Left Turn Safety: Preventing Injury and Death Through Signs and Signaling

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Preventing Injury and Death Through Signs and Signaling

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Abstract

Thousands of accidents each year are precipitated by drivers making a left turn within an intersection. These accidents tend to be caused primarily by driver error, confusing signaling or high rates of speed by through traffic. Extensive research suggests that reducing the rate of speed of through traffic, implementing warning signs with flashers along a roadway, adjusting the traffic signal phasing at an intersection, and utilizing creative intersection designs are all options which are available to combat these concerns and substantially minimize risks to all drivers. A recent fatal accident in Spotsylvania County highlights the need for intersection improvement at Plank Road and Orange Plank Road. The varied strengths and weaknesses inherent to several possible solutions are explored and discussed. By reducing speeds, adding warning signs with flashing lights, and changing the signal at this Spotsylvania intersection to protected-only phasing, further injuries can be prevented and lives can be saved.

*Keywords*: left turn, signal phasing, intersection design
Introduction

Left hand turns are one of the most dangerous maneuvers a driver can make. According to research collected by the National Highway Traffic Safety Administration (2010), approximately 36% of reported vehicle crashes occurred at intersections, and in over half of those accidents the factor that led to the crash, called “the critical pre-crash event”, was a left turn (p.2). While we typically execute a left turn without incident, the limitations of poor judgement, poor sight lines, or poor signaling can have tragic consequences. In May of this year, *The Free-Lance Star* reported that this was the case for a young Spotsylvania resident who recently lost her life while making an unprotected left turn from Plank Road to Orange Plank Road. In fact, 33 accidents have occurred at this location between 2013 and 2017, which is an approximately 50% increase from the crashes recorded between 2007 and 2011 (Shenk, 2018, p. 1A). Regulated by a permitted/protected light, a flashing yellow arrow is meant to caution drivers to yield the right-of-way to oncoming traffic, but this signal does not adequately protect drivers making a left turn. The intersection of Plank Road and Orange Plank Road must be made safer by converting the left turn signal to protected only, adding flashing warning signs along the roadway to notify approaching drivers to watch for turning vehicles, and reducing the speed limit through the intersection, in order to prevent further injuries and loss of life.

Defining the Problem

Road safety has become a worldwide concern. According to a recent report issued by the World Health Organization (2018), 1.35 million people died in 2016 as a result of traffic accidents globally; and road traffic injury is now the leading cause of death for children and young adults ages 5-29, as well as the eighth leading cause of death for all age groups (p.3). The
world is reliant upon the knowledge and skill of traffic engineers and city planners to overcome the challenges inherent to designing safe roadways for an ever-increasing global population.

One of the toughest design obstacles is the left hand turn. These have been the bane of civil engineers since automobiles began to rule the road, and the reasons are myriad. In order to determine how to regulate traffic flow within an intersection, engineers must consider the number of possible conflict points, the volume of traffic flowing through an intersection, the speed of oncoming through traffic, and line of sight visibility (Jolovic, Stevanovic, and Martin, 2016, p. 3). Additionally, the age of drivers is a factor. Research published in the Journal of Transportation Engineering found that young drivers under the age of twenty-five and older drivers above the age of sixty-five have increased difficulty navigating a left turn through an intersection, thought to be due to inexperience and recklessness on the part of younger drivers and difficulty understanding traffic signaling for older drivers (Mueller, Hallmark, Wu, and Pawlovich, 2007, p. 557). This confusion can be addressed through signal phasing modification.

According to researchers from the University of Kentucky’s Department of Civil Engineering, the primary method to control left turn traffic at intersections is via traffic signal phasing, which can be permitted only, protected only, permitted/protected, or variable left turn mode. The protected only signal phase is universally recognized as the safest option, since it disrupts the flow of traffic and gives the right-of-way to left turning drivers, particularly when opposing traffic is traveling at a high rate of speed (Stamatiadis, Sallee, and Kirk, 2016, p.17-18). Safety is sometimes compromised, however, in order to improve traffic efficiency along roadways with higher vehicular volume leading to the utilization of permitted/protected phasing. With this option, a flashing yellow arrow indicates that left-turning drivers should yield the right of way to oncoming traffic but may proceed if the way is clear. Unfortunately, this has a
tendency to befuddle drivers, especially those over the age of sixty-five, approaching the intersection who may misinterpret the signal (Mueller et al., 2007, p. 557). Considering Spotsylvania’s increasing population, the 55 mile per hour speed limit along Plank Road at Orange Plank Road, and the wide age range of drivers along Plank Road, it’s time to explore safer alternatives for drivers turning left.

Solutions & Evaluations

Several solutions of varying complexity are available to increase safety and mobility for drivers. Perhaps the most obvious is to make the left turn signal light “protected only”. This is unquestionably the safest signal method, providing a protected space for the driver and minimizing the confusion of drivers who see a yellow light, and make an assumption that the light for oncoming traffic is red. Unfortunately, according to Daniel Cole (personal communication, October 11, 2018), traffic engineer for Spotsylvania County with more than 30 years experience, this signal phase is also known to reduce traffic flow because of increased signal cycle lengths. In addition, spillback, or overflow of vehicles turning left into the through lanes, has the tendency to increase the likelihood of rear-end collisions. Since Route 3 traffic congestion is already a contentious point with many locals, this may be met with resistance. Mr. Cole did suggest that this might be a feasible solution, however if made in conjunction with extension of the left turn lane.

