Improving System Safety through Left-Turn Signal Operations

TexITE/ITS Texas Fall Meeting 2024

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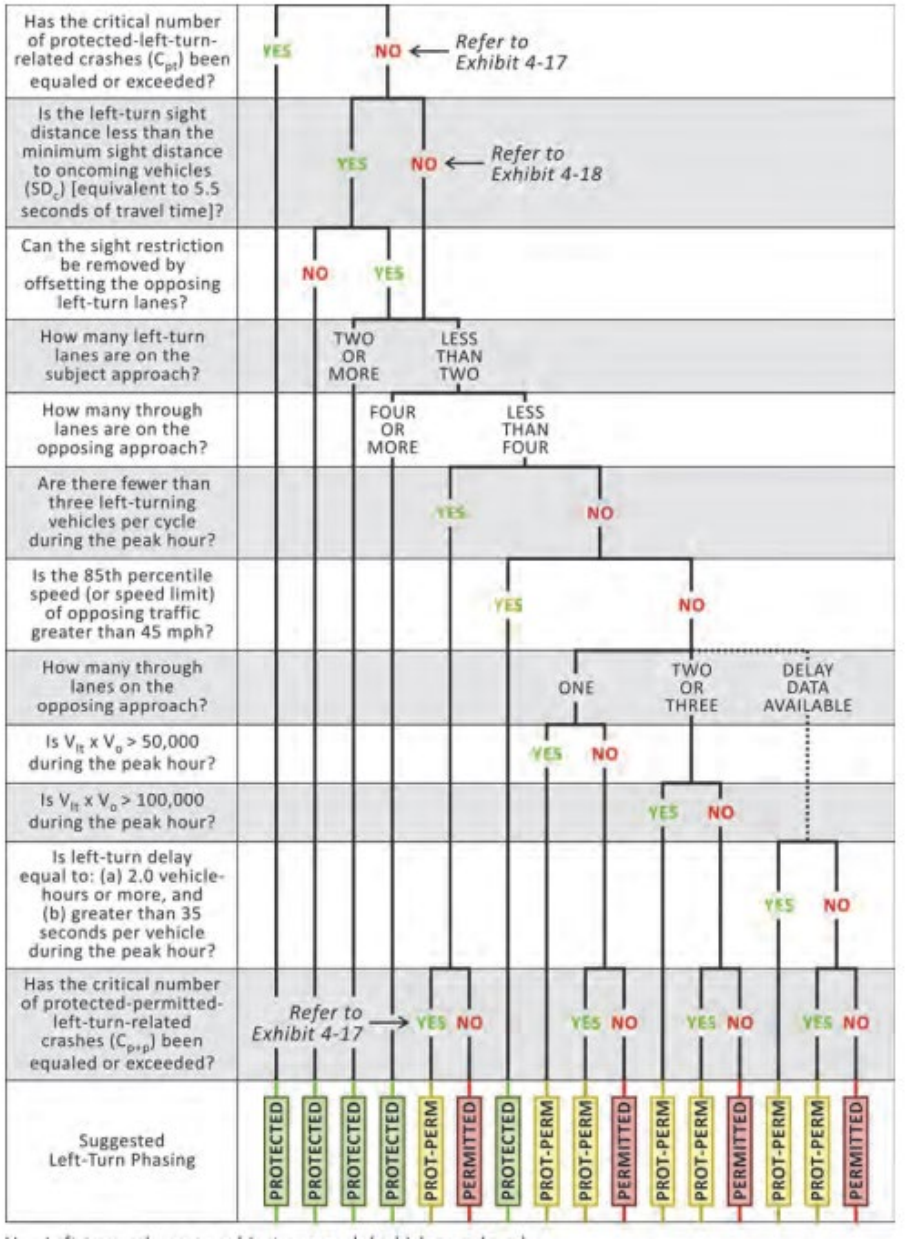
Current Left Turn Operations

- 171 fatal and serious injury crashes related to left turns in Austin from 2019-2023
- Most intersections protected-permissive by default
- Not initially evaluated for proper treatment
  - Often only consider vertical sight distance or very high speeds
- Often only evaluated after history of crashes

