



## Technical Memorandum

**To:** Debra Heiser, P.E., City of St. Louis Park  
**From:** Bryant Ficek, P.E., P.T.O.E.  
Jonah Finkelstein, E.I.T.  
**Date:** April 22, 2016  
**Re:** Flashing Yellow Arrow (FYA) Recommendations

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### Purpose of Report and Study Objectives

The City of St. Louis Park has partnered with Spack Consulting to retime 15 existing traffic signals throughout the city in 2016. One component of the signal retiming is the review and recommendation, of the 15 selected traffic signals, for Flashing Yellow Arrow (FYA) operation. The purpose of this memorandum is to determine which of the 15 signals is a candidate for FYA operation and to document the process used for selection.

### Conclusions and Recommendations

Based on the seven-point FYA analysis, the proposed signals were categorized into four tiers of potential benefit due to the installation of flashing yellow arrow. The categories are:

1. High Benefit: Signals with an immediate benefit from running FYA.
2. Medium Benefit: Signals with some immediate and more future benefit from running FYA.
3. Low Benefit: Signals with little immediate and future benefit from running FYA.
4. FYA Not Warranted: Signals not warranted to operate FYA due to lane geometrics.

It is recommended that the City of St. Louis Park focuses on the high and medium benefit signals for FYA operation as they will result in the most immediate benefit by decreasing intersection delay. The installation of FYA will also prepare the signal for changes in left turn operation due to future growth and changes in traffic volumes helping the city facilitate safe and efficient flow as St. Louis Park grows.

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## Flashing Yellow Arrow Benefits

Flashing Yellow Arrow (FYA) signal heads allow flexibility in left turn operation with the ability to change the left turn phasing from permissive, to protected/permissive, to protected only phasing. This flexibility gives traffic engineers the ability to operate left turn phasing differently throughout the day, switching from permissive operation during low traffic periods, to protected/permissive or protected only operation during peak hour periods of the day, where permissive only operation would not facilitate safe and proper traffic flow. FYAs are also proven to be safer than standard protected/permissive signals with drivers understanding the phasing and operation more clearly, leading to less left-turn and opposing thru vehicle conflicts. This flexibility in operation and increased safety, makes FYAs a very powerful and efficient tool to use in signal timing, decreasing overall delay and increasing driver safety.

## Project Intersections

The City of St. Louis Park selected 15 signals for retiming and FYA review. These signals include:

1. 16<sup>th</sup> Street and Zarthan Avenue.
2. 16<sup>th</sup> Street and Park Place Plaza.
3. 36<sup>th</sup> Street and Belt Line Boulevard.
4. 36<sup>th</sup> Street and Highway 100 Northbound Ramps.
5. 36<sup>th</sup> Street and Park Center Boulevard.
6. Cedar Lake Road and Nevada Avenue.
7. Cedar Lake Road and Texas Avenue.
8. Cedar Lake Road and Zarthan Avenue.
9. Cedar Lake Road and Park Place Boulevard.
10. Louisiana Avenue and Oxford Street.
11. Louisiana Avenue and Louisiana circle.
12. Park Center Boulevard and Highway 100 Northbound Onramp.
13. Park Center Boulevard and Target Entrance (already operates FYA on north and south approach).
14. Shelard Parkway and Ford Road.
15. Texas Avenue and 33<sup>rd</sup> Street.

## FYA Selection Criteria

Seven separate analysis points were used to determine an intersection and approach's candidacy for FYA operation. The criteria points were drawn from MnDOT's *Traffic Signal Timing and Coordination Course Manual* Section 4.10 Flashing Yellow Arrow Operation. These criteria were:

1. Is there a shared left turn lane?
2. Do the opposing left turn paths overlap?
3. Is adequate sight distance achieved?
4. Is the cross-product of left turns and opposing thru traffic greater than 80,000 vph (100,000 if 2 opposing lanes)?
5. Is the speed limit greater than 45 MPH?
6. Does the left turn face three or more opposing lanes?
7. Does the left turn have 2 or more lanes?

Using these points as an initial check list, all approaches, at every intersection, were analyzed to determine if FYA operation could be operated at the intersection, and the potential benefit it would bring.

The first criteria point determines if a FYA can be installed on the corresponding approach. If a shared thru-left lane is present, FYA is not an operational choice for approach and cannot be installed. Criteria points two and three determine if an approach can run any operation other than protected left turns. If an approach's left turn path overlaps with the opposing left turn's, or there is inadequate sight distance, the signal must operate the turn protected only throughout the day. This removes a significant amount of the benefit of installing FYA as the signal will only be operating protected and not utilize the phasing flexibility of the FYA signal head. The following four points, four through seven, help determine conditions that may require protected only operation for some time periods of the day, depending on the volume, speed, and layout of the intersection under analysis. These points, if answered yes, suggest that protected only operation is suggested during time periods of higher volume, determined by engineering judgement.

Each study intersection's seven-point analysis can be seen in the attached appendix.

### **FYA Recommendations and Classifications**

Using the seven criteria points for FYA operation, the signals were split into four categories:

1. **High Benefit:** Signals that are currently running protected only and can operate as permissive of protected/permissive, based on volume, during certain periods of the day. These are signals where an immediate benefit would occur.
2. **Medium Benefit:** Signals that are running protected/permissive and can operate permissive only during certain time periods of the day. These are signals that also may need to run protected only in the future, as traffic volume increases with time. These signals would have some immediate benefit and the potential for more future benefit when protected operation becomes necessary due to traffic volumes.
3. **Low Benefit:** Signals that are running permissive only left turns with low volumes or signals running with protected only volume for most of the day. These signals would see little immediate benefit as the traffic volume either does not warrant left turn phasing or exceeds protected left turn phasing operation volumes for a significant amount of the day.
4. **FYA Not Warranted:** Signals with shared thru-lefts, overlapping left turn paths, or inadequate sight distance, that are not eligible for any operation other than protected left turns.

The 15 signals were categorized as follows:

1. High Benefit Signals:
  - a. 16<sup>th</sup> Street and Park Place Plaza.
  - b. 36<sup>th</sup> Street and Highway 100 Northbound Ramps.
  - c. 36<sup>th</sup> Street and Park Center Boulevard.
  - d. Cedar Lake Road and Park Place Boulevard.

- e. Shelard Parkway and Ford Road.
- 2. Medium Benefit Signals:
  - a. 16<sup>th</sup> Street and Zarthan Avenue.
  - b. 36<sup>th</sup> Street and Belt Line Boulevard.
  - c. Cedar Lake Road and Texas Avenue.
  - d. Cedar Lake Road and Zarthan Avenue.
- 3. Low Benefit Signals:
  - a. Louisiana Avenue and Oxford Street.
  - b. Louisiana Avenue and Louisiana circle.
  - c. Park Center Boulevard and Highway 100 Northbound On-ramp.
- 4. FYA Not Warranted Signals
  - a. Cedar Lake Road and Nevada Avenue.
  - b. Park Center Boulevard and Target Entrance (already operates FYA on north and south approach).
  - c. Texas Avenue and 33<sup>rd</sup> Street.

Table 1, below, summarizes the approaches where FYA would supply the most benefit.

**Table 1: Installation of FYA by Approach**

Intersection		Install FYA on Approach?			
Mainline	Cross Street	NB	SB	EB	WB
16th Street	Zarthan Avenue				X
16th Street	Park Place Plaza	X	X		
36th Street	Belt line			X	
36th Street	Hwy 100 NB				X
36th Street	Park Center			X	X
Cedar Lake Road	Nevada Avenue				
Cedar Lake Road	Texas Avenue			X	
Cedar Lake Road	Zarthan Avenue			X	X
Cedar Lake Road	Park Place Boulevard			X	X
Louisiana Avenue	Oxford Street	X	X		
Louisiana Avenue	Louisiana Circle	X	X		
Park Center Boulevard	Hwy 100 Ramp	X			
Park Center Boulevard	Target Entrance				
Shelard Parkway	Ford Road			X	X
Texas Avenue	33rd Street				

	- High Benefit Signal
	- Medium Benefit Signal
	- Low Benefit Signal
	- FYA Not Warranted

## Appendix A - FYA Analysis

Intersection: 1 - 16th St & Zarthan Ave  
 Mainline: West 16th Street  
 Cross Street: Zarthan Avenue

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbound (No Left Turn)

Approach: Northbound (No opposing approach)

## Appendix A - FYA Analysis

Intersection: 2 - 16th Street & Park Place Plaza

Mainline: West 16th Street

Cross Street: Park Place Plaza

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	<b>Cross Product:</b> (Volume over within this period as well) 11:30AM - 1:45PM 3:45PM - 7:30PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	<b>Volume:</b> 10:30AM - 9:00PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	YES	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	YES	

## Appendix A - FYA Analysis

Intersection: 3 - 36th St & Highway 100 NB  
 Mainline: 36th Street  
 Cross Street: Highway 100 NB  
 Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	YES	<b>Cross Product:</b> (Volume over within this period as well) 7:00AM - 8:30PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbund (No Left Turn Lane)

Approach: Northbound (No Opposing Through Approach)

## Appendix A - FYA Analysis

Intersection: 4 - 36th Street & Park Center Blvd  
 Mainline: 36th Street  
 Cross Street: Park Center Blvd

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	YES	Not eligible for FYA
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	YES	Not eligible for FYA
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	Cross Product: 5:00PM-6:00PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	Cross Product: (Prot/Pm or above from 11:15AM-7:30PM) 12:00PM-1:30PM 3:15pm-7:00PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	



## Appendix A - FYA Analysis

Intersection: 5 - Cedar Lake Road & Nevada Avenue S  
 Mainline: Cedar Lake Road  
 Cross Street: Nevada Avenue S

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

## Appendix A - FYA Analysis

Intersection: 6 - Cedar Lake Road & Texas Avenue S  
 Mainline: Cedar Lake Road  
 Cross Street: Texas Avenue S

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Cross product reaches Prot/perm volumes during AM & PM peak only. Rest of day is permissive level
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	Not Eligible
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound (No Opposing Through Approach)

## Appendix A - FYA Analysis

Intersection: 7 - Cedar Lake Road & Zarthan Avenue  
 Mainline: Cedar Lake Road  
 Cross Street: Zarthan Avenue S

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	EBL is in Prot/perm level during PM peak only (4:45PM-6:15)
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)?	NO	
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

## Appendix A - FYA Analysis

**Intersection:** 8 - Park Center Blvd & Highway 100 NB  
**Mainline:** Park Center Blvd  
**Cross Street:** Highway 100 NB

**Approach:** Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	<b>Cross Product:</b> 8:15AM-8:40AM 10:30AM-7:45PM <b>Volume:</b> 6:30AM-10:00PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

**Approach:** Southbound (No Left Turn Lane)

## Appendix A - FYA Analysis

Intersection: 9 - Park Center Blvd & Target Entrance  
 Mainline: Park Center Blvd  
 Cross Street: Target Entrance

Approach: Northbound (FYA Operation)

Approach: Southbound (FYA Operation)

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not Eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	Not Eligible
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not Eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	Not Eligible
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

## Appendix A - FYA Analysis

Intersection: 10 - Shelard Parkway & Ford Road  
 Mainline: Shelard Parkway  
 Cross Street: Ford Road

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	Cross Product: 7:15AM-9:15AM Volume: 6:45AM-9:45AM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	YES	

## Appendix A - FYA Analysis

Intersection: 11 - Texas Avenue S & 33rd Street W  
 Mainline: Texas Avenue S  
 Cross Street: 33rd Street W

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	<b>Not eligible for FYA</b>
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	<b>Not eligible for FYA</b>
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	<b>Not eligible for FYA</b>
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	<b>Not eligible for FYA</b>
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)?	NO	Not Eligible
	-Is the Peak Hour Left turn volume greater than 240 vph?		
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

## Appendix A - FYA Analysis

Intersection: 12 - 36th St & Belt Line Blvd  
 Mainline: 36th Street  
 Cross Street: Belt Line Blvd

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	YES	<b>Cross Product:</b> (Prot/Perm or above 7:30AM-8:00PM) 8:00AM-8:45AM, 1:00PM-1:45PM, 4:00PM-7:15PM <b>Volume:</b> (Perm or above 7:45AM-8:00PM) 8:15AM-8:45AM, 12:30PM-7:45PM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound (No Left Turn Lane)



## Appendix A - FYA Analysis

Intersection: 13 - Cedar Lake Rd & Park Center Blvd  
 Mainline: Cedar Lake Rd  
 Cross Street: Park Center Blvd

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	YES	Not eligible for FYA
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	YES	Not eligible for FYA
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Cross Product: (prot/perm 5:30PM-6:00PM) Volume: (Prot/Perm, 8:00AM-8:30AM, 5:15PM-7:30PM)
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

## Appendix A - FYA Analysis

Intersection: 14 - Louisiana Ave S & Oxford St  
 Mainline: Louisiana Ave S  
 Cross Street: Oxford Ave S

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater then 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater thean 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

## Appendix A - FYA Analysis

Intersection: 15 - Louisiana Ave S & Louisiana Cir  
 Mainline: Louisiana Ave S  
 Cross Street: Louisiana Cir

Approach: Northbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Southbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	NO	
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	YES	Cross Product: (prot/perm 7:15AM-7:45AM) Volume: (Prot/Perm 7:00AM-8:15AM) 7:00AM-7:45AM
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	
Double left turn?	-Does the left turn have 2 or more lanes?	NO	

Approach: Eastbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible

Approach: Westbound

Check	Description	Yes/No	Comments
Left Turn Lane	-Is there an shared left turn lane?	YES	Not eligible for FYA
Left Turn Offset	-Do the opposing left turn paths conflict?	NO	
Adequate Sight Distance?	-Does the left turn have limited sight distance?	NO	Not Eligible
Cross product/Volume	-Is the cross product greater than 80,000 (100,000 if 2 opposing lanes)? -Is the Peak Hour Left turn volume greater than 240 vph?	NO	Not Eligible
Speed limit >45?	-Is the speed limit greater than 45 mph?	NO	Not Eligible
Number of opposing thru lanes	-Does the left turn face 3 or more opposing lanes?	NO	Not Eligible
Double left turn?	-Does the left turn have 2 or more lanes?	NO	Not Eligible