



Campbell M. Gilmour
Director

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
DEVELOPMENT SERVICES BUILDING
150 BEAVERCREEK ROAD | OREGON CITY, OR 97045

Memorandum

To: Joseph Marek, PE, PTOE, Traffic Engineering Supervisor *JM*

From: Christian Snuffin, PE

Subject: Oregon City Candidate Signalized Intersections for Conversion to Flashing Yellow Arrow Operation

Date: December 13, 2011

*— Sounds great
lets move forward
w/ the City*

Oregon City has requested that we evaluate the feasibility of converting five traffic signals within the city limits to protected/permitted (PPLT) control of major street left turn movements using flashing yellow arrow (FYA) signal indicators. I have performed an investigation of the proposed intersections to determine whether FYA conversion would be appropriate. I am seeking your concurrence with the recommendations below for conversion to FYA of five signals within Lake Oregon City. The table below provides pertinent details about the existing and proposed conditions related to the signals at candidate intersections.

FYA Conversion Candidate Intersections – Oregon City

Major St	Minor St	Mounted On	Dir	Existing LT Signal Head	Proposed LT Signal Heads	Qty	Proposed Standard Signal Heads	Qty	Comments
Molalla Ave	Clairmont Way	Span Wire	N/S	Programmed	3 Section Bimodal	2			3-section head recommended because of vertical clearance limitations of span wire
Molalla Ave	Gaffney Ln	Span Wire	N/S	Programmed	3 Section Bimodal	2			3-section head recommended because of vertical clearance limitations of span wire
Molalla Ave	Holmes Ln - Hilda St	Mast arm	N/S	Doghouse	4 Section	2	3 section	2	
Warner Milne Rd	Beavercreek Rd	Mast arm	WB	3 Section	4 Section	1			T Intersection, WB only
Warner Milne Rd	Linn Ave - Leland Rd	Mast arm	N/S, E/W	3 Section	4 Section	4			

The intersections were evaluated based on guidelines developed by ITE and ODOT. The criteria used included the following:

- Existing signalized intersections with protected left-turn phasing on the major street
- Existing five-section doghouse style PPLT signal heads
- No more than two through opposing lanes
- Adequate sight distance from left-turn lane approach

Each of the candidate intersections meets these criteria. Additional criteria and considerations are discussed below.

ITE Volume Criteria

According to ITE and ODOT guidelines, PPLT phasing should be considered when the left turn volume on one approach routinely exceeds 200 vehicles per hour, or the product of opposing and left-turning hourly volumes exceeds 50,000 for one opposing lane, or 100,000 for two opposing lanes. The volume criterion for protected-only left turn phasing is met when the left turn volume on one approach routinely exceeds 300 vehicles per hour, or the product of opposing and left-turning hourly volumes exceeds 150,000 for one opposing lane, or 300,000 for two opposing lanes. The intersection of Beaver Creek and Warner Milne, which currently operates with protected-only left turn phasing for the westbound left turn, does not meet the PPLT volume criteria. This indicates that converting to a less restrictive PPLT condition could improve overall intersection efficiency by allowing left turners to proceed when gaps allow. No volume data is available for Molalla and Clairmont. However, observations of traffic operations indicate that traffic volumes are comparable to other intersections that currently have flashing yellow arrows.

Crash History

Five years of crash data was collected and evaluated at each of the potential candidate intersections. None of the intersections appeared to have a safety problem associated with the left-turn movements in question. No crash data prior to the installation of protected left turns was available at any of the intersections. While installation of FYA is not expected to have detrimental effects on safety, consideration will be given to reverting to protected-only control if it is determined that FYA contributes to increases in crashes at any of the candidate intersections.

Recommended Signal Controller Upgrades and Timing Modifications

2070 Controller

The 2070 traffic controller has a number of innovative features associated with FYA that can enhance operational efficiency and safety, some of which are discussed below. These features are not available with the 170 controllers that are currently being used at the candidate intersections. Therefore, we recommend that the controllers be upgraded to 2070s at each of the intersections.