NCHRP 812 (FHWA Signal Timing Guide v2)

- Outlines evaluation process to recommend treatment

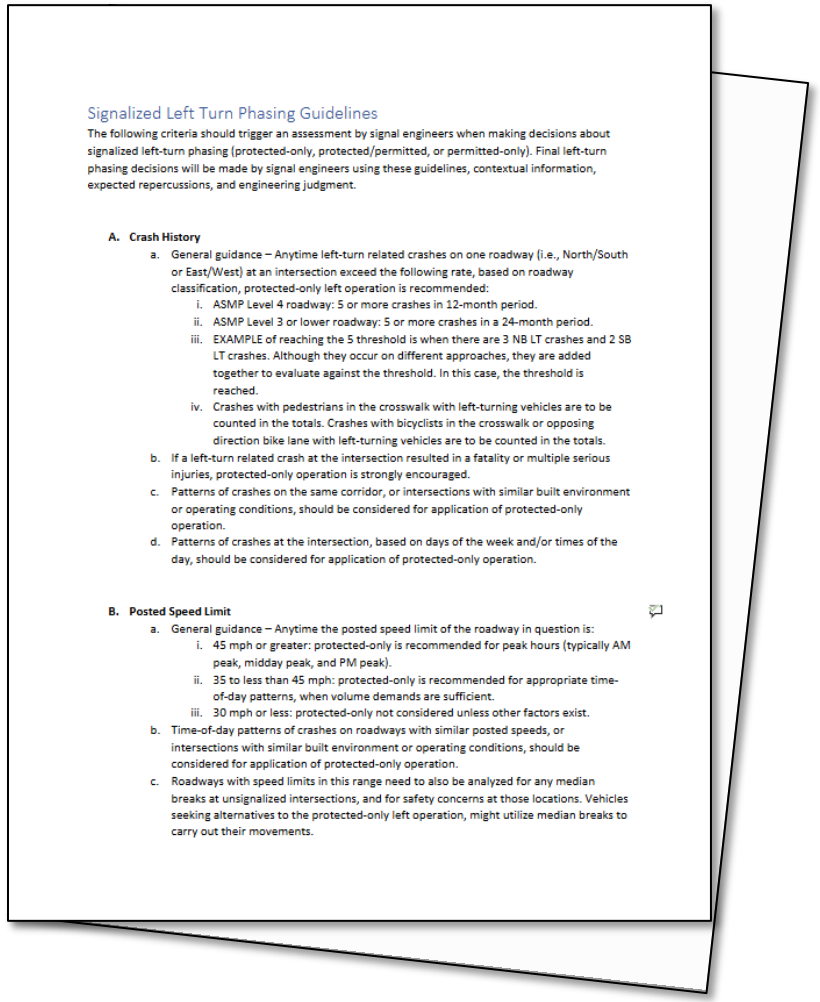
- Criteria include:
  - Crash History
  - Sight Distance
  - Speed
  - Volume
  - Laneage
  - Delay



NCHRP 812 Exhibit 4-16

Austin's New Left Turn Guidelines

- Goal to reduce crashes, especially fatal and serious injury
- Safe System approach
- Leaves room for engineering judgement



Signalized Left Turn Phasing Guidelines

The following criteria should trigger an assessment by signal engineers when making decisions about signalized left-turn phasing (protected-only, protected/permitted, or permitted-only). Final left-turn phasing decisions will be made by signal engineers using these guidelines, contextual information, expected repercussions, and engineering judgment.

