

DeIDOT Left-Turn Traffic Signal Operations

The type of left-turn phasing operation chosen for a signalized intersection is one of the most critical traffic signal design and operational issues considered. The decision includes the consideration of both safety and efficiency. There are various federal and DeIDOT guidelines to help make these decisions; however, those guidelines continue to evolve over time. The list below, in generic terms, is in order of least restrictive to most restrictive. Engineering studies assess traffic flow on a daily and in some cases seasonal basis, the number of approach and opposing traffic lanes, pedestrian movements, and the geometry of the intersection to determine the appropriate signal phasing. Note that for any traffic movement with any type of signal operation, drivers are required to cautiously enter the intersection, and must yield to other vehicles and pedestrians who are lawfully within the intersection.

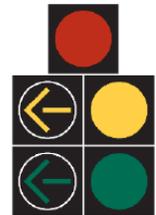
Permitted

This type of operation never provides a separate left-turn arrow. Drivers turn left on a circular green indication, when they can find a gap in opposing traffic. This type of operation is often used on relatively low volume side streets, and sometimes in urban areas with relatively low speeds and low left-turning volumes. As left-turning volumes increase, permitted phasing operation may result in a higher crash risk and becomes less efficient than other options noted below.



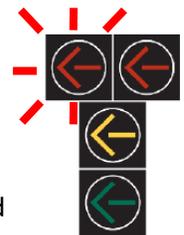
Standard Protected-Permitted

This type of operation is typically implemented in Delaware with the "doghouse" signal head. Normally a left-turn green arrow is displayed first ("protected" part of phase), followed by a yellow left-turn arrow, then a brief circular red indication, and finally a circular green indication ("permitted" part of phase). It is generally viewed that this type of operation is more efficient (less delay) than protected-only, but also has a higher crash risk, because a driver has to make a decision about selecting an adequate gap in opposing traffic. This type of operation is often used on local, collector and some arterial roadways with one or two opposing through lanes and moderate left-turning volumes.



Special Protected-Permitted (Flashing Red Arrow)

Protected-permitted operation with a flashing red arrow has been implemented at many signalized intersections in Delaware. Normally a left-turn green arrow is displayed first ("protected" part of phase), followed by a yellow arrow, then a circular red indication or red arrow, and finally a flashing red arrow ("permitted" part of phase). Legally, drivers are required to completely stop and then proceed during the flashing red arrow interval when there is an adequate gap in opposing traffic. This type of left-turn operation is generally between standard protected-permitted and protected-only phasing with respect to both efficiency and crash risk.



DelDOT is one of the few agencies in the country that utilizes a flashing red arrow. Although this phasing operation is somewhat unusual, it has proven to be both relatively safe and efficient at many locations. In 2008, DelDOT formally reviewed the safety and operational characteristics of all flashing red arrow intersections in Delaware. Some locations were modified to protected-only operations due to moderate crash issues or concerns about driver sight lines.

Given the relatively successful use of flashing red arrows in Delaware, DelDOT intends to install them at additional intersections and make existing locations compliant with revised federal guidelines. A typical application will be at a location that is currently standard protected-permitted but has a moderate crash problem. Rather than applying the traditional solution of converting to protected-only operations, DelDOT may first consider flashing red arrow left-turn operations.

Protected-Only

This type of operation presents the driver with a green arrow, then a yellow arrow, and finally a red arrow. The driver does not need to make a decision about gaps. It is generally agreed that this type of operation has less crash risk than protected-permitted, but is less efficient (more delay). Naming this type of operation the “safest” is not accurate. Although the chances of left-turning crashes may be reduced, potentially the chances of rear-end crashes is increased, particularly if traffic backs up beyond turn lanes on a regular basis. Furthermore, the increased delay may lead to increased red-light-running crashes or diversion to nearby, uncontrolled intersections. This type of left-turn operation is often implemented on divided highways with both heavy left-turning and opposing through traffic, used whenever there are dual left-turn lanes, and often implemented where there is a significant number of left-turn crashes. Opposing vehicle speeds, sight line restrictions, and motorist expectancy are additional criteria that are taken into consideration when evaluating the need for protected-only operations.



Split Phasing

This is a form of protected-only operation where all movements on an approach get green, yellow, and red indications at the same time with no opposing traffic. This type of operation is often used on side streets with shared left/through lanes and moderate to heavy left-turn volumes. Depending on the number/type of lanes and traffic volumes, this type of operation may be relatively safe and efficient for side street movements, but often requires additional time which must be taken away from main street movements.

