Flashing Yellow Arrow (FYA) for Protected/Permissive Left Turns (PPLT) at Signalized Intersections

One or Two Yellow Arrows?

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(Field Data - Jackson County, Oregon)

ITE Las Vegas – July 20, 2015, Session 2C-3
Doghouse – Shared Head

LEFT TURN
YIELD
ON GREEN
<table>
<thead>
<tr>
<th>Problems With Doghouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Installed signal due to crash history - 1995</td>
</tr>
<tr>
<td>• First doghouse in Jackson County</td>
</tr>
<tr>
<td>• Crashes 5 years before signal - 12</td>
</tr>
<tr>
<td>• Crashes 5 years after signal - 42</td>
</tr>
<tr>
<td>• Left turn crashes 5 years before signal - 1</td>
</tr>
<tr>
<td>• Left turn crashes 5 years after signal - 32</td>
</tr>
<tr>
<td>• Traffic volumes before/after signal similar</td>
</tr>
<tr>
<td>– Single left turn lane - 470 PM peak hour</td>
</tr>
<tr>
<td>– Two opposing lanes - 275 per lane</td>
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</tbody>
</table>
4 Section FYA – Exclusive Head
3-Section Bi-Modal
Standard 3-Section FYA
3-Section FYA lead-lag
Crash and Benefit Results

Doghouse to FYA

• Crash Results
  – Left turn crashes 2.7 years prior - 19
  – Left turn crashes 2.7 years after - 8

• Benefit
  – Crash reduction - 11 or 58%
Crash and Benefit Results

Protected to PPLT using 3-Section FYA – Main & Lozier

• Crash Results
  – Left turn crashes 1.7 years prior - 0
  – Left turn crashes 1.7 years after - 6
    • All crashes occurred in first 6 months
    • Press release for the Hispanic citizens
  – Crash Cost (I=$40,000, PDO=$10,000) = $150,000

• Benefit - Delay Reduction
  – Entering volume PM peak = 2,100
  – Average delay protected only = 26 sec
  – Average delay p/p = 16 sec
  – Peak hour delay reduction = 6 veh. hours
  – Daily benefit at $20.00/hr. = $1,200
  – Total benefit for 622 days (1.7 years) = $750,000

• Benefit / Crash Cost Ratio
  – $750,000 / $150,000 = 5
Citizen Comments

• Negative comments – Total 7
  – Email 12/10/01
  – Letter 5/23/02

• Positive comments – Total 16
  – Sheriff’s article 1/9/02
  – Letter 1/9/02
  – Letter 1/13/02
  – Letter 1/16/02
  – Newspaper article 7/25/02
FYA and MUTCD History

• 1995 NCHRP 3-54 begins
  – Report 493 released in 2003 and FYA is the preferred PPLT display
  – Terminating the FYA with a separate yellow arrow?

• 2009 MUTCD
  – Included 4-Section and 3-Section Bi-Modal FYA (clearance limitations)
  – Prohibited Standard 3-Section FYA

• 2014 FHWA I.A. 3-Section FYA
  – NCHRP Project No. 20-07 / Task 283
Most Recent Research Results

• “[T]here was not a significant difference in driver comprehension when the FYA indication is located in the middle section.” Id. at 52.

• “38% [of the drivers surveyed] preferred the FYA indication in [the] middle section, 9% preferred the bottom.” Id. at 66.

  “…thinks it should be on the mid-section because it makes sense”

  “…preferred the mid-section but does not know why”

  “Makes sense for the FYA to be in the middle because it keeps the order”

  “Best in middle because yellow is normally in the middle”

  “Middle is better, tells me to slow down and be cautious”
Most Recent Research Results

- “There was also no significant difference in correct responses between the three-section and four section vertical signal displays.” *Id.* at 73.
- “[T]he FYA indication can be effectively used in a three-section traffic signal display only when used bimodally with the steady YA indication.” *Id.* at 74.
Conclusions and Issues

• FYA reduces crash rates when compared to the circular green display (Doghouse)
• Standard 3-Section left turn head is an acceptable PPLT display (single yellow arrow)
• Drivers want more PPLT displays
• Conflict Monitoring for 3-Section FYA
  – Oregon monitors FYA but not clearance
  – NEMA cannot monitor 3 modes of yellow arrow operation; protected clearance, FYA and permissive clearance (fix coming?)
  – MUTCD language ambiguous on monitoring
• Questions? trafficguru@hotmail.com
• Research ongoing - Try it at your agency