

# PROJECT INFORMATION

<b>Project Title</b>	Evaluation of Flashing Yellow Arrows (FYA) for Protected/Permissive Left Turn (PPLT) control
<b>ID</b>	ICT-R27-097
<b>Project Cost</b>	\$399,154.00
<b>Duration</b>	50 Months (11/01/2010 to 03/31/2016)
<b>SUBMITTER</b>	
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<b>RESEARCH PROGRAM</b>	
<b>Sponsoring Agency or Organization</b>	Illinois Department of Transportation / Illinois Center for Transportation
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<b>RESEARCH AND RESULTS</b>	
<b>Brief Summary of the Research Project</b>	<p>In the spring of 2010, the Illinois Department of Transportation initiated an area wide implementation of the flashing yellow arrow (FYA) as the display for the left-turn permissive interval at more than 100 intersections operating with protected/permissive left-turn (PPLT) control in the Peoria, Illinois, area (See Figure 1 Vertical FYA Signal Head). Researchers evaluated the effectiveness of FYAs on safety at 86 intersections and 164 approaches where no other improvements were made. The effectiveness evaluation was performed using three years of "before FYA installation" crash data and three years of "after FYA installation" crash data using the naïve before and after and empirical Bayes methods for highway safety evaluation.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Vertical five-section signal head with CG-permissive indication</p> </div> <div style="text-align: center;">  <p>Vertical four-section signal head with FYA-permissive indication</p> </div> </div> <p align="center"><b>Figure 1 Vertical FYA Signal Head</b></p>

Analyses were also performed to assess the effects of the FYA supplemental signs and to assess the effects of the FYA overall on two subsets of drivers: older drivers (age 65+) and younger drivers (age 16 to 21 years). Crash modification factors for statistically significant crash reductions at the FYA approaches based on the empirical Bayes method were provided. The findings of this research, conducted on 164 FYA approaches in the Peoria area, indicate that FYAs for PPLT control greatly improve safety for left-turning vehicles.



Figure 2 FYA with Supplemental Signage

During this project, IDOT held the 2012 National State Safety Engineers and Traffic Engineers Peer-to-Peer Workshop, with 31 states attending. Representatives from the Federal Highway Administration (FHWA), American Traffic Safety Services Association (ATTSA) and American Association of State Highway and Transportation Officials (AASHTO) also participated. At this peer exchange attendees from both IDOT and Oregon DOT presented on FYA, helping to advance the FYA initiative and research project.

**Impact, or Potential Impact, of Implementing Research Results**

The researchers analyzed the costs using the Highway Safety Manual stated costs of various types of crashes and average construction prices to install the signal heads. The equivalent uniform annual benefit of the decreased crashes was found to be approximately \$1,630,000 at the 86 intersections studied. The equivalent uniform annual cost of the implementation of the signal heads was approximately \$82,500. The results of the economic effectiveness of the FYAs yielded a benefit to cost ratio of 19.8 to 1.0. The results of this research may be used to make informed decisions on future installations of the FYA countermeasure to improve safety at signalized intersections.

The research also demonstrated that at the intersections studied the number of left-hand turn related crashes was reduced by as much as 24% when just the left-turn signal arrow was installed and as much as 31% when additional supplemental signage was installed with the left-turn signal arrow (See Figure 2).

Based on the findings of the research, IDOT has implemented a Bureau of Design and Environment (BDE) specification from the anticipated Crash Modification Factors developed from the research. In addition,

	<p>BDE is looking to incorporate FYAs into IDOT’s design and traffic operations policies.</p> <p>Priscilla Tobias, Director of IDOT’s Office of Program Development, stated “In my discussions with community members and the Illinois State Police, both have communicated that they like the Flashing Yellow Arrows because they allow traffic to move more quickly and with fewer crashes.” She continues, “Flashing Yellow Arrows have been implemented in IDOT Districts Four and Six, and other Districts are planning to follow suit.”</p>
<b>Web Links (if available)</b>	<p><a href="https://apps.ict.illinois.edu/projects/getfile.asp?id=3093">https://apps.ict.illinois.edu/projects/getfile.asp?id=3093</a> – Literature Review <a href="https://apps.ict.illinois.edu/projects/getfile.asp?id=3094">https://apps.ict.illinois.edu/projects/getfile.asp?id=3094</a> – Interim Report <a href="https://apps.ict.illinois.edu/projects/getfile.asp?id=4814">https://apps.ict.illinois.edu/projects/getfile.asp?id=4814</a> – Final Report <a href="https://www.youtube.com/watch?v=l3x_Z9Cm-Cg">https://www.youtube.com/watch?v=l3x_Z9Cm-Cg</a> – IDOT FYA Outreach Video</p>