FYA Suppression for Pedestrian Service

The intersections of Molalla and Clairmont and Molalla at Gaffney are known to have relatively high pedestrian volumes due to their proximity to significant generators. As the use of flashing yellow arrows has become more widespread in recent years, concerns have arisen regarding

pedestrian conflicts. Under normal FYA signal timing, the flashing yellow may appear at the same time as an adjacent conflicting pedestrian phase. This had not been seen as a problem because drivers making permissive left turns are required by law to yield to pedestrians within the crosswalk. However, some close calls and crashes have occurred that resulted from drivers turning on a FYA phase and failing to yield to pedestrians who are occupying the crosswalk during a WALK indication.

To address this concern, some jurisdictions have begun implementing “ped friendly” FYA timing that suppresses the FYA phase (left-turn signal remains red) until the adjacent conflicting pedestrian phase has been served. Ped friendly FYA timing currently requires lengthy internal logic programming language, as it is not intrinsic to the Voyage controller software. The software developer is expected to incorporate ped friendly FYA timing options into the next Voyage software release, which will eliminate the need for users to manually enter code language. Once a standardized approach is developed, the County intends to implement this timing as a county-wide standard at all FYA locations using 2070 controllers. Locations with higher pedestrian volumes will be given priority.

Time-of Day / Gap Dependent Flashing Yellow Arrow

Time-of-day FYA allows the FYA to be disabled during certain times of day when traffic or pedestrian volumes are typically too heavy to allow safe opportunities to make a permissive left turn. The times during which the FYA is disabled, if at all, should be determined based on the volume characteristics of intersections on a case-by-case basis.

Gap-dependent flashing yellow provides somewhat smarter control by suppressing the FYA until there are sufficient gaps in the opposing traffic flow to safely make a left turn.

Both time-of-day FYA and gap dependent FYA reduce the chance that some drivers may feel pressured by the flashing arrow to accept inadequate gaps.

The County has not yet implemented gap-dependent or time-of-day FYA at any County owned or maintained signals. However, we believe this feature can provide a benefit for users, and it should be considered at all candidate intersections for FYA conversion. As previously noted, these features may only be used with a 2070 controller.

Non-Candidate Intersections

The table below lists the remaining Oregon City intersections that are not eligible for conversion to flashing yellow arrow at this time.

Oregon City FYA Candidate Intersections
December 13, 2011

FYA Non-Candidate Intersections – Oregon City

Major St	Minor St	Reason
Molalla Av	Warner Milne Rd	Existing FYA
Molalla Av	McDonalds access	Existing FYA
Molalla Av	Beavercreek Rd	Programmed improvements; FYA may be installed with O.C. CIP project
Abernethy Rd - 17th St	Washington St	Permissive-only phasing
Washington St	15th St	Existing FYA
Washington St	14th St	Existing FYA
Washington St	7th St	Split phasing
7th St	Monroe St	Existing FYA
Molalla Av	Pearl St	Permissive-only phasing
Beavercreek Rd	Southridge Center access	Existing FYA
Beavercreek Rd	Fred Meyer access	Existing FYA
Beavercreek Rd	Fir St	Existing FYA
Beavercreek Rd	Hilltop	Existing FYA
Washington St	Home Depot/Metro Access	Programmed; to be installed with OR 213 jug-handle project

Most of the intersections listed above are either currently already running PPLT using FYA or are scheduled to be converted to FYA. Of the three other intersections, Washington St at 7th St operates with split phasing due to geometric restrictions and the predominate traffic volume patterns. The other two (Molalla at Pearl and Washington at Abernethy/17th) operate with permissive-only phasing, and the traffic volumes do not currently warrant PPLT phasing.

Prioritization for FYA Conversion

The five candidate intersections may be retrofitted with FYA as soon as funding is available. At each of the intersections to be converted to FYA, an upgrade to 2070 signal controllers is also recommended. As noted above, the 2070 provides more features and flexibility for operating FYA, as well as a host of other advanced programming and communication features that can help increase operational efficiency.