percentile speed corresponds to an 11 % improvement to anticipated yielding rate.
$r(s) = \frac{1}{1+e^{0.2887s-9.7792}}$


90% yielding at 26 mph
75% yielding at 30 mph
50% yielding at 34 mph
25% yielding at 37.5 mph
15% yielding at 40 mph
$r(s) = \frac{1}{1+e^{0.2887s-9.7792}}$
Average Yielding Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
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40
45
85 %ile Speed (mph)

Overall Performance

15% reduction

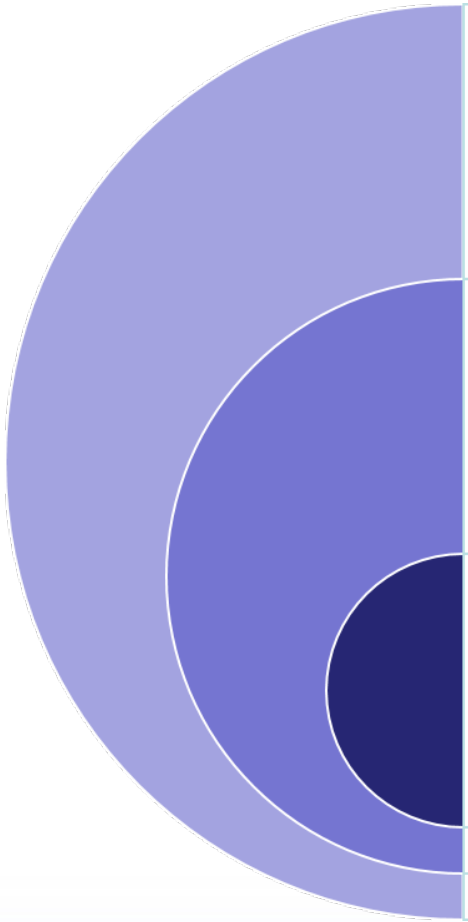
70% driver yielding
(110% increase)