Another possibility would be to reduce the speed of through traffic. This stretch of Route 3 has a posted speed limit of 55 mph, yet according to a speed study conducted approximately 200 feet in advance of the Plank Road/Orange Plank Rd intersection, by Spotsylvania County traffic engineer Daniel Cole on July 18, 2018, the majority of motorists were traveling 60 mph or faster. Researchers have found that left turn accidents are more severe and likely to cause serious
injury or death when crossing through lanes with speeds greater than 45 mph (Yan and Radwan, 2008, p.46). Therefore, it seems prudent to lower the speed limit to 45 mph as traffic on Route 3 approaches the intersection, though it is understood that some drivers may not even notice the new speed limit sign, and continue at the previously posted 55 mph.

While cynics may rightfully contend that drivers will ignore or be oblivious to simple signage, the reality is that road signs are useful tools available to increase driver awareness in an intersection. In fact, a sign placed directly next to the left turn traffic signal, which explicitly reminds drivers that they must yield the right-of-way, has been used with some success and was recently implemented at the site of the May 2018 fatal accident (Shenk, 2018, p. 1A). Flashing lights attached to a “Watch for Turning Vehicles” sign would more effectively grab the attention of drivers. A study conducted by Wu, et al. determined that reducing the speed limit in conjunction with warning flashers resulted in significant reduction of crash frequency and injury severity (2013, p.90). Flashing lights can also be linked to sensors placed in the left turning lanes to warn oncoming traffic to be more alert as they approach the intersection. Though not enough on its own, as it does not directly address the left turn, I believe this measure could be part of a viable solution.

The Virginia Department of Transportation (VDOT) is aware of the inherent dangers of left turns, and according to Daniel Cole, has recently introduced some innovative, though complex, designs which would virtually eliminate the need for left turns altogether, thus, drastically improving intersection safety as a whole. Options which may be considered for intersections with at least three legs include the Continuous Green-T (CGT), the Median U-turn (MUT), and the Restricted Crossing U-Turn (RCUT) (Cole, personal communication, 2018). While a CGT would allow for continuous traffic flow westbound on Route 3, and therefore
reduce signal cycle times, the number of conflict points within the intersection would remain the same, thus improved safety would not necessarily be predicted and should not be implemented at this intersection. However, both the MUT and RCUT show promise.

If implemented, these designs eliminate one or more left turns, thereby reducing conflict points and improving predicted safety outcomes. In a Median U-Turn intersection, left turns from the main road, in this case Route 3, would be replaced by U-turns in the median past the main intersection, which allows for improved traffic flow, since fewer signal phases are required (Cole, personal communication, 2018). Similar U-turns are also utilized within a Restricted Crossing U-Turn, however in addition, side street users, those on Orange Plank Road in this case, would also be required to begin with a right turn followed by a U-turn if they desire to turn left. These designs also potentially reduce the total number of conflict points by up to 50% and the most dangerous crossing conflicts by up to almost 90% (Cole, personal communication, 2018). While the costs associated with these designs are fewer than other traditional solutions, the implementation could still strain the county’s meager budget. Initially, the complexity and unfamiliarity of these traffic pattern manipulations would challenge both the understanding of county planners and the navigational skills of drivers. Additional time and money would need to be spent educating drivers on how to navigate the modernized intersection through public service announcements and/or directional signs. Thus, at least for now, this solution is likely not feasible.

**Implementation**

Both the county and the Virginia Department of Transportation rely on the public to make them aware of safety concerns on our roadways, so contacting local government officials and VDOT should be the first step towards implementation. The speed limit for eastbound lanes
on Plank Road should be reduced to 45 mph, a quarter mile before and after the intersection with Orange Plank Road, and warning signs with flashing lights should be placed along the roadside just prior to the newly posted speed limit alerting drivers to possible vehicles crossing the approaching intersection. Both of these options are inexpensive for the county, and if the public is willing to bring their valid safety concerns for this intersection to the county planners, they can be implemented quickly with little to no disruption of traffic. The next step would be to change the phasing of the signal to protected-only and construct an extended left turn lane. This small but necessary bit of construction will admittedly disrupt the flow of traffic temporarily as well as slightly increase costs; however the inconvenience is worth the brief delay, in order to reduce driver confusion and prevent additional accidents.

**Conclusion**

Relying on research-based evidence, a multi-fold solution incorporating a change in signal phasing and a few signs would bring about significantly improved crash rates, preventing injuries and fatalities. Because of the deadly accident in May, the intersection of Orange Plank Road and Plank Road has risen in notoriety with local and state traffic engineers. It’s time to capitalize on their heightened awareness. By calling or emailing members of the Spotsylvania County Board of Supervisors and VDOT, citizens can join together en masse to insist that safety at this intersection be made a priority, and we can help prevent the injury, or even death, of our friends and loved ones who travel along this route.
References

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