

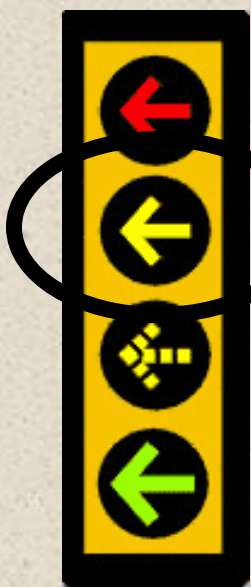
Flashing Yellow Arrow (FYA) for Protected/Permissive Left Turns (PPLT) at Signalized Intersections

One or Two Yellow Arrows?

Eric Niemeyer, PE

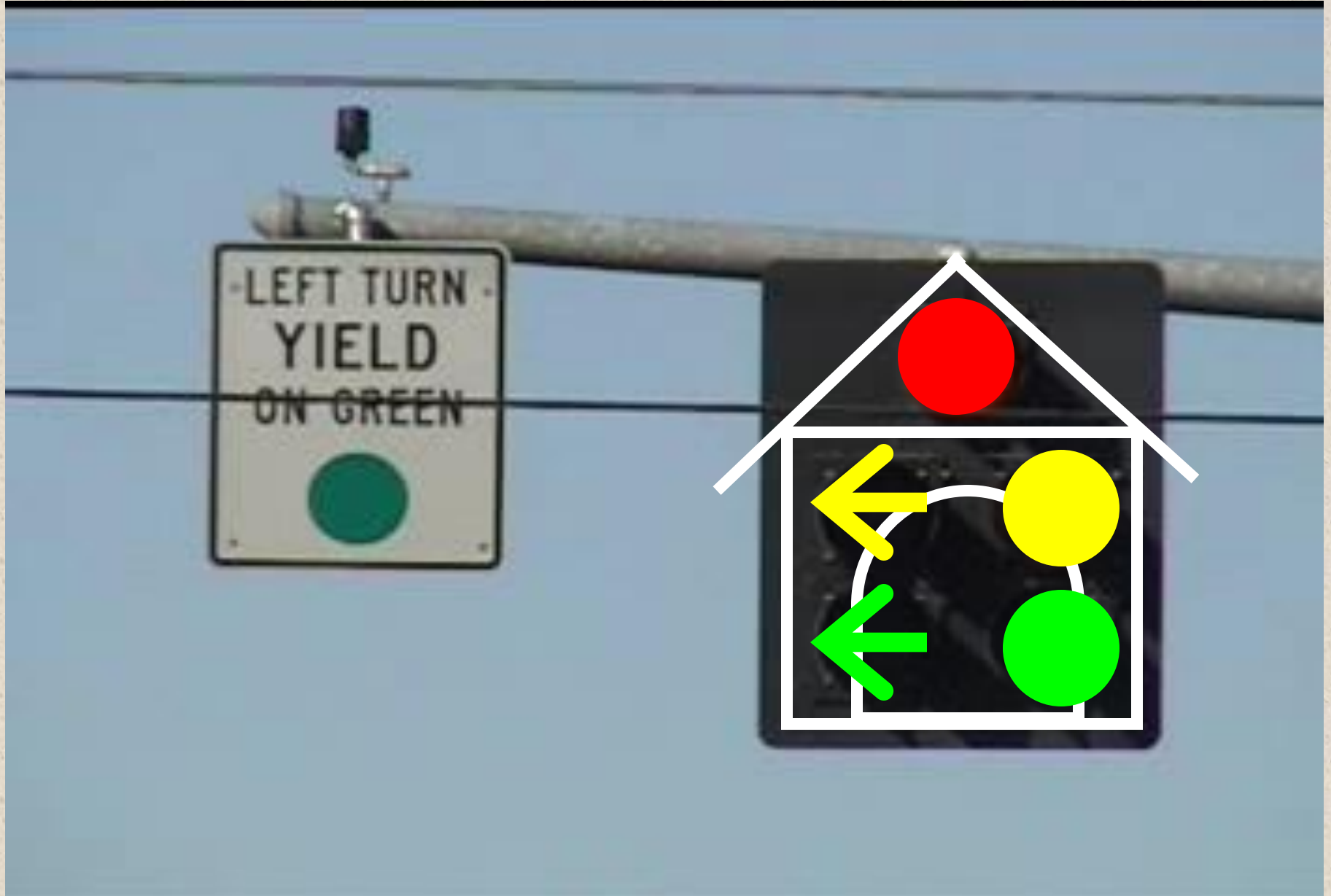
Traffic Operations Engineer

City of Springfield, Oregon



(Field Data - Jackson County, Oregon)

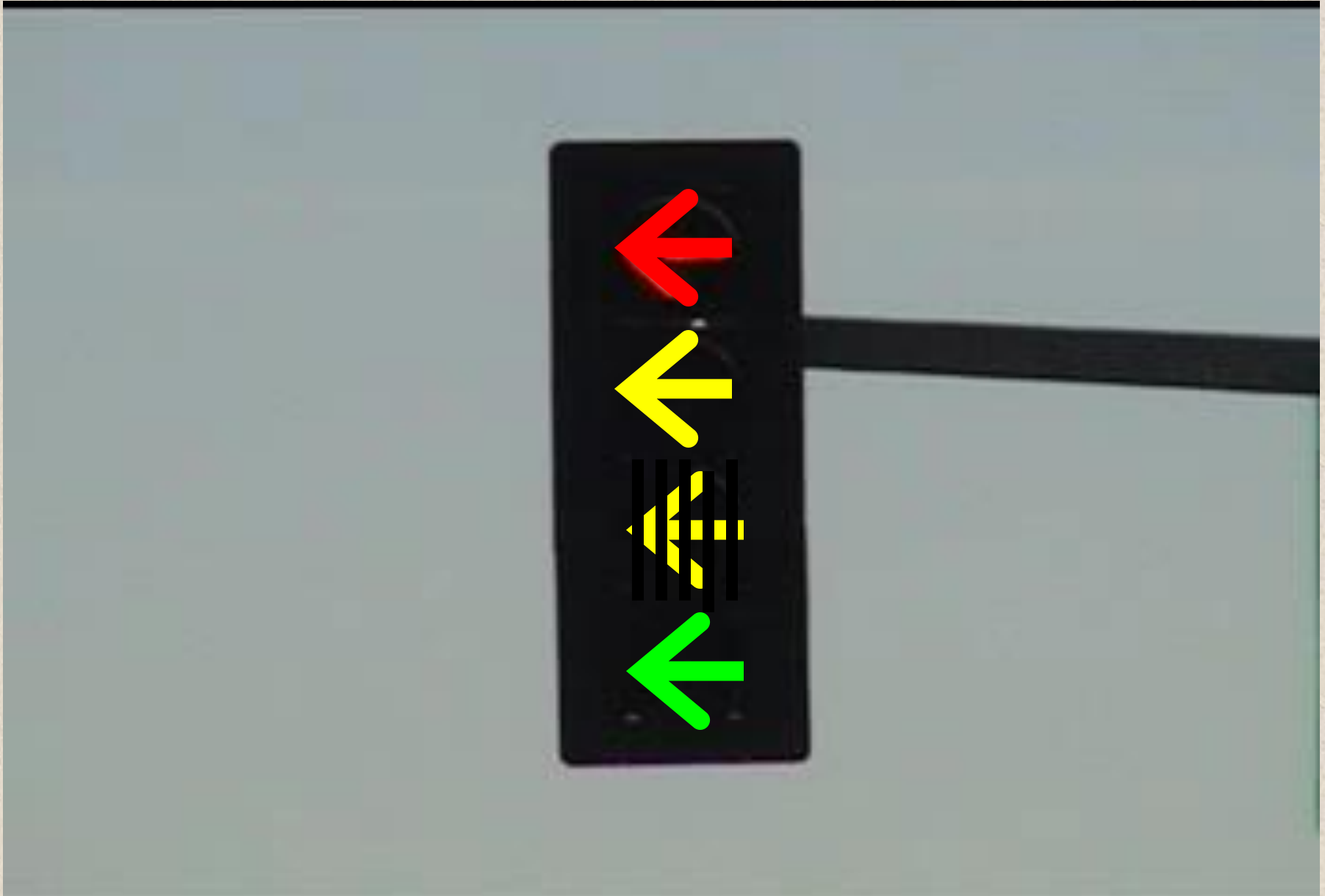
Doghouse – Shared Head



Problems With Doghouse

- **Installed signal due to crash history - 1995**
- **First doghouse in Jackson County**
- **Crashes 5 years before signal - 12**
- **Crashes 5 years after signal - 42**
- **Left turn crashes 5 years before signal - 1**
- **Left turn crashes 5 years after signal - 32**
- **Traffic volumes before/after signal similar**
 - **Single left turn lane - 470 PM peak hour**
 - **Two opposing lanes - 275 per lane**

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

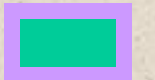


- Letter 5/23/02



- **Positive comments – Total 16**

- Sheriff's article 1/9/02



- Letter 1/9/02



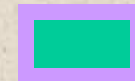
- Letter 1/13/02



- Letter 1/16/02



- News paper 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**