Overall increase in use

Evaluate safety
performance

Best Practices for RRFBs

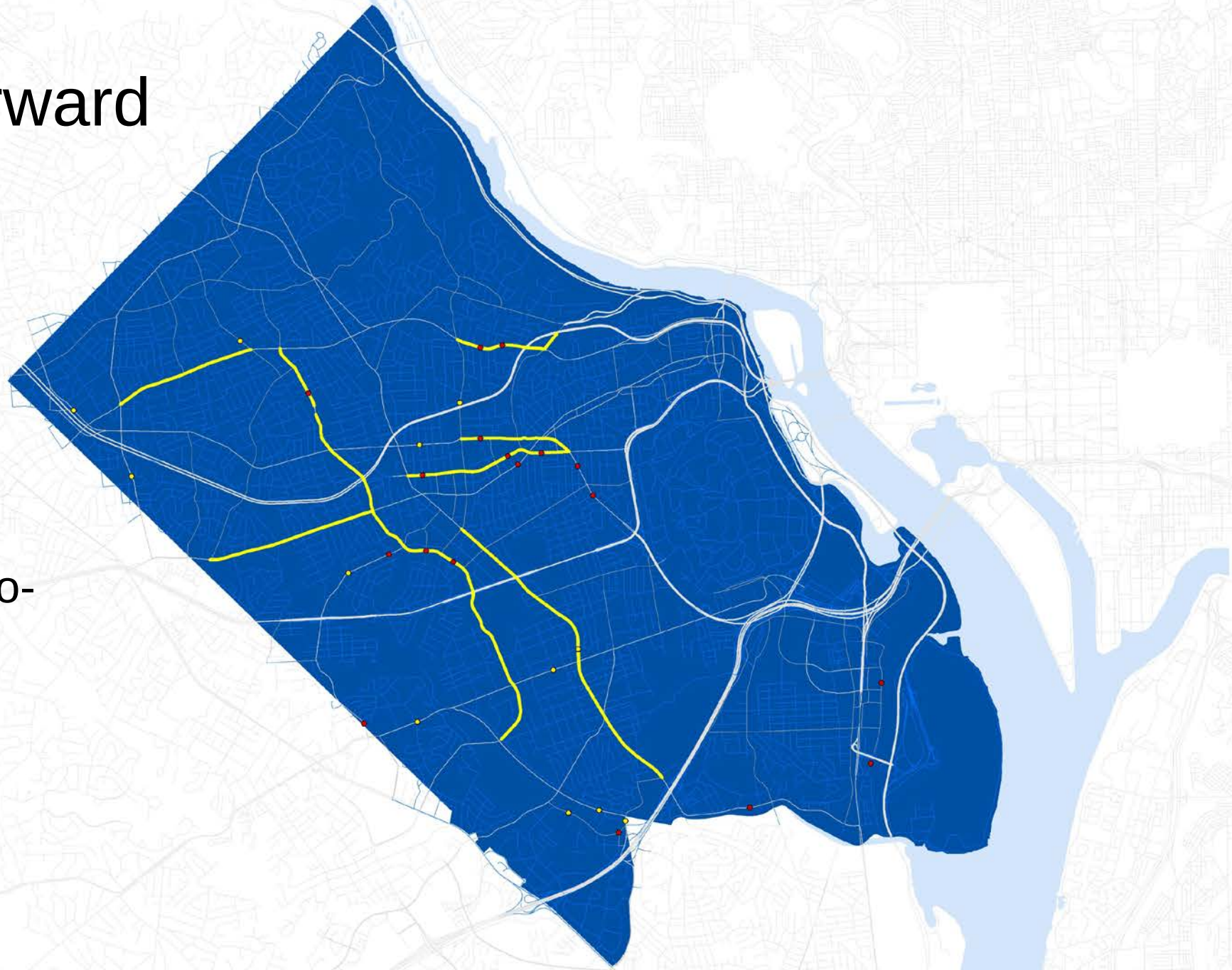
Finding:
15% yielding at 40 mph



Systemic	✓Screen out high-speed (>40 mph) locations from potential RRFBs
Corridor or Sector Planning	✓ Consider Complete Streets designs to reduce speed
Individual Project	✓Conduct before and after speed study ✓Consider speed-feedback signs, “slow” markings, and speed enforcement

Looking Forward

- Evaluate individual locations
- Determine if RRFBs are an appropriate measure for two-lane streets
- Continue implementation



Questions?

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To prioritize among RRFB projects

RECOMMENDED PRIORITY RATIO

$$\textbf{10,000 x } \frac{\text{Anticipated yield rate – “Before” yield rate}}{\text{Project Cost Estimate}}$$

Priority Ratio (Safety and Financial Cost and User Experience)

- Based on yield rate and project cost, so safety, user comfort, and financial cost are all reflected.
- Factor of 10,000 generally results in values from 0.1 to 1.0.

To compare to other proposed improvements

HSIP B/C RATIO (Safety and Financial Cost Only)

- Use a CMF of **0.526** (for “Install RRFB”) and crash history to predict crash reduction. Use your state or local best practice to convert this to a financial value.

HCM LOS (User Comfort Only)

- LOS will improve when driver yielding decreases, as it is a linear function of crossing delay (HCM method): cutting wait time by 50% improves LOS score by 50%.

Roadway Configuration	Roadway ADT & Posted Speed Limit											
	1,500 to 9,000 vpd			9,000 to 12,000 vpd			12,000 to 15,000 vpd			> 15,000 vpd		
	≤ 30 mph	35 mph	40 mph	≤ 30 mph	35 mph	40 mph	≤ 30 mph	35 mph	40 mph	≤ 30 mph	35 mph	40 mph
2 Lanes (two-way street)	A	B	C	A	B	C	A	B	C	B	C	E
2 Lanes (one-way street)	A	B	C	B	B	C	B	B	C	B	C	E
3 Lanes w/ raised median[1]	A	A	C	A	C	C/D	B	C	D/E	C	D/E	E
3 Lanes, no median	A	A	C/D	C	C	C/D	C	D	D/E	C	D/E	E
4 Lanes w/ raised median[1]	A	A	C/D	A	C	C/D	C	C	D/E	C/D/E	D/E	E
4 lanes, no median	A	C/D	C/D/E	C	C/D	D/E	C/D	E	E	E	E	E
5 Lanes w/ raised median[1]	A	A	C/D	A	C	C/D/E	C/D	C/D	E	C/D/E	E	E
5 lanes, no median	A	C/D	D/E	C	C/D	D/E	E	E	E	E	E	E
6 Lanes w/ raised median[1]	A	A	C/D	A	C	D/E	D/E	D/E	E	E	E	E
6 lanes, no median	A	D/E	D/E	C	D/E	D/E	E	E	E	E	E	E

[1] *The raised median or refuge island must be at least 6 feet wide to adequately serve as refuge area for pedestrians.*

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5 lanes, no median	A	C/D	D/E	C	C/D	D/E	E	E	E	E	E	E
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