A. Crash History

a. General guidance – Anytime left-turn related crashes on one roadway (i.e., North/South or East/West) at an intersection exceed the following rate, based on roadway classification, protected-only left operation is recommended:
   i. ASMP Level 4 roadway: 5 or more crashes in 12-month period.
   ii. ASMP Level 3 or lower roadway: 5 or more crashes in a 24-month period.
   iii. EXAMPLE of reaching the 5 threshold is when there are 3 NB LT crashes and 2 SB LT crashes. Although they occur on different approaches, they are added together to evaluate against the threshold. In this case, the threshold is reached.
   iv. Crashes with pedestrians in the crosswalk with left-turning vehicles are to be counted in the totals. Crashes with bicyclists in the crosswalk or opposing direction bike lane with left-turning vehicles are to be counted in the totals.
b. If a left-turn related crash at the intersection resulted in a fatality or multiple serious injuries, protected-only operation is strongly encouraged.
c. Patterns of crashes on the same corridor, or intersections with similar built environment or operating conditions, should be considered for application of protected-only operation.
d. Patterns of crashes at the intersection, based on days of the week and/or times of the day, should be considered for application of protected-only operation.

B. Posted Speed Limit

a. General guidance – Anytime the posted speed limit of the roadway in question is:
   i. 45 mph or greater: protected-only is recommended for peak hours (typically AM peak, midday peak, and PM peak).
   ii. 35 to less than 45 mph: protected-only is recommended for appropriate time-of-day patterns, when volume demands are sufficient.
   iii. 30 mph or less: protected-only not considered unless other factors exist.
b. Time-of-day patterns of crashes on roadways with similar posted speeds, or intersections with similar built environment or operating conditions, should be considered for application of protected-only operation.
c. Roadways with speed limits in this range need to also be analyzed for any median breaks at unsignalized intersections, and for safety concerns at those locations. Vehicles seeking alternatives to the protected-only left operation, might utilize median breaks to carry out their movements.

Austin's Left Turn Guideline Criteria

Crash History	• Crash thresholds by roadway class
Posted Speed Limit	• >40 mph highly recommend Prot-Only
Horizontal Sight Distance	• Interplay with crash history
Laneage	• 2+ LT lanes = Prot-Only • >2 opposing thru lanes = Prot-Only
Other	• Pedestrians, transit interactions • Skews, turn bay length

Evaluation Process

Data Entry	Analysts input stats for evaluation
Tool Output	Excel tool outputs findings for each category
Engineering Evaluation	Engineer evaluates and makes recommendation
Recommendation	P.E. uses tool output and guidelines
Review & Final Decision	Consultant staff Signal Engineers Vision Zero team
Track	Power BI

Evaluation Process – Evaluation Tool

D	E	F	G	H	J	K	L	N	O	P	Q	R
Signal	Movemer	Intersection Name	Road Name	Current Treatment	Step 2 Criteria Met (Speed & Lane Geometry)	Step 3 Criteria Met (Crash)	3 or More Overnigh Crashes?	Assessment Result	Q	Recommendati	Final Decisic	Implementati on Status
597	EBL	RUNDBERG LN / 35 SVRD	E Rundberg Ln	Protected-Permissive	TOD	No	No	TOD	TH	No Change		
610	NBL	LAMAR BLVD / LONGSPUR BLVD	N Lamar Blvd	Protected-Only (Always)	No	No	No	Protected-Only	TH	No Change	No Change	Implemented
610	SBL	LAMAR BLVD / LONGSPUR BLVD	N Lamar Blvd	Protected-Permissive	TOD	Yes	No	Protected-Only	TH	Protected-Only	TOD	Implemented
610	WBL	LAMAR BLVD / LONGSPUR BLVD	Longspur Blvd	Protected-Permissive	No	No	No	Protected-Permissive	TH	No Change	No Change	Implemented
610	EBL	LAMAR BLVD / LONGSPUR BLVD	Longspur Blvd	Protected-Permissive	No	No	No	Protected-Permissive	TH	No Change	No Change	Implemented
777	NBL	RUNDBERG LN / MIDDLE FISKVILLE RD	Middle Fiskville Rd	Permissive-Only	No	No	No	Permissive-Only	TH	No Change	No Change	Implemented
777	SBL	RUNDBERG LN / MIDDLE FISKVILLE RD	Middle Fiskville Rd	Permissive-Only	No	No	No	Permissive-Only	TH	No Change	No Change	Implemented
777	WBL	RUNDBERG LN / MIDDLE FISKVILLE RD	Rungberg Ln	Protected-Permissive	TOD	Yes	No	Protected-Only	TH	Protected-Only	TOD	Implemented
777	EBL	RUNDBERG LN / MIDDLE FISKVILLE RD	Rungberg Ln	Protected-Permissive	TOD	Yes	No	Protected-Only	TH	Protected-Only	TOD	Implemented
1025	SBL	LAMAR BLVD / POWELL LN	N Lamar Blvd	Permissive-Only	Yes	No	No	Protected-Only	TH	Protected-Only	Protected-Only	Implemented
1025	NBL	LAMAR BLVD / POWELL LN	N Lamar Blvd	Protected-Only (Always)	No	No	No	Protected-Only	TH	No Change	No Change	Implemented
1025	WBL	LAMAR BLVD / POWELL LN	Powell Ln	Protected-Only (Always)	No	No	No	Protected-Only	TH	No Change	No Change	Implemented
1054	NBL	LAMAR BLVD / FAIRFIELD DR	N Lamar Blvd	Protected-Permissive	TOD	No	No	TOD	TH	TOD	TOD	Implemented
1054	SBL	LAMAR BLVD / FAIRFIELD DR	N Lamar Blvd	Protected-Permissive	TOD	No	No	TOD	TH	TOD	TOD	Implemented
1054	WBL	LAMAR BLVD / FAIRFIELD DR	Farifield Dr	Permissive-Only	No	No	No	Permissive-Only	TH	No Change	No Change	Implemented
1054	EBL	LAMAR BLVD / FAIRFIELD DR	Farifield Dr	Protected-Permissive	No	No	No	Protected-Permissive	TH	No Change	No Change	Implemented
1055	NBL	LAMAR BLVD / GRADY DR	N Lamar Blvd	Protected-Permissive	TOD	No	No	TOD	TH	TOD	TOD	Implemented
1055	SBL	LAMAR BLVD / GRADY DR	N Lamar Blvd	Protected-Permissive	TOD	No	No	TOD	TH	TOD	TOD	Implemented
1055	WBL	LAMAR BLVD / GRADY DR	W Grady Dr	Protected-Permissive	No	No	No	Protected-Permissive	TH	No Change	No Change	Implemented
1055	EBL	LAMAR BLVD / GRADY DR	W Grady Dr	Protected-Permissive	No	No	No	Protected-Permissive	TH	No Change	No Change	Implemented

Evaluation Tracking

Austin Left-Turn Treatment Evaluation

AUSTIN TRANSPORTATION | MOBILITY MANAGEMENT CENTER | Kimley»Horn

11/10/2024 12:03:56...
Date Last Refreshed

Signal ID: All

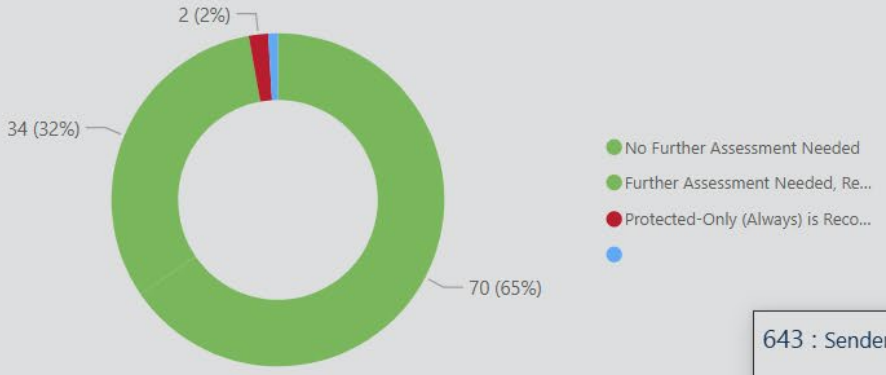
Batch: 19

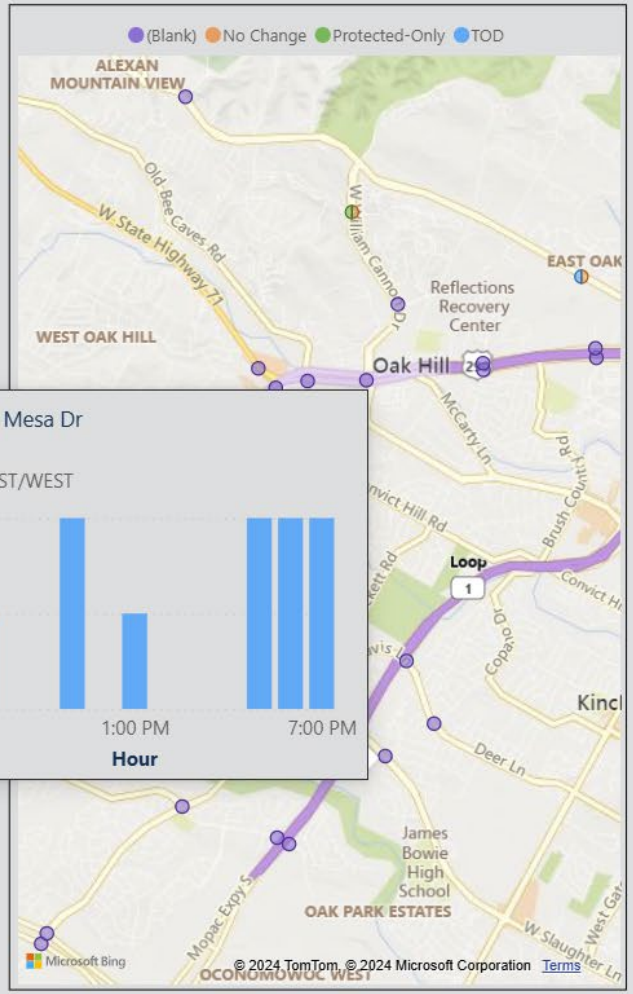
Name: All

Current Treatment: All

Next Step?: All

of Movements by Status





Signal ID	Movement	Road Name	ASMP Level	Next Step?	Directional Left Turn Crashes: Fatal	Directional Left Turn Crashes: Serious Injury	Directional Left Turn Crashes: 12-Month Max	Directional Left Turn Crashes: 24-Month Max	Dir Le Turn Crashe 24 Mo - 6-9 WEEK
1016	NBL	Escarpment Blvd		No Further Assessment Needed	0	0	2	2	
1016	SBL	Escarpment Blvd		No Further Assessment Needed	0	0	2	2	0
1069	EBL	US 290 HWY			0	0	0	0	0
75	EBL	Us 290 HW	4	Further Assessment Needed, Review Crash Data to Identify Crash Time of Day/Day of Week	0	0	0	0	0

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Implementation

- Quickly implement at FYA locations
- Many require minor signal upgrades
- Created check-list
  - Triple check for omits in each plan
  - Observe every peak and plan to verify good operation

Evaluation Process – Early Findings

- Main drivers were:
  - Crash history
  - Geometry
  - Speed

- Considered corridors for consistency
  - Pro-actively prevent similar crashes at nearby intersections
  - Evaluate in batches based on retiming zones/corridors

Project Status

- Evaluated: 624 intersections, 2295 movements
- Total Intersections with new protections implemented: 148
- Evaluation results so far (by movement):
  - 85% No Change
  - 8% Prot-Only
  - 7% TOD
- Generally, average number of post implementation SRs has decreased as we've implemented better

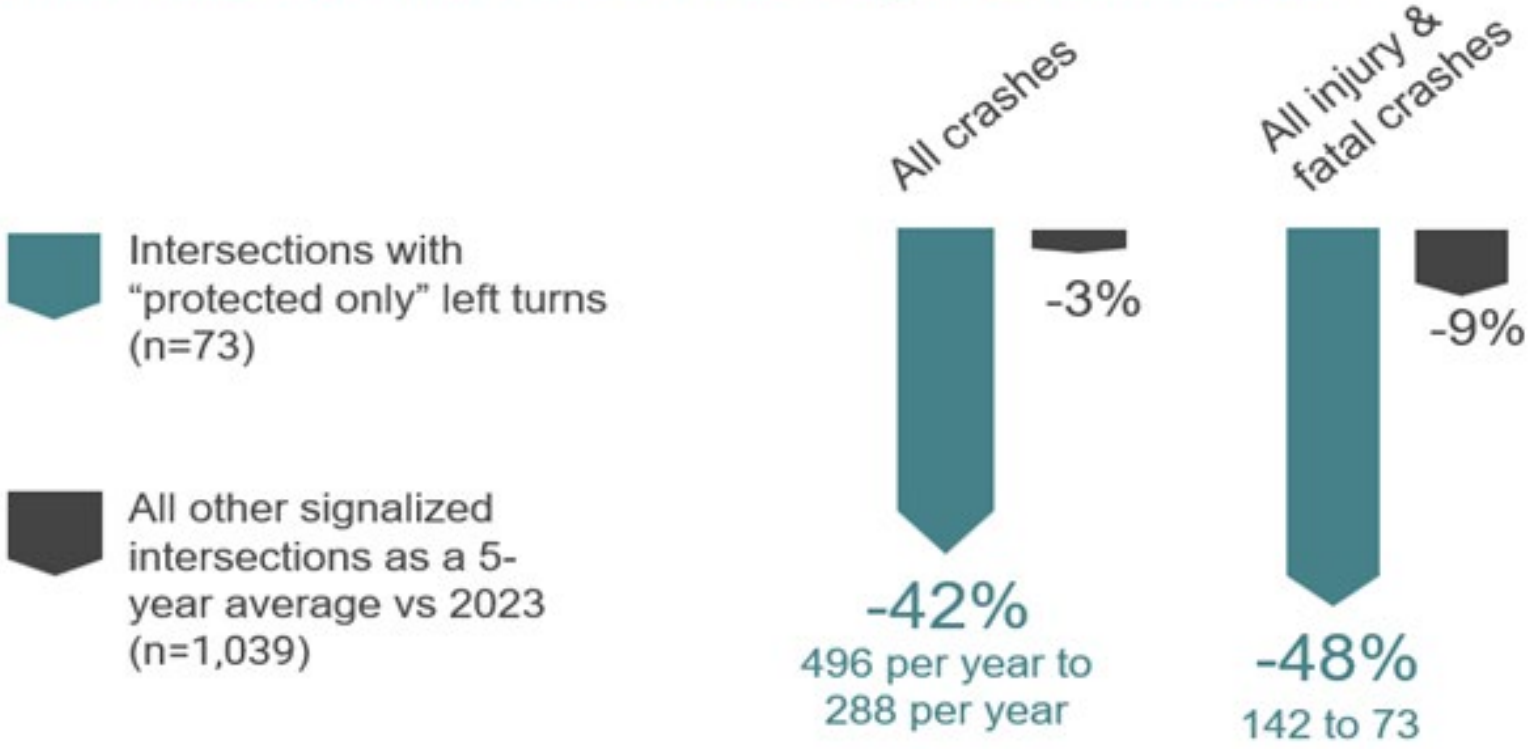
Lessons Learned

- May require extensive retiming
  - Implement in corridors or zones for easy of implementation and retiming
  - Consider 'innovative' operations like half-cycling, double-service
- Detection Checks ahead of time to resolve inefficiencies
- Be ready to explain why to the public

Safety Improvements – Promising Early Results

"Protected Only" Left Turns: Annualized Crash Reductions

Treatment intersections versus all other signalized intersections



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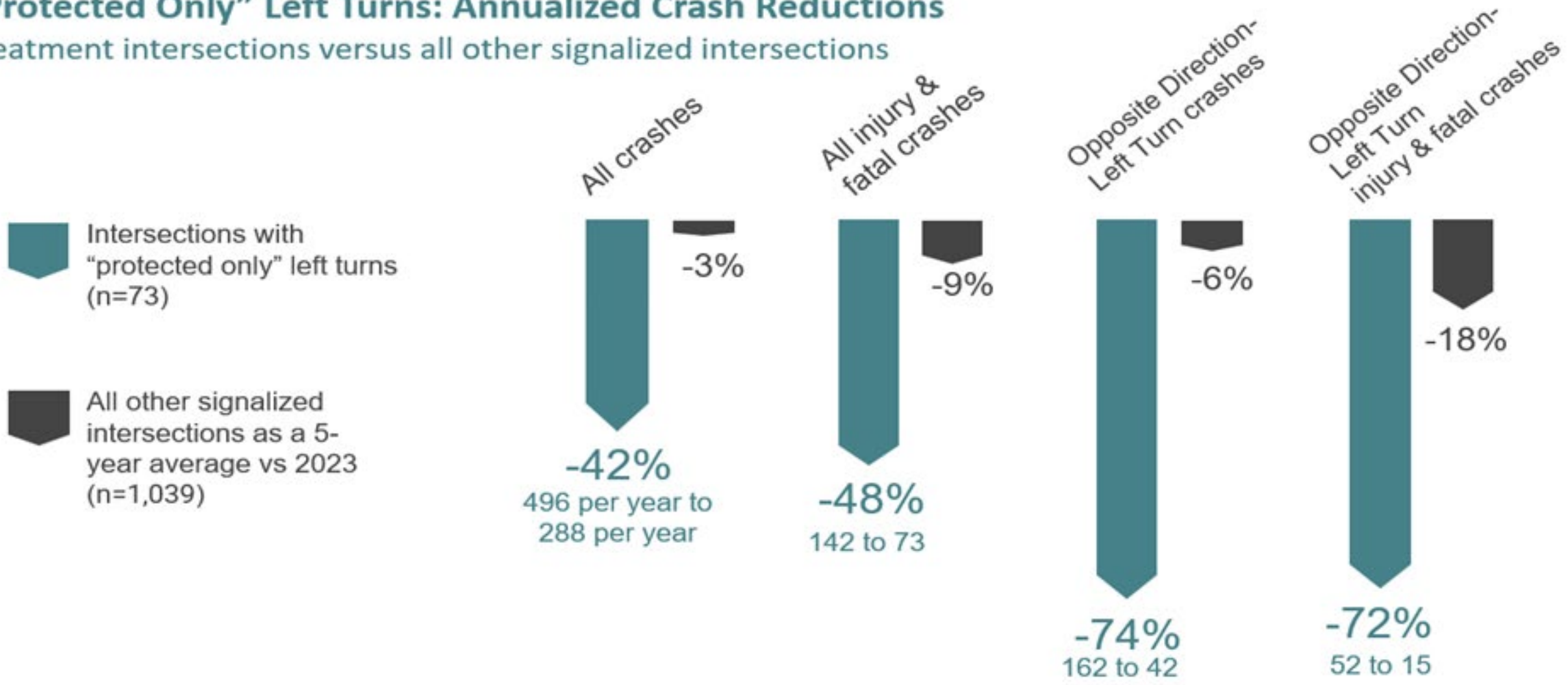
Safety Improvements – Promising Early Results

"Protected Only" Left Turns: Annualized Crash Reductions

Treatment intersections versus all other signalized intersections




Opposing Left-Through Conflicts - BEFORE
NB Left - SB Through
43 Events - BEFORE
5 Events - AFTER
SB Left - NB Through
27 Events - BEFORE
2 Events - AFTER
EB Left - WB Through
12 Events - BEFORE
3 Events - AFTER
WB Left - EB Through
1 Event - BEFORE
12 Events - AFTER
Opposing Left-Through Conflicts - AFTER

Next Steps

- Continue evaluation and implementation
  - 1-2 batches per month or as needed for priority locations
  - Meet biweekly to review findings
- Evaluate overall delay impacts using INRIX Signal Analytics
- Larger scale crash rate evaluation

Recommendations

- Consider adopting or adapting left turn treatment guidance
- Make an evaluation and implementation plan
- Find champions in leadership to help advocate
- Go help make our intersections safer!

Thanks